VII — CHEMICAL WEED CONTROL

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VII — CHEMICAL WEED CONTROL

Chemical Weed Control in Field Corn

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NOTES: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

Control of witchweed is part of the State/Federal Quarantine Program. Contact the N.C. Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
NO-TILL BURNDOWN, Emerged annual weeds, top-kill and suppression of perennials			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. The rate in the preceeding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Apply before crop emerges. Glyphosate rate depends upon weed species and weed size; see labels for suggested rates. See comments on labels concerning nitrogen as the carrier. Weed control may be decreased when nitrogen or other liquid fertilizers are used as carriers. Apply in 10 to 20 gal of water per acre using flat fan nozzles. For residual grass and broadleaf weed control, glyphosate can be tank mixed with most preemergence corn herbicides and herbicide combinations. See the section on Corn—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations. May tank mix glyphosate with Harmony SG at 0.45 to 0.9 oz per acre to improve control of curly dock, Carolina geranium, henbit, and wild garlic. Tank mix can be applied anytime prior to corn emergence. See Harmony SG label for details. May tank mix Basis with glyphosate to improve control of henbit and wild radish. Basis will also give no more than 2 weeks control of lambsquarters, pigweeds, and annual grasses. May tank mix Resolve with glyphosate for improved control of Italian ryegrass, and henbit. Glyphosate and the above glyphosate tank mixes will not control field pansy. A tank mix of Gramoxone plus atrazine should be used where field pansy is present. Glyphosate-resistant horseweed (marestail) is now common in eastern North Carolina counties. A tank mix of glyphosate or Gramoxone plus either 1.5 to 2 pt of 2,4-D or 0.5 pt of Clarity is suggested. Apply these tank mixes 7 to 14 days ahead of planting. If horseweed is present at planting time, a tank mix of Gramoxone plus atrazine is suggested.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL (Firestorm) 3 SL (Parazone) 3 SL	 2 to 4 pt 1.33 to 2.67 pt 1.33 to 2.67 pt	0.5 to 1 (lb a.e.)	Apply before, during, or after planting but before crop emerges using clean water or clear fertilizer solution as the carrier. Apply in a minimum of 10 GPA (20 to 40 preferred) using flat fan nozzles. Add either a nonionic surfactant at 1 pt per 100 gal or a crop oil concentrate at 1 gal per 100 gal. Use 0.5 to 0.64 lb a.e. on weeds 1 to 3 in., 0.75 lb a.e. on weeds 3 to 6 in., and 1 lb a.e. on weeds 6 in. or taller. Use 0.5 lb a.e. for rye cover crop or 0.75 lb a.e. for wheat cover crop. Rainfast within 30 minutes. For residual grass and broadleaf weed control, paraquat can be tank mixed with most preemergence corn herbicides and herbicide combinations. See the section on Corn—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Better and more consistent burndown will be achieved with mixtures of paraquat plus atrazine than with paraquat alone.
glufosinate-ammonium, MOA 10 (Ignite 280 SL)	29 to 36 fl oz	0.53 to 0.66	Ignite can be applied prior to emergence of transgenic or non-transgenic hybrids to control emerged weeds. See label for adjuvant use. If applied preplant, no additional applications can be made following crop emergence. Day time temperatures should be above 75 F for control by Ignite. Thorough spray coverage is necessary: a minimum of 20 GPA with flat fan nozzles is suggested.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be use for suppression of small emerged summer annual and winter weeds. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
NO-TILL BURNDOWN, Glyphosate-resistant horseweed (marestail)			
flumioxazin, MOA 14 (Valor SX) S1 WDG + paraquat, MOA 22 (Gramoxone Inteon) 2.5 SL or glyphosate, MOA 9 (numerous brands and formulations)	2.0 oz 2 to 4 pt See label	0.063 0.5 to 1.0 (lb a.e.) 0.38 to 1.13 (lb a.e.)	Corn must be planted 14 to 30 days after application. Can be applied with other herbicides, including Clarity, 2,4-D and atrazine. Apply with non-ionic surfactant at 1 qt.100 gal. Carefully follow label directons for sprayer cleaning after each day's use.
glyphostate, MOA 9 (numerous brands and formulations) + atrazine, MOA 5 (numerous brands) + 2,4-D, MOA 4 (numerous brands)	See labels	0.75 to 1.13 (lb a.e.) + 1 to 2 + 0.75 to 1	See comments for glyphosate alone. Apply mixtures containing 2,4-D at least 7 to 14 days ahead of corn planting.
glyphostate, MOA 9 (numerous brands and formulations) + atrazine, MOA 5 (numerous brands) + dicamba, MOA 4 (numerous brands)	See labels	0.75 to 1.13 (lb a.e.) + 1 to 2 + 0.25	See comments for glyphosate alone. Mixtures containing dicamba may be applied to medium- to fine-textured soils before or during planting. Do not apply to coarse-textured soils with less than 2.5% organic matter. Avoid contact of the herbicide with the seed by planting corn at least 1.5 inches deep and ensuring the furrow is closed.
glufosinate-ammonium, MOA 10 (Ignite 280 SL) + atrazine, MOA 5 (numerous brands)	29 fl oz + 1 to 2 qt	0.53 + 1 to 2	Daytime temperatures should be above 75 F for control by Ignite. Thorough spray coverage is necessary; a minimum of 20 GPA with flat-fan nozzles is suggested.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
NO-TILL BURNDOWN OR PREEMERGENCE			
dimethenamid-p, MOA 15 + saflufenacil, MOA 14 (Integrity)	10 to 16 oz	0.44 to 0.65 (lb a.i.)	Integrity can be used to control a range of grass and broadleaf weeds, including glyphosate-resistant marestail. See label for adjuvant selection (burndown) and application rate based on soil texture and organic matter content. Corn injury from Integrity can occur when organphosphate or carbamate insecticides are appliec to corn.
imazethapyr, MOA 2 + saflufenacil, MOA 14 (Optill)	2.0 oz	0.085 (lb a.I.)	USE ONLY ON CLEARFIED HYBRIDS. See Optill lael for application with other herbicides. Apply prior to corn emergence to prevent injury. Do not apply if an organophosphate or carbamate insecticide has been used.
PREEMERGENCE, Annual grasses; control of suppression of yellow nutsedge			
acetochlor, MOA 15 (Degree) 3.8 FME (Harness) 7 EC (Surpass EC) 6.4 EC (TopNotch) 3.2 FME	 2.25 to 5 pt 1.25 to 2.75 pt 1.5 to 3 pt 4 to 6 pt	 1.1 to 2.4 1.1 to 2.4 1.2 to 2.4 1.6 to 2.4	Controls most annual grasses, pigweed, and nightshade. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Controls yellow nutsedge when incorporated; suppresses yellow nutsedge if applied preemergence. Do not apply to sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter if groundwater depth is 30 ft or less. Read label and adjust rates for soil texture and organic matter. Degree can be used at rates of 4.5 to 6.25 pt on soils with 6% to 10% organic matter and at 6.25 pt on soils with greater than 10% organic matter. Harness can be used at rates of 2.5 to 3.4 pt on soils with 6% to 10% organic matter and 3.4 pt on soils with greater than 10% organic matter. Surpass can be used at rates up to 3.75 pt on soils with greater than 7% organic matter. These herbicides can be shallowly incorporated; see labels for details. See comments on labels for rotational crops. May be tank mixed with atrazine or simazine for broadleaf weed control. Each herbicide contains the safener dichlormid. May be applied to emerged corn up to 11 in. tall. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
alachlor, MOA 15 (Micro-Tech) 4 FME	2 to 4 qt	2 to 4	Controls most annual grasses and pigweed. At higher rates, controls nightshade. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Generally less effective on yellow nutsedge than dimethenamid or metolachlor. Read labels and adjust rates for soil texture and organic matter. May be shallowly incorporated; see labels for details. May be mixed with atrazine or simazine for broadleaf weed control. May be applied to emerged corn up to 5 in. tall. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12 to 21 fl oz	0.56 to 1.0	Use 12 to 18 fl oz on soils with less than 3% organic matter and 14 to 21 fl oz on soils with greater than 3% organic matter. Controls most annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see label for incorporation details. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read label and adjust rates for soil texture and organic matter. May be mixed with atrazine or simazine for broadleaf weed control. Do not apply to sandy soil with less than 3% organic matter where depth to groundwater is 30 ft or less. May be applied to emerged corn up to 12 in. tall. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
metolachlor, MOA 15 (Me-Too-Lachlor II) 7.8 EC (Parallel) 7.8 EC	1 to 2 pt	0.98 to 1.95	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of a metolachlor product to get the activity one would get from 1 pt of an s-metolachlor product.
S-metolachlor, MOA 15 (Brawl II) 7.64 EC (Cinch) 7.64 EC (Dual II Magnum) 7.64 EC (Medal II) 7.64 EC	1 to 2 pt	0.96 to 1.91	Controls most annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see label for incorporation details. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read labels and adjust rates for soil texture and organic matter. May be mixed with atrazine or simazine for broadleaf weed control. May be applied to emerged corn up to 40 in. tall. Direct if corn is taller than 5 in. Does not control emerged weeds. See labels for tank mix options to control emerged weeds.
PREEMERGENCE, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90 WDG	 1 to 2 qt 1.1 to 2.2 lb	1 to 2	Do not exceed 1.6 lb a.i. on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. Do not exceed 2 lb a.i. on any soil. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. May be tank mixed with preemergence grass control herbicides. Generic brands of atrazine are available, including products containing 5 lb per gallon. See label for details on set-back requirements from streams and lakes.
mesotrione, MOA 27 (Callisto) 4 F	6 to 7.7 oz	0.19 to 0.24	Controls pigweed, lambsquarters, jimsonweed, common ragweed, smartweed, velvetleaf, and nightshade. Does not control sicklepod or prickly sida. Not adequately effective on cocklebur or morningglory. Callisto is generally more effective when applied postemergence. No rotational restrictions for small grains or for other crops planted the following spring. Can mix with various preemergence grass control herbicides or with atrazine or atrazine-containing products. See precautions on label concerning use of Counter and Lorsban.
PREEMERGENCE, Most annual grasses and broadleaf weeds			
acetochlor, MOA 15 + atrazine, MOA 5 (Degree Xtra) 4.04 FME	2.9 to 3.7 qt	2 to 2.5 + 1 to 1.25	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Do not apply to sands with less than 3% organic matter, loamy sands with less than 2% organic matter, or sandy loams with less than 1% organic matter if groundwater depth is 30 ft or less. Read labels and adjust rates for soil texture and organic matter. See labels for comments on rotational crops. May be incorporated; see labels for details. See labels for details on set-back requirements from streams and lakes. Do not exceed 1.6 lb a.i. atrazine on highly erodible soils (as defined by NRCS) with less than 30% plant residue cover. Degree Xtra contains 2.7 lb acetochlor and 1.34 lb atrazine per gallon. Harness Xtra contains 3.1 lb acetochlor and 2.5 lb atrazine per gallon. FulTime contains 2.4 lb acetochlor and 1.6 lb atrazine per gallon. These products and certain tank mixes may also be applied early postemergence; see labels for details.
acetochlor, MOA 15 + atrazine, MOA 5 (FulTime) 4 F	2.5 to 5 qt	1.5 to 3 + 1 to 2	
acetochlor, MOA 15 + atrazine, MOA 5 (Harness Xtra) 5.6 F	1.4 to 3 qt	1.1 to 2.3 + 0.9 to 1.9	
alachlor, MOA 15 + atrazine, MOA 5 (Bullet) 4 FME (Lariat) 4 F	2.5 to 4.5 qt	1.56 to 2.81 + 0.94 to 1.69	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Read label and adjust rates for soil texture and organic matter. Do not exceed 4.25 qt on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. See label for details on set-back requirements from streams and lakes. Bullet and Lariat contains 2.5 lb alachlor and 1.5 lb atrazine per gallon. May be applied early postemergence; see labels for details.
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90 WDG + simazine, MOA 5 (Princep 4L) 4 F (Princep Caliber 90) 90 WDG	2 to 3 pt 1.1 to 1.6 lb + 1 to 1.44 qt 1.1 to 1.6 lb	1 to 1.5 1 to 1.44 + 1 to 1.44	Controls most annual broadleaf weeds plus crabgrass, goosegrass, fall panicum, and foxtails. Does not control Texas panicum, broadleaf signalgrass, seedling johnsongrass, or shattercane. Can be incorporated; see labels for details. Can use a 1:2 ratio of atrazine to simazine on more severe annual grass problems. If using 1:2 ratio, atrazine rates are 0.66 to 0.96 lb a.i. and simazine rates are 1.34 to 1.92 lb a.i. Read label and adjust rates to soil texture. See labels for rotational restrictions and other precautions. Generic brands of simazine and atrazine are available, including atrazine products containing 5 lb per gallon. See atrazine label for details on set-back requirements from streams and lakes.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREEMERGENCE, Most annual grasses and broadleaf weeds (continued)			
dimethenamid-P, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5 F	2.4 to 4.6 pt	0.5 to 1 + 1 to 1.9	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Adjust rate for soil texture and organic matter according to the label. Do not exceed 3.8 pt on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. May be applied preplant incorporated; see label for details. See label for details on set-back requirements from streams and lakes. Guardsman Max contains 1.7 lb of dimethenamid-P and 3.3 lb of atrazine per gallon. May be applied early postemergence; see label for details.
metolachlor, MOA 15 + atrazine, MOA 5 (Parallel Plus) 5.5 F	1.4 to 2.83 qt	0.95 to 1.9 + 1 to 2	See below comments for s-metolachlor plus atrazine. Products containing s-metalachlor are more active on weeds per unit of formulated product than those containing metolachlor.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.3 to 2.6 qt	0.78 to 1.56 + 1 to 2	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. Rates for coarse-textured soils may not give sufficient control of heavy fall panicum, broadleaf signalgrass, and other grassy weeds. Cultivation and/or an additional herbicide application may be needed. Read label and adjust rates for soil texture and organic matter. Do not exceed 2.1 qt on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. May be applied preplant incorporated; see labels for details. See label for details on set-back requirements from streams and lakes. These products contain 2.4 lb of S-metolachlor and 3.1 lb atrazine per gallon. May be applied early postemergence; see label for details.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lexar) 3.7 L	3 to 3.5 qt	1.3 to 1.5 + 1.3 to 1.5 + 0.17 to 0.20	Controls most broadleaf weeds and annual grasses. Does not adequately control Texas panicum, seedling johnsongrass, or shattercane. May not adequately control cocklebur, morningglory, or sicklepod. Use 3 qt on soils with less than 3% organic matter; use 3.5 qt on soils with greater than 3% organic matter. Not recommended on soils with greater than 10% organic matter. See label for setback requirements from streams and lakes. May be applied postemergence to corn up to 12 in. tall; see label for tank mixes to control grasses when applying postemergence.Lexar contains 1.74 lb S-metolachlor, 1.74 lb atrazine, and 0.224 lb mesotrione per gallon.
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L + atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90 WDG	1.8 to 3.6 pt 2 to 4 pt + 1 to 2 qt 1.1 to 2.2 lb	0.75 to 1.5 0.95 to 1.9 + 1 to 2	Annual grass control is more variable and sometimes less acceptable with this combination than with alternatives. Suggested for use only on fields with light annual grass pressure. Do not apply to excessively wet soils. Read label and adjust rates to soil texture and organic matter. Do not exceed 1.6 lb a.i. atrazine on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. Do NOT incorporate. See atrazine label for details on set-back requirements from streams and lakes. Generic brands of atrazine (including products containing 5 lb/gal) and pendimethalin (such as Acumen, Helena Pendimethalin, Pendant, Pendimax, and Stealth, all containing 3.3 lb/gal) are available.
rimsulfuron, MOA 2 + thifensulfuron methyl, MOA 2 (Basis) 75 WDG	0.33 to 0.5 oz	0.010 to 0.016 + 0.005 to 0.008	Applied early preplant or preemergence, Basis will burn down small annual grasses and broadleaf weeds plus give residual short-duration control of certain grasses and small-seeded broadleaf weeds. See label for weeds controlled. Use only in combination with other preemergence herbicides. If burndown is desired, add 1 gal crop oil per 100 gal spray solution plus ammonium nitrogen fertilizer as specified on the label. Use only on soils with 1% to 3.5% organic matter. Basis contains 50% rimsulfuron and 25% thifensulfuron.
glufosinate-ammonium, MOA 10 (Ignite 280 SL)	29 to 36 fl oz	0.53 to 0.66 (lb a.i.)	Ignite can be applied prior to emergence of transgenic or nontransgenic hybrids. See comments under NO-TILL BURNDOWN for more details.
EARLY POSTEMERGENCE, Small annual grasses and certain broadleaf weeds			
rimsulfuron, MOA 2 + thifensulfuron methyl, MOA 2 (Basis) 75 WDG	0.33 oz	0.010 + 0.005	Limited spectrum of control and critical application timing. Controls fall panicum and foxtails less than 2 in. tall and smartweed, lambsquarters, redroot pigweed, and velvetleaf 1 to 3 in. tall. For control of other broadleaf weeds, Basis may be mixed with atrazine, Banvel or Clarity. Plan on cultivating or using Evik or Linex at lay-by. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Also add a nitrogen-containing fertilizer according to label directions. See label for comments concerning injury when used in conjunction witih insecticides. Basis contains 50% rimsulfuron and 25% thifensulfuron.
EARLY POSTEMERGENCE, Small annual broadleaf and grass weeds			
acetochlor, MOA 15 + atrazine, MOA 5 (Degree Xtra) 4.04 FME	2.9 to 3.7 qt	2 to 2.5 + 1 to 1.25	Apply as a very early postemergence application to weeds no larger than two leaves and before corn exceeds 11 in. Adjust rates for soil types as specified on labels. See remarks concerning soil type limitations, set-back requirements from streams and lakes, and rotational crops under Field Corn—Preemergence. May be tank mixed with several other herbicides to control emerged weeds. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 lb a.i.
(FulTime) 4L	2.5 to 5 qt	1.5 to 3 + 1 to 2	
(Harness Xtra) 5.6 L	1.4 to 3 qt	1.1 to 2.3 + 0.9 to 1.9	
alachlor, MOA 15 + atrazine, MOA 5 (Bullet) 4 FME	2.5 to 4.5 qt	1.6 to 2.8 + 0.9 to1.7	Apply as a very early postemergence application to weeds no larger than two leaves and before corn exceeds 5 in. See remarks for Bullet under Field Corn—Preemergence. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 lb a.i. See labels for details on set-back requirements from streams and lakes.
atrazine, MOA 5 (AAtrex 4L) 4 F (AAtrex Nine-O) 90 WDG	2 qt 2.2 lb	2	Atrazine can be sprayed overtop of corn as an early postemergence treatment. Must be applied before weeds are over 1.5 in. tall to be effective and before corn exceeds 12 in. tall. Not effective during drought. Add 1 qt per acre of crop oil concentrate. If an earlier application was made, the total atrazine applied may not exceed 2.5 lb a.i. per acre per year. See label for details on set-back requirements from streams and lakes. May be tank mixed with preemergence grass control herbicides. When tank mixing, check respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available, including products containing 5 lb per gallon.
dimethenamid-P, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5F	2.4 to 4.6 pt	0.5 to 1 + 1 to 1.9	May be applied to corn up to 12 in tall. Application must be made before weeds are greater than 1.5 in. tall or in a tank mix with products that will control emerged weeds. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 lb a.i. See label for details on set-back requirements from streams and lakes.
metolachlor, MOA 15 + atrazine, MOA 5 (Parallel Plus) 5.5 F	1.4 to 2.83 qt	0.95 to 1.9 + 1 to 2	See below comments for s-metolachlor plus atrazine products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
EARLY POSTEMERGENCE, Small annual broadleaf and grass weeds (continued)			
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 L (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 L (Medal II AT) 5.5 F	1.6 to 2.6 qt	0.96 to 1.56 + 1.24 to 2	Apply as a very early postemergence application to weeds no larger than two leaves and before corn exceeds 5 in. See remarks for these products under Field Corn—Preemergence. If an atrazine-containing herbicide was applied earlier, the total amount of atrazine per acre per season should not exceed 2.5 lb a.i. See label for details on set-back requirements from streams and lakes.
S-metolachlor, MOA 15 + atrazine, MOA 5 + mesotrione, MOA 27 (Lexar) 3.7 L	3 to 3.5 qt	1.3 to 1.5 + 1.3 to 1.5 0.17 to 0.20	May be applied to corn up to 12 in. tall. Add nonionic surfactant according to label directions. Do not apply to Counter-treated corn. Application to corn treated with other organophosphate insecticides may cause injury.
POSTEMERGENCE, Annual broadleaf weeds			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop or directed. Drop nozzles suggested after corn is 8 in. tall to ensure better weed coverage. Controls many broadleaf weeds such as cocklebur, jimsonweed, smartweed, velvetleaf, prickly sida, spurred anoda, and spreading dayflower. See label for weeds controlled and recommended weed size for treatment. Add crop oil concentrate at 2 pt per acre. May be tank mixed with atrazine.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril) 4 EC	1 to 1.5 pt 0.5 to 0.75 pt	0.25 to 0.38	Can be applied overtop of corn from four-leaf stage up to tasseling. Drop nozzles suggested after corn is 8 in. tall for better coverage on weeds. Controls most broadleaf weeds if treated when small. See label for weeds controlled and recommended weed size for treatment. Does not control sicklepod, prickly sida, spurred anoda, or croton. Marginally effective on pigweed and morningglory unless treated very timely. Crop oil or surfactant not necessary when applying Buctril alone. Can tank mix with Accent, atrazine, Banvel, Clarity, or 2,4-D for broader spectrum control. Primary advantage over 2,4-D or Clarity is safety when sensitive crops are nearby. Will cause some burn on corn foliage.
carfentrazone, MOA 14 (Aim EC) 2 L	0.5 fl oz	0.008	Controls velvetleaf, morningglory, redroot pigweed, lambsquarters, and nightshade. See label for weed size to treat. Apply before corn exceeds V8 stage (8 leaves with collars). Add nonionic surfactant at 1 qt per 100 gal. May be mixed with 2,4-D amine, Accent, atrazine, Banvel, Basis, Callisto, Clarity or Distinct. May be mixed with Lightning for Clearfield corn, Ignite for Liberty Link corn, or with glyphosate for Roundup Ready corn.
dicamba, dimethylamine salt, MOA 4 (Banvel) 4 SL (Diablo) 4 SL (Dicamba DMA Salt) 4 SL (Rifle) 4 SL (Sterling) 4 SL	0.5 pt	0.25	Apply overtop of corn from spike stage until 8 in. tall. On corn 8 to 36 in. tall, Banvel or Clarity can be applied at 0.5 pt using drop nozzles. Carefully follow all precautions on label concerning drift to sensitive crops. Dicamba is more effective than 2,4-D on smartweed, sicklepod, nightshade, burcucumber, and pokeweed.
dicamba, diglycolamine salt, MOA 4 (Clarity) 4 SL	0.5 pt	0.25	
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt (Distinct) 76.4 WDG	4 oz	0.125 + 0.05	Apply to corn 4 to 36 in. tall. Drop nozzles suggested on corn taller than 10 in. Drop nozzles must be used on corn taller than 24 in. Rate can be increased to 6 oz on corn shorter than 10 in. Add nonionic surfactant at 1 qt per 100 gal spray solution plus either 5 qt 30% UAN or 5 lb ammonium sulfate per 100 gal. Do not add crop oil. Control of annual weeds similar to that by Banvel or Clarity. Distinct may be somewhat more effective on perennial broadleaf weeds. Carefully follow all precautions on label concerning drift to sensitive crops.
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt + safener (Status) 61.1 WDG	5 to 10 oz	0.14 to 0.28 + 0.053 to 0.106	Apply to corn 4 to 36 in. tall. Drop nozzles suggested on corn taller than 24 in. Add nonionic surfactant at 1 qt per 100 gal spray solution plus either 5 qt 30% UAN or 5 lb ammonium sulfate per 100 gal. Do not add crop oil. Potential for crop injury from Status is much less than from dicamba products without safener.
flumiclorac pentyl ester, MOA 14 (Resource) 0.86 EC	4 to 8 fl oz	0.027 to 0.054	Can be applied overtop of corn from the two-leaf through the ten-leaf stage at 4 to 6 fl oz per acre. At 4 to 6 fl oz, Resource controls velvetleaf and small lambsquarters, ragweed, smooth pigweed, and Palmer amaranth. When applying overtop, add nonionic surfactant at 1 qt/100 gal spray solution. Resource can be directed at 4 to 8 fl oz per acre. At 8 fl oz, Resource controls velvetleaf and small cocklebur, lambsquarters, ragweed, jimsonweed, Palmer amaranth, redroot and smooth pigweed, and prickly sida. See label for recommended weed sizes for treatment. When directing, add 2 pt per acre of crop oil concentrate. For broader spectrum control, Resource may be tank mixed with atrazine, Accent, Banvel, Basis, Buctril, Clarity, or 2,4-D. May be mixed with glyphosate on Roundup Ready corn, with Ignite on Liberty Link corn, and with Lightning on Clearfield corn.
mesotrione, MOA 27 (Callisto) 4 F	3 fl oz	0.094	Can be applied overtop or with drop nozzles until corn is 30 in. tall or has eight leaves. Add crop oil concentrate at 1 gal per 100 gal spray solution. Do not use methylated seed oil or adjuvant blends containing methylated seed oil. Controls most broadleaf weeds. Partial control of common ragweed and morningglory. Does not control sicklepod or prickly sida. Can tank mix with atrazine, Accent, Basis, or Steadfast. See precautions on labels of these products. Can be mixed with Ignite on Liberty Link corn or glyphosate on Roundup Ready corn. No rotational restrictions for small grains or other crops planted the following spring. Rainfast in 1 hr. See precautions on label concerning use of Counter and Lorsban.
thifensulfuron methyl, MOA 2 (Harmony SG) 50 WDG	0.125 oz	0.0039	Apply only to corn with 2 to 6 leaves (1 to 4 collars) but not larger than four collars or 12 in tall. Add either nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Also, add a nitrogen-containing fertilizer according to label directions. Controls lambsquarters, pigweeds, smartweed, and velvetleaf; see label for recommended weed size for treatment. Harmony SG will also control curly dock and burcucumber. See label for comments concerning injury when used in conjunction with insecticides. May be mixed with atrazine.
2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1 pt	0.24 to 0.48	Use 0.5 pt overtop when corn is 4 to 5 in. tall and weeds are small. Increase rate to 1 pt as corn reaches 8 in. Use drop nozzles and direct spray toward base of corn if over 8 in. tall. Do not cultivate for about 10 days after spraying as corn may be brittle. Reduce rate of 2,4-D if extremely hot or soil is wet. For better control of sicklepod and horsenettle, add a nonionic surfactant to 1 pt of 2,4-D and direct spray. Not adequately effective on smartweed, nightshade, burcucumber, or pokeweed. Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. **USE OF ESTER FORMULATIONS OR ACID + ESTER FORMULATIONS (SUCH AS WEEDONE 638) OF 2,4-D IS NOT SUGGESTED IF SENSITIVE CROPS, ESPECIALLY COTTON OR TOBACCO, ARE LOCATED WITHIN 1 MILE OF THE CORN.**

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE, Annual broadleaf weeds (continued)			
rimsulfuron, MOA 2 + thifensulfuron, MOA 2 (Resolve Q) 22.4% WDG	1.25 oz	0.014 + 0.0031	Apply overtop or with drop nozzles to corn up to 20 in. or 7 leaf collars. Controls redroot and smooth pigweed and velvetleaf. Suppresses cocklebur, smartweed, lambsquarters, common ragweed,and morningglory. Also controls 1- to 2-in. fall panicum. Provides short-term residual control of lambsquarters, nightshade, redroot pigweed, and smooth pigweed. Add 1 qt nonionic surfactant per 100 gal and 2 qt/acre UAN. May tank mix with other postemergence corn herbicides (except Basgran), including glyphosate on Roundup Ready corn and Ignite on Liberty Link corn. See label statement concerning sensitive hybrids. See rotational restrictions on label.
tembotrione, MOA 27 (Laudis) 3.5 L	3 fl oz	0.082	Can be applied overtop or with drop nozzles to corn from emergence up to V8 stage. Add methylated seed oil at 1 gal per 100 gal of spray solution. Also add 1.5 qt/A UAN. Controls most broadleaf weeds. Does not control sicklepod or prickly sida and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Can tank mix with atrazine, Accent, Buctril, Steadfast, or Stout. Can tank mix with Ignite on Liberty Link corn or glyphosate on Roundup Ready corn. Rain-free in 1 hour. See label for rotational restrictions.
tembotrione, MOA 27 + thiencarbazone-methyl, MOA 2 (Capreno) 2.88 + 0.57 SC	3 fl oz	0.003 + 0.015 (lb a.i.)	Apply postemergence over the top prior to V6 stage. Use drop nozzles for better coverage of later stages of corn. Apply with crop oil concentrate at 1 gal/100 gal and UAN at 1.5 qt/A. See comments under Laudis for spectrum of control and possible tank mixture. See label for precautions when organophosphate insecticide is used in corn.
topramezone, MOA 27 (Impact) 2.8 L	0.75 fl oz	0.016	Can be applied overtop or with drop nozzles to corn from emergence until 45 days prior to harvest. Add crop oil concentrate or methylated seed oil at 1 gal per 100 gal spray solution. Also add 1.25 to 2.5 gal UAN per 100 gal spray solution. See label for adjuvant recommendations in tank mixes. Controls most broadleaf weeds. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Can tank mix with glyphosate on Roundup Ready corn, Ignite on Liberty Link corn, or Lightning on Clearfield corn. Rain-free in 1 hour. See label for rotational restrictions.
pyraflufen-ethyl, MOA 14 (ET)	0.5 to 2.0 fl oz	0.0008 to 0.0003 (lb a.i.)	ET can be used for limited suppression of small broadleaf weeds up to V4 stage. Do not apply with crop oil concentrate. Some leaf speckling can ocur but is transient. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
POSTEMERGENCE, Annual grasses, broadleaf weeds, and johnsongrass			
foramsulfuron, MOA 2 + iodosulfuron-methyl-sodium, MOA 2 (Equip) 32 WDG	1.5 oz	0.028 + 0.00188	Apply to corn with one to four collars. Can be applied to corn with five to eight collars if drop nozzles are used. Add 1.5 pt per acre of methylated seed oil plus an ammonium fertilizer as recommended on the label. Do not use crop oil concentrate or nonionic surfactant. Do not apply to corn with Counter in-furrow. See label concerning use of Counter 20CR applied as T-band. Controls johnsongrass and shattercane up to 8 in. and annual grasses 2 to 3 in. See label for recommended weed size to treat. May not adequately control crabgrass or broadleaf signalgrass. Broadleaf weeds should be 2 to 4 in. tall. See label for broadleaf weeds controlled. Does not adequately control sicklepod. May tank mix with atrazine or dicamba. See label for rotational restrictions on peanuts and tobacco. Equip contains 30% foramsulfuron and 2% iodosulfuron-methyl-sodium.
nicosulfuron, MOA 2 + rimsulfuron, MOA 2 (Steadfast) 75 WDG	0.75 oz	0.023 + 0.012	Apply overtop or with drop nozzles to corn up to 20 in. tall. Do not apply to corn taller than 20 in. or exhibiting more than 6 leaf collars. Add 1 gal crop oil concentrate per 100 gal or 1 qt nonionic surfactant per 100 gal. Also add nitrogen fertilizer according to label directions. Controls johnsongrass and most annual grasses. Not effective on goosegrass. Crabgrass must be 1 in. or less. Controls pigweed, morningglory, and smartweed and suppresses several other broadleaf species. See label for weeds controlled and weed size to treat. Do not apply to corn treated with Counter; see label for details on insecticide usage. See label for comments on susceptible hybrids. Can tank mix with atrazine, Callisto, or Clarity. See label precautions for tank mixes. Steadfast contains 50% nicosulfuron and 25% rimsulfuron.
nicosulfuron, MOA 2 + rimsulfuron, MOA 2 (Steadfast Q) 37.7 WDG	1.5 oz	0.024 + 0.011	Apply to corn up to 20 in. tall with 6 or fewer leaf collars. Add 1 gal crop oil concentrate per 100 gal or 1 qt nonionic surfactant per 100 gal. Also add nitrogen fertilizer according to label directions. Controls johnsongrass and most annual grasses and broadleaf weeds. May not adequately control crabgrass, goosegrass, Palmer amaranth, and sicklepod. See label for weeds controlled and weed size to treat. Do not apply to corn treated with Counter 15G; see label for precautions concerning other organophosphate insecticides. See label for comments on susceptible hybrids. Can tank mix with atrazine, Callisto, Clarity, or Distinct. See label precautions for tank mixes. Steadfast Q contains 25% nicosulfuron and 12.5% rimsulfuron.
nicosulfuron, MOA 2 + thifensulfuron, MOA 2 (Stout) 72.5 WDG	0.5 to 0.75 oz	0.0211 to 0.0316 + 0.00156 to 0.00234	Apply overtop or with drop nozzles to corn up to 16 in. or 5 leaf collars. Add 1 gal crop oil concentrate or 1 qt nonionic surfactant per 100 gal spray solution. Also add 2 qt/acre UAN. Controls johnsongrass and most annual grasses. Not effective on goosegrass. Crabgrass must be 1 in. or less. Controls pigweed, lambsquarters, morningglory, jimsonweed, smartweed, and velvetleaf. See label for weeds controlled and size to treat. Do not apply to corn treated with Counter; see label for details on insecticide usage. Can tank mix with atrazine, Callisto, dicamba, or Lexar. Stout contains 67.5% nicosulfuron and 5% thifensulfuron.
POSTEMERGENCE, Annual broadleaf weeds and some annual grasses: **Clearfield hybrids ONLY**			
imazethapyr, MOA 2 + imazapyr, MOA 2 (Lightning) 70 WDG	1.28 oz	0.042 + 0.014	**USE ONLY ON CLEARFIELD HYBRIDS**. Make only one application per year. Can be applied anytime up to 45 days prior to harvest. Use of drop nozzles will give better coverage in larger corn. Controls most annual broadleaf weeds and certain annual grasses; see label for weeds controlled and recommended growth stage for application. Not adequately effective on ragweed. Season-long sicklepod control may require a pre-emergence application of atrazine or a lay-by application of an appropriate herbicide. Suppresses yellow and purple nutsedge. Add either 1 qt per 100 gal nonionic surfactant or 1 gal per 100 gal of crop oil concentrate or methylated seed oil. Also add 1 to 2 qt per acre of UAN or 2.5 lb per acre ammonium sulfate. May be tank mixed with most other corn herbicides; see labels for details. See Lightning label for rotational restrictions.
imazethapyr, MOA 2 + saflufenacil, MOA 14 (Optill)	2.0 oz	0.085 (lb a.i.)	USE ONLY ON CLEARFIELD HYBRIDS. See Optill label for application with other herbicides. Apply prior to corn emergence to prevent injury. Do not apply if an organophosphate or carbamaate insecticide has been used.
POSTEMERGENCE, Annual grasses and annual broadleaf weeds: **Liberty Link hybrids ONLY**			
glufosinate-ammonium, MOA 10 (Ignite 280) 2.34 SL	22 fl oz	0.40	**USE ONLY ON LIBERTY LINK HYBRIDS.** May be applied overtop from corn emergence until corn is in V7 stage (7 leaves with collar) or 24 in. tall, whichever comes first. Apply with drop nozzles to corn 24 to 36 in. tall. Rate depends upon weed species and weed size; see label for details. Controls most annual grass and broadleaf weeds, but only marginally effective on goosegrass. Not effective on dayflower. Timing of application is critical for pigweed control. Use of drop nozzles in corn over 8 in. tall may improve spray coverage. May make two applications per year, but do not exceed 44 fl oz per season. Add 3 lb per acre of ammonium sulfate. Do not add surfactant or crop oil. May be tank mixed with most postemergence corn herbicides; see respective labels for details. Tank mixes of Ignite plus atrazine have been most effective.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE, Annual grasses and broadleaf weeds, johnsongrass, and suppression of perennial broadleaf weeds: **Roundup Ready Hybrids ONLY**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**APPLY ONLY TO ROUNDUP READY (glyphosate-resistant) HYBRIDS.** Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. See TABLE 7-10 for glyphosate rate conversions. Glyphosate controls most annual weeds; exceptions include dayflower, Florida pusley, and hemp sesbania. Timely application is critical for morningglory control. Glyphosate also controls johnsongrass and suppresses other perennial weeds. See label of brand you use for recommended rates and sizes of weeds to treat. Adjuvant recommendations vary according to glyphosate product. See label of brand used for specific recommendations. Apply overtop from corn emergence through the V8 stage (8 leaves with collars) or until corn reaches 30 in., whichever comes first. Drop nozzles suggested on corn 24 to 30 in. Apply only with drop nozzles when corn is 30 to 48 in. Make multiple applications at least 10 days apart. Do not exceed a total of 2.25 lb a.e. per acre in crop. For resistance managment, do not rely entirely on glyphosate. Herbicides with other modes of action should be included in the program. Such herbicides can be preemergence, mixed with glyphosate, or lay-by. See comments on resistance management in TABLE 7-11. Any registered soil-applied herbicide or lay-by herbicide can be used on Roundup Ready corn. Aim, atrazine, Bullet, Callisto, Clarity, Degree, Degree Xtra, Distinct, Harness, Harness Xtra, Impact, Laudis, Micro-tech, Resolve, Resolve Q, Resource, Status or 2,4-D can be mixed with glyphosate applied postemergence. When using a tank mix, follow all directions and precautions on the respective labels, especially corn stage for application.
glyphosate, MOA 9 + s-metolachlor, MOA 15 + mesotrione, MOA 27 (Halex GT) 4.39 L	3.6 to 4 pt	0.94 to 1.05 + 0.94 to 1.05 + 0.094 to 0.105	**Apply only to hybrids designated Roundup Ready or Agrisure GT.** Apply from corn emergence up to 30 in. or 8 leaf collars. Add nonionic surfactant at 1 qt/100 gal spray solution. Also add AMS according to label directions. Do not substitute UAN for AMS. May tank mix with atrazine. See precautions on label when using Halex GT in conjunction with insecticides.
POSTEMERGENCE, Yellow nutsedge			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop of corn or directed when yellow nutsedge is 6 to 8 in. tall. If needed, make a second application 7 to 10 days later. Add 2 pt per acre of crop oil concentrate.
POSTEMERGENCE, Yellow and purple nutsedge			
halosulfuron (Sandea) 75 WDG	0.67 to 1.33 oz	0.03 to 0.06	Apply overtop or with drop nozzles to corn from spike stage until layby. Add nonionic surfactant at 1 qt/100 gal spray solution.
POSTEMERGENCE, Yellow and purple nutsedge: **Clearfield hybrids ONLY**			
imazethapyr, MOA 2 + imazapyr, MOA 2 (Lightning) 70 WDG	1.28 oz	0.042 + 0.014	**USE ONLY ON CLEARFIELD HYBRIDS.** Apply when nutsedge is 1 to 3 in. tall. Add surfactant and nitrogen-containing fertilizer as specified on the label. See comments on Lightning in section on broadleaf weed control. Label claims supression only.
POSTEMERGENCE, Yellow and purple nutsedge; **Roundup Ready hybrids ONLY**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**APPLY ONLY TO ROUNDUP READY HYBRIDS.** Two applications of glyphosate may be necessary for nutsedge control. See previous comments under Roundup Ready corn.
POSTEMERGENCE, Annual grasses			
foramsulfuron, MOA 2 (Option) 35 WDG	1.5 oz	0.033	Apply overtop to corn in V1 to V6 stage. Can be applied with drop nozzles to corn through V8 stage. Add a methylated seed oil at 1.5 pt per acre and either 1.5 to 2 qt per acre of 30% UAN or 1.5 to 3 lb per acre of ammonium sulfate. Do not cultivate for 7 days before or after application. Controls most annual grasses; see comments on label for crabgrass and broadleaf signalgrass. Also controls small broadleaf weeds, such as burcucumber, cocklebur, pigweed, lambsquarters, common ragweed, velvetleaf, and nightshade. May be applied twice per season. May be tank mixed with atrazine, Callisto, or Distinct. Do not apply to corn treated with Counter, Dyfonate, or Thimet. See comments on label concerning sensitive hybrids.
nicosulfuron, MOA 2 (Accent) 75 WDG (Accent Q) 54.5 WDG	0.67 oz 0.9 oz	0.031	Can be applied overtop or with drop nozzles to corn up to 20 in. tall. If corn is 20 to 36 in. tall, apply only with drop nozzles and avoid spraying into the corn whorl. Do not apply if corn is greater than 36 in. Add either a crop oil concentrate at 1 gal per 100 gal or a nonionic surfactant at 1 qt per 100 gal spray solution. See label concerning additional adjuvants. Do not cultivate for 10 days before application. Controls ryegrass, small broadleaf signalgrass, foxtails, fall panicum, Texas panicum, barnyardgrass, shattercane, and seedling johnsongrass. May not adequately control crabgrass and goosegrass. Also controls small burcucumber, jimsonweed, morningglory, pigweed, and smartweed. Can be applied twice, but do not exceed 1.33 oz per acre per year. Reduced rates of 1/3 to 1/2 oz may be applied under certain conditions; see label for details. May be tank mixed with atrazine, Callisto, Clarity, or Distinct for improved broadleaf control. See label for comments concerning injury when used in conjunction with insecticides.
nicosulfuron, MOA 2 + thifensulfuron, MOA 2 (Stout) 72.5 WDG	0.5 to 0.75 oz	0.021 to 0.032 + 0.0016 to 0.0023	Apply to corn up to 16 in. tall, or five collars. See hybrid information and precautions on label. Add 2 qt per acre of UAN plus either 1% crop oil concentrate or 0.25% nonionic surfactant. May be tank mixed with atrazine, dicamba, or Callisto. See maximum corn size and precautions on labels of tank mix partners.
POSTEMERGENCE, Johnsongrass and shattercane			
formasulfuron, MOA 2 (Option) 35WDG	1.5 oz	0.033	Apply before seedling and rhizome johnsongrass exceed 16 in. tall. See comments for Option under Annual Grasses.
nicosulfuron, MOA 2 (Accent) 75 WDG	0.67 oz	0.031	Apply when seedling johnsongrass is 4 to 12 in. tall, rhizome johnsongrass is 8 to 18 in. tall, or shattercane is 4 to 12 in. tall. See other comments for Accent under Annual Grasses.
nicosulfuron, MOA 2 + thifensulfuron, MOA 2 (Stout) 72.5 WDG	0.75 oz	0.0316 + 0.00234	Apply before shattercane or seedling johnsongrass exceeds 12 in. or rhizome johnsongrass exceeds 18 in. See comments for Stout under Annual Grasses.
POSTEMERGENCE, Johnsongrass: **Roundup Ready hybrids ONLY**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	**APPLY ONLY TO ROUNDUP READY HYBRIDS.** See previous comments under Roundup Ready corn.

TABLE 7-1A. CHEMICAL WEED CONTROL IN FIELD CORN

Herbicide, Mode of Action Code[1] and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE, Bermudagrass: **Roundup Ready hybrids ONLY**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.125 (lb a.e.)	**APPLY ONLY TO ROUNDUP READY HYBRIDS.** See previous comments under Roundup Ready corn. Two applications are usually required for adequate control.
LAY-BY, Annual broadleaf weeds; control or suppression of perennial broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1 pt	0.24 to 0.48	Apply with drop nozzles. Do not apply to corn in the tassel to dough stage. May add 1 qt of nonionic surfactant per 100 gal spray solution. Surfactant may increase control of sicklepod and perennial weeds. Corn hybrids vary in sensitivity; check with seed dealer for sensitivity of hybrid used. Use extreme caution to avoid drift to sensitive crops, such as cotton and tobacco. **USE OF ESTER FORMULATIONS OR ACID + ESTER FORMULATIONS (SUCH AS WEEDONE 638) OF 2,4-D IS NOT SUGGESTED IF SENSITIVE CROPS, ESPECIALLY COTTON OR TOBACCO, ARE LOCATED WITHIN 1 MILE OF THE CORN.** Liquid nitrogen may be used as the carrier. When using 2,4-D amine, mix 1 pt of herbicide in at least 2 qt of water, and add this mixture to the spray tank with considerable agitation until thoroughly mixed. Do not allow nitrogen-herbicide mixture to stand in the sprayer.
dicamba, dimethylamine salt, MOA 4 (Banvel) 4 SL	0.5 pt	0.25	Apply as directed spray using water as the carrier to corn up to 36 in. tall. Do not apply within 15 days of tassel emergence. Add nonionic surfactant at 1 pt per 100 gal for Clarity or 2 pt per 100 gal for Banvel, Distinct, or Status. See comments on labels concerning addition of UAN or AMS. Follow precautions on labels concerning drift to sensitive crops.
dicamba, digylycolamine salt, MOA 4 (Clarity) 4 SL	0.5 pt	0.25	
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt (Distinct) 61.1 WDG	4 oz	0.125 + 0.053	
dicamba, sodium salt, MOA 4 + diflufenzopyr, sodium salt + safener (Status) 61.1 WDG	5 to 10 oz	0.14 to 0.28 + 0.053 to 0.107	
ametryn, MOA 5 (Evik) 80 WDG	2 lb	1.6	Apply as a directed spray after corn is at least 15 in. tall. Do not apply Evik within 3 weeks of tasseling. Add nonionic surfactant at 2 qt per 100 gal spray solution. Evik and Linex may be applied using liquid nitrogen as the carrier. Add surfactant when using nitrogen as the carrier.
linuron, MOA 7 (Linex) 4 L	1.5 pt	0.75	Note that current labeled rates of Linex have been reduced from previous years.
PREHARVEST Annual grasses and johnsongrass			
sodium chlorate (Defol 750) 7.5 L	3.2 qt	6	Apply on warm, sunny day at least 14 days before anticipated harvest. Apply by ground or air after corn reaches hard dough or dent stage. Add surfactant or crop oil according to label directions. Thorough spray coverage essential.
PREHARVEST, Broadleaf weeds			
2, 4-D, amine, MOA 4 (various brands	1 to 2 pt	0.48 to 0.95	Suppresses perennial broadleaf weeds and controls many annual broadleaf weeds. Apply after hard dough or dent stage by ground or air. Avoid drift to sensitive crops.
carfentrazone, MOA 14 (Aim) 2 EC	1.9 fl oz	0.03	Desiccates morningglory, cocklebur, and pigweed. Apply 3 or more days ahead of harvest. Add 1 gal crop oil concentrate per 100 gal spray solution. Thorough coverage is critical; use minimum of 20 GPA for ground application. May be applied by air. For dense morningglory infestations, two applications at 1 oz/acre may be more effective.
PREHARVEST, Annual grasses and broadleaf weeds			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	1.2 to 2 pt	0.3 to 0.5	Apply after black layer has formed and at least 7 days prior to harvest. Add nonionic surfactant at 1 qt per 100 gal spray solution. Generic brands of paraquat containing 3 lb active ingredient per gal are available These products would be applied at 0.8 to 1.3 pt per acre.
PREHARVEST, Annual grasses, johnsongrass, and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after kernel fill is complete (black layer formed) and grain moisture is 35% or less. Apply at least 7 days prior to harvest. Maximum rate for aerial application varies by product; see label of brand used. Avoid drift to other crops and desirable vegetation.
POSTHARVEST, Horsenettle and other perennial and annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL + dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	2 pt + 1 to 2 pt 1 to 2 pt	0.95 + 0.5 to 1	This is an effective way to reduce perennial broadleaf weeds in succeeding crops. Follow label precautions on dicamba label concerning drift to sensitive crops. Delay small grain seeding at least 20 days.
POSTHARVEST, Bermudagrass, other annual and perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	1.5 (lb a.e.)	This is an effective way to reduce perennial weeds in succeeding crops. Apply at least 10 to 14 days before killing frost. Rate can be increased up to 3.75 lb a.e. Include adjuvant according to the label for the brand used. Dicamba may be mixed with glyphosate.

Weed Response to Preemergence Herbicides — Corn

W. J. EVERMAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-1B WEED RESPONSE TO PREEMERGENCE HERBICIDES IN CORN

Species	Herbicides												
Species	Atrazine	Atrazine + Simazine	Bicep II Magnum, Brawl II, Cinch ATZ, or Medal II AT	Bullet or Lariat	Callisto	Dual II Magnum, Brawl II, Cinch, or Medal II	Outlook	Guardsman Max	Degree, Harness, Surpass, or TopNotch	Degree Xtra, Fultime, or Harness Xtra	Micro-Tech	Lexar	Prowl H_2O
Grasses:													
Bermudagrass	N	N	N	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	P	P	G	FG	P	G	FG	FG	G	G	FG	G	P
Crabgrass	G [1]	G [2]	E	E	F	E	E	E	E	E	E	E	F
Fall panicum	N	FG	E	E	PN	E	E	E	E	E	E	E	PF
Foxtails	F	FG	E	E	PN	E	E	E	E	E	E	E	F
Goosegrass	F	FG	E	E	PN	E	E	E	E	E	E	E	PF
Johnsongrass													
Seedling	N	N	PF	PF	N	PF	PF	PF	PF	PF	PF	F	PF
Rhizome	N	N	N	N	N	N	N	N	N	N	N	N	N
Shattercane	N	N	P	P	N	P	P	P	P	P	P	PF	PF
Texas panicum	N	N	PF	PF	N	PF	PF	PF	PF	PF	PF	PF	PF
Sedges:													
Nutsedge													
Yellow	N	N	F	PF	P	FG [3]	F	F	PF	PF	PF	FG	N
Purple	N	N	N	N	—	N	N	N	N	N	N	N	N
Broadleaf Weeds:													
Balloonvine	G	GE	G	G	—	N	N	G	N	G	N	G	N
Burcucumber [4]	F	FG	F	F	—	N	N	F	N	F	N	F	N
Cocklebur	G	GE	G	G	PF	N	N	G	N	G	N	G	N
Eastern black nightshade	E	E	E	E	E	F	F	E	F	E	FG	E	N
Florida beggarweed	G	GE	G	G	—	F	F	G	F	G	F	G	N
Florida pusley	E	E	E	E	—	GE	GE	E	GE	E	GE	E	G
Hemp sesbania	F	F	F	F	—	N	N	F	N	F	N	F	N
Jimsonweed	E	E	E	E	G	N	N	E	N	E	N	E	N
Lambsquarters	E	E	E	E	E	F	FG	E	F	E	F	E	G
Morningglory	G	G	G	G	FG	N	N	G	N	G	N	G	N
Pigweed	E	E	E	E	E	G	GE	E	GE	E	GE	E	FG
Prickly sida	E	E	E	E	—	P	P	E	P	E	P	E	N
Ragweed													
Common	E	E	E	E	F	PF	F	E	PF	E	PF	E	N
Giant	FG	G	G	G	—	N	N	G	N	G	N	FG	N
Sicklepod	G	GE	G	G	P	N	N	G	N	G	N	G	N
Smartweed	G	GE	G	G	GE	N	N	G	N	G	N	G	N
Tropic croton	G	GE	G	G	PN	N	N	G	N	G	N	G	N
Velvetleaf	G	G	G	G	E	N	N	G	N	G	N	G	N

[1] No control of smooth crabgrass.

[2] Poor to fair on smooth crabgrass.

[3] Dual is normally good on yellow nutsedge when incorporated

[4] Multiple flushes of germination; one application of any herbicide will seldom be adequate.

Key:

E = excellent control, 90% or better

G = good control, 80% to 90%

F = fair control, 50% to 80%

P = poor control, 25% to 50%

N = no control, less than 25%

Weed Response to Postemergence Herbicides — Corn

W. J. EVERMAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-1C WEED RESPONSE TO POSTEMERGENCE HERBICIDES IN CORN

	Herbicides															
Species	**Accent**	**Aim**	**Atrazine [1]**	**Banvel, Clarity, Distinct, or Status**	**Basagran**	**Buctril**	**Callisto**	**2,4-D**	**Evik [2]**	**Glyphosate [5]**	**Harmony SG**	**Ignite [3]**	**Lightning [4]**	**Linex [2]**	**Resource**	**Steadfast, Steadfast Q**
Grasses:																
Bermudagrass	N	N	N	N	N	N	N	N	N	F[7]	N	NP	N	N	N	N
Broadleaf signalgrass	GE	N	F	N	N	N	P	N	E	E	N	GE	G	GE	N	G
Crabgrass	PF	N	FG[6]	N	N	N	F	N	GE	E	N	G	PF	GE	N	PF
Fall panicum	G	N	P	N	N	N	P	N	GE	E	N	E	PF	GE	N	G
Foxtails	G	N	G	N	N	N	P	N	E	E	N	E	G	E	N	G
Goosegrass	P	N	G	N	N	N	P	N	GE	E	N	PF	P	G	N	P
Johnsongrass																
Seedling	E	N	P	N	N	N	P	N	GE	E	N	GE	GE	G	N	E
Rhizome	GE	N	N	N	N	N	N	N	P	E	N	F[11]	G[8]	NP	N	G
Shattercane	E	N	P	N	N	N	—	N	G	E	N	—	G	FG	N	E
Texas panicum	G	N	NP	N	N	N	—	N	G	E	N	—	PF	G	N	G
Sedges:																
Nutsedge																
Yellow	P	N	PF	N	G[12]	N	F	N	F	FG[7]	N	P	F	F	N	P
Purple	N	N	N	N	N	N	F	N	PF	G	N	P	FG	P	N	N
Broadleaf Weeds:																
Balloonvine	—	—	G	G	P	—	—	G	—	—	—	—	—	—	P	—
Burcucumber [9]	F	N	FG	F	P	F	—	P	F	E	PF	G	P	F	FG	F
Cocklebur	F	N	E	E	E	E	E	E	E	E	FG	E	E	E	G	F
Eastern black nightshade	N	G	GE	E	P	G	G	F	G	FG	P	G	GE	PF	FG	P
Florida beggarweed	—	—	G	G	N	E	—	FG	E	G	—	E	—	E	P	—
Florida pusley	N	FG	G	G	PN	E	—	G	E	P	—	FG	FG	G	—	—
Hemp sesbania	F	—	FG	E	P	G	—	E	F	P	—	—	—	—	P	—
Jimsonweed	FG	N	E	E	E	E	E	E	E	E	F	G	E	E	G	E
Lambsquarters	P	G	E	E	FG	E	E	E	E	E	E	E	G	E	G	F
Morningglory	F	G	G	E	P	G	GE	E	E	FG[10]	FG	E	G	E	FG	G
Pigweed	G	G	E	E	N	F	E	E	E	E	E	FG	E	E	G	G
Prickly sida	P	—	GE	G	G	F	P	G	GE	G	P	GE	G	GE	—	P
Ragweed																
Common	P	P	GE	E	G	E	FG	E	E	E	F	E	PF	E	G	P
Giant	P	N	F	GE	GE	E	—	E	G	G	P	G	P	G	P	P
Sicklepod	F	—	G	GE	N	N	P	G	G	E	P	E	F[13]	GE	N	F
Smartweed	G	—	G	E	E	GE	G	F	G	G	E	E	GE	GE	P	G
Tropic croton	—	—	G	GE	F	FG	—	G	G	G	P	—	P	G	P	—
Velvetleaf	F	E	G	G	G	G	G	G	G	E	G	G	GE	G	E	F

[1] Assumes addition of crop oil concentrate.
[2] Apply directed only.
[3] Apply only to Liberty Link hybrids.
[4] Apply only to Clearfield corn hybrids.
[5] Apply only to Roundup Ready (glyphosate-resistant) hybrids. See comments on resistance management in TABLE 7-11.
[6] No control of smooth crabgrass.
[7] Control is good with two applications of glyphosate.
[8] Follow-up treatment with Accent may be needed for acceptable control.
[9] Multiple flushes of germination; one application of any herbicide will seldom be adequate.
[10] With good application timing and a follow-up application as needed, morningglory control can be good.
[11] Ignite applied twice is usually good on johnsongrass.
[12] Two applications may be needed for good control.
[13] Sicklepod control by Lightning can be erratic. For more consistent control, mix atrazine, Banvel, Clarity, Distinct, Marksman, or 2,4-D with Lightning.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Cotton

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NOTES: A mode of action code (MOA) has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

Control of witchweed is part of the State/Federal Quarantine Program. Contact the N.C. Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
EARLY PREPLANT BURNDOWN, Burndown of emerged annual weeds in no-till, strip-till, or stale seedbed systems			
glyphosate MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Apply any time prior to planting to control emerged weeds. See labels for weeds controlled, application rates for specific weeds, and application directions and precautions. Does not adequately control cutleaf eveningprimrose, field pansy, or Carolina geranium, and may not adequately control wild radish. Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rates in the preceeding column are expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations. Cover crops: Wheat < 12 in.: 0.56 lb a.e. Wheat > 12 in.: 0.75 lb a.e. Rye < 18 in.: 0.56 lb a.e. Rye > 18 in.: 0.75 lb a.e. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations)	See label + See label	0.56 to 1.13 (lb a.e.) + 0.24 to 0.48 (lb a.e.)	See comments for glyphosate alone. Most, but not all, brands of 2,4-D may be applied at least 30 days ahead of cotton planting. Glyphosate plus 2,4-D is the most effective option available for control of cutleaf eveningprimrose. Excellent control can be obtained with 2,4-D at 0.18 to 0.24 lb a.e. Glyphosate plus 2,4-D is not effective on Carolina geranium. At higher rates (1 lb a.e.), this tank mix will control glyphosate-resistant horseweed. Research to date has shown no significant difference between ester and amine formulations of 2,4-D mixed with glyphosate. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
glyphosate, MOA 9 (numerous brands and formulations) + dicamba, diglycolamine salt, MOA 4 (Clarity) 4 SL	See label + 8 fl oz	0.56 to 1.13 (lb a.e.) + 0.25	See comments for glyphosate alone. Following application of Clarity and a minimum of 1 in. rainfall, a waiting period of at least 21 days is required before planting. Clarity controls or suppresses several annual broadleaf weeds, and it suppresses Carolina geranium and curly dock. Dicamba is somewhat less effective on cutleaf eveningprimrose than 2,4-D. This tank mixture will control glyphosate-resistant horseweed.
glyphosate, MOA 9 (numerous brands and formulations) + carfentrazone, MOA 14 (Aim) 2 EC	See label + 0.5 to 1 fl oz	0.56 to 1.13 (lb a.e.) + 0.008 to 0.016	See comments for glyphosate alone. Aim, ET, or Resource added to glyphosate will increase speed of control and may improve control of some species. These tank mixes will not control cutleaf eveningprimrose or glyphosate-resistant horseweed. See Aim, ET, or Resource labels for suggestions on adjuvant usage. There is no waiting period between application of these herbicides and cotton planting.
glyphosate, MOA 9 (numerous brands and formulations) + flumiclorac pentyl ester, MOA 14 (Resource) 0.86 EC	See label + 2 to 4 fl oz	0.56 to 1.13 (lb a.e.) + 0.013 to 0.027	
glyphosate, MOA 9 (numerous brands and formulations) + Pyraflufen ethyl, MOA 14 (ET) 0.208 EC	See label + 0.5 to 2 fl oz	0.56 to 1.13 (lb a.e.) + 0.0008 to 0.0032	
glyphosate, MOA 9 (numerous brands and formulations) + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 1 to 2 oz	0.56 to 1.13 (lb a.e.) + 0.031 to 0.063	See comments for glyphosate alone. In no-till or stale seedbed system, a minimum of 14 days must pass and a 1-in. rainfall must occur between Valor SX application and cotton planting when Valor SX is applied at 1 oz/acre; 21 days must pass when applied at 1.5 to 2 oz/acre. If a strip-till operation occurs between Valor application and cotton planting, the waiting interval can be reduced to 14 days for 2 oz Valor. However, strip-tilling after Valor application will reduce or eliminate weed control in the tilled strip. Compared to glyphosate alone, the tank mix will improve control of cutleaf eveningprimrose and wild radish. However, this tank mix is less effective than glyphosate plus 2,4-D on primrose. Clarity or 2,4-D may be added to this mixture. Do not confuse Valor SX and Valor XLT. Only Valor SX should be used for burndown in cotton. Regardless of glyphosate product used, a nonionic surfactant at 1 qt/100 gal. is recommended. Applied at 1 oz/acre, Valor SX will give 2 to 4 weeks residual control of lambsquarters, pigweed, prickly sida, spurge, and Florida pusley. At 2 oz/acre, Valor SX will give 6 to 8 weeks residual control of these species. Application to cover crop or dense stand of winter weeds may reduce residual control. This tank mixture will not control glyphosate-resistant horseweed. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed. Carefully follow label directions for cleaning out the sprayer after each day's use.**
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 + tribenuron, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	See label + 0.75 oz	0.56 to 1.13 (lb a.e.) + 0.0156 + 0.0078	See comments for glyphosate alone. Harmony Extra should be applied at least 14 days prior to planting. Compared to glyphosate alone, the tank mix is more effective on Carolina geranium, curly dock, henbit, swinecress, Virginia pepperweed, wild mustard, and wild radish. Add nonionic surfactant according to Harmony Extra label. This tank mix is not effective on cutleaf eveningprimrose or glyphosate-resistant horseweed.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
EARLY PREPLANT BURNDOWN, Burndown of emerged annual weeds in no-till, strip-till, or stale seedbed systems (continued)			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2.6 to 4 pt	0.65 to 1	Apply any time prior to planting to control emerged weeds. Add nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Follow directions and precautions on label. Usually not adequately effective on cutleaf eveningprimrose, horseweed, or larger wild mustard or wild radish. Apply 2.5 pt (0.63 lb a.i.) for wheat and 2 pt (0.5 lb a.i.) for rye cover crops. Generic brands of paraquat containing 3 lb active per gallon are available. These products should be applied at 1.7 to 2.7 pt per acre.
paraquat, MOA 22 (Gramoxone Inteon 2 SL + diuron, MOA 7 (Direx) 4 F (Diuron) 4 F	2.6 to 4 pt + 1 to 2 pt	0.65 to 1 + 0.5 to 1	See comments for Gramoxone alone. Do not apply to sand or loamy sand soil or soil with less than 1% organic matter. Higher rates of Direx may be used for heavier soils; see label for directions. Apply 15 to 45 days ahead of planting. If Cotoran is applied preemergence, reduce Cotoran rate to account for residual activity of Direx. Do not apply Di-Syston or Thimet in-furrow. When mixed with crop oil concentrate and applied in April, this combination has given good control of common weeds, including cutleaf eveningprimrose. Generic brands of paraquat containing 3 lb active per gallon are available. These products would be applied at 1.7 to 2.7 pt per acre. **See comments under EARLY PREPLANT BURNDOWN—Glyphosate-resistant horseweed.**
glufosinate-ammonium, MOA 10 (Ignite 280) 2.34 SL	29 to 43 fl oz	0.53 to 0.79	Ignite 280 SL can be applied prior to emergence of any transgenic or conventional cotton variety to control emerged weeds. If greater than 29 oz applied preplant, the seasonal total applied cannot exceed 72 fl oz. Control greatly affected by temperature; apply on a sunny day with temperature above 75 degrees. Less effective than glyphosate on grasses. **See comments under EARLY PREPLANT BURNDOWN – Glyphosate-resistant horseweed.**
EARLY PREPLANT BURNDOWN, Glyphosate-resistant horseweed			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + See label + 2 oz	0.56 to 1.13 (lb a.e.) + 1 (lb a.e.) + 0.063	Glyphosate-resistant horseweed is common in eastern North Carolina. Growers east of US 1 should assume horseweed present in their fields is glyphosate resistant and act accordingly. Glyphosate plus 2,4-D plus Valor SX or glyphosate plus Clarity plus Valor SX are the preferred treatments. See previous comments concerning waiting intervals between application of 2,4-D, Clarity, and Valor SX and planting. The 2,4-D or Clarity is needed in the mixture to control emerged resistant horseweed and the Valor SX will control any horseweed that germinates after this application. Gramoxone plus diuron must be applied 15 to 45 days ahead of cotton planting. Adjust diuron rate according to soil type, as described on product labels. Best results will be obtained if sprayed when daytime temperatures exceed 70 degrees. Add 1 gal of crop oil concentrate per 100 gal spray solution. Clarity or 2,4-D may be added to this mixture for better control of emerged horseweed, as long as appropriate waiting intervals between application and planting are maintained. Generic brands of paraquat containing 3 lb active per gal may be used at 2.7 pt. Sharpen is effective on glyphosate-resistant horseweed, but needs to be applied with other herbicides to broaden the spectrum of control. See label for specifics on adjuvant selection. **Interval between application and cotton planting varies by soil texture and organic matter. Wait to plant cotton until at least 42 days and an accumulation of 1 inch or rainfall has occurred.** See label for comments relative to at-planting application of carbamate and organophosphate insecticides and injury potential from Sharpen. Do not apply to soils classified as sand with less than 1.5% organic matter. Ignite is recommended for fields where growers have failed to control glyphosate-resistant horseweed and cotton will be planted in less than 15 days after application. Best results with Ignite will be obtained if sprayed when daytime temperatures exceed 75 degrees. If greater than 29 oz applied preplant, the seasonal total applied cannot exceed 72 fl oz.
glyphosate, MOA 9 (numerous brands and formulations) + dicamba, diglycolamine salt, MOA 4 (Clarity) 4 SL + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 8 fl oz + 1 to 2 oz	0.56 to 1.13 (lb a.e.) + 0.25 + 0.063	
paraquat, MOA 22 (Gramoxone Inteon 2 SL + diuron, MOA 7 (Direx) 4 F (Diuron) 4F	4 pt + 1 to 2 pt	1 + 0.5 to 1	
safufenacil, MOA 14 (Sharpen) 2.85 F	1.0 fl oz	0.022	
glufosinate, MOA 10 (Ignite 280 SL) 2.34 L	29 to 43 fl oz	0.53 to 0.79	
AT PLANTING BURNDOWN, Burndown of cover crops and weeds at planting			
glyphosate MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	See TABLE 7-10 for glyphosate rate conversions. If an early burndown treatment was applied (see COTTON—Early Preplant Burndown), apply glyphosate or paraquat in combination with desired residual herbicides at planting. Glyphosate or paraquat may be tank mixed with registered preemergence herbicides and applied after planting but before cotton emergence. See suggested rates and precautions on labels of tank-mix partners. If an early burndown treatment was not used, apply glyphosate or paraquat 7 to 21 days ahead of planting. If weeds are emerged at planting, make a second application in combination with desired residual herbicides. See comments on residual herbicides under COTTON—Preemergence. Glyphosate and paraquat rates depend upon weed species and size; see labels for recommended rates. Add nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal spray solution to Gramoxone. Need for adjuvants with glyphosate depends upon brand used; see specific labels for details. Generic brands of paraquat containing 3 lb active per gallon are available. These products would be applied at 1.7 to 2.7 pt per acre. Cover crops: Wheat < 12 in.: glyphosate, 0.56 lb a.e. or paraquat, 0.65 lb a.i. Wheat > 12 in.; glyphosate 0.75 lb a.e. or paraquat, 0.65 lb a.i. Rye < 18 in.: glyphosate, 0.56 lb a.e. or paraquat, 0.5 lb a.i. Rye > 18 in.: glyphosate, 0.75 lb a.e. or paraquat, 0.5 lb a.i.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2.6 to 4 pt	0.65 to 1	
glufosinate-ammonium, MOA 10 Ignite 280 SL	29 to 43 fl oz	0.53 to 0.79	See comments under EARLY PREPLANT BURNDOWN for more details.
PREPLANT INCORPORATED, Annual grasses and certain small- seeded broadleaf weeds			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	1.2 to 3.6 pt 2 to 4 pt	0.5 to 1.5 0.95 to 1.9	Consult labels for application rates and for time, method, and depth of incorporation. Deep incorporation, especially on sandy soils, may cause stunting and delayed crop development. Incorporation of trifluralin can be delayed 24 hr; pendimethalin incorporation can be delayed 7 days. Immediate incorporation is suggested. Generic brands of pendimethalin and trifluralin are available.
trifluralin, MOA 3 (Treflan) 4 EC	1 to 2 pt	0.5 to 1	

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREPLANT INCORPORATED, Annual grasses and most annual broadleaf weeds			
trifluralin, MOA 3 (Treflan) 4 EC + fluometuron, MOA 7 (Cotoran) 4 F	1 to 2 pt + 1 to 2 qt	0.5 to 1 + 1 to 2	Follow trifluralin label for incorporation directions. Fluometuron is usually more effective on broadleaf weeds as a preemergence application if adequate rainfall for activation is received. Shallow incorporation is more effective than deep incorporation. Generic brands of fluometuron and trifluralin are available.
PREEMERGENCE, Annual grasses, pigweed, and lambsquarters			
pendimethalin, MOA 3 (Prowl H_2O) 3.8 L (Prowl) 3.3 EC	2 to 4 pt 2.4 to 3.6 pt	0.95 to 1.9	See labels for rates on specific soils. May be mixed with diuron, fluometuron, Reflex, or Staple. Generic brands of pendimethalin are available.
PREEMERGENCE, Most annual broadleaf weeds			
diuron, MOA 7 (Direx) 4 F (Diuron) 4 F	1 to 2 pt	0.5 to 1	See label for rates on specific soils. May be mixed with pendimethalin, Reflex, or Staple. See rotational restrictions and maximum seasonal use rates on label. Other brands of diuron are available. Do not apply Di-Syston or Thimet in-furrow.
fluometuron, MOA 7 (Cotoran) 4 F	1 to 2 qt	1 to 2	Use the lower end of rate range on lighter soils. May be tank mixed with pendimethalin, Reflex, or Staple. Generic brands are available.
fomesafen, MOA 14 (Reflex) 2 L (Dawn) 2 SL	1 to 1.5 pt	0.25 to 0.38	Suggested primarily for control of Palmer amaranth. Also very effective on yellow nutsedge. Label restricts application only to coarse-textured soils. May be tank mixed with diuron, fluometuron, pendimethalin, or Staple. See label for specific comments on tank mixing.
pyrithiobac sodium, MOA 2 (Staple LX) 3.2 SL	1.7 to 2.1 fl oz	0.0425 to 0.053	Do not apply Staple preemergence on soils with less than 0.5% organic matter. May tank mix with diuron, fluometuron, pendimethalin, or Reflex. Palmer amaranth biotypes resistant to Staple are very common in North Carolina.
POST-EMERGENCE OVERTOP, Annual broadleaf weeds, any cultivar			
fluometuron, MOA 7 (Cotoran) 4 F	1 to 2 qt	1 to 2	May be applied overtop cotton 3 to 6 in. tall. Add surfactant according to label directions. Overtop application should be considered as a **salvage treatment only**; cotton usually injured, maturity delayed, and yield reduced. Rates greater than 1 lb a.i. per acre not advised. Other brands of fluometuron may be used in a similar manner.
MSMA, MOA 17 (various brands)	1 to 1.25 pt	0.75 to 1	Apply to cotton 3 to 6 in. tall, but before first square stage. Directed application preferred; overtop application injures cotton and may delay maturity and reduce yield. Consider only as a **salvage treatment** for cocklebur. Use only a brand of MSMA specifically labeled for overtop application. Add nonionic surfactant if the label of the brand used specifies a surfactant.
pyrithiobac sodium, MOA 2 (Staple) 3.2 SL	2.6 to 3.8 fl oz	0.065 to 0.095	May be applied overtop of cotton from cotyledonary stage up to 60 days prior to harvest. Avoid application during or shortly after cool weather. Apply in 10 to 40 GPA at 20 to 40 PSI. Add nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not add crop oil. May make two applications per year, not exceeding a total of 5.1 fl oz. May be tank mixed with most insecticides, but do not tank mix with any product containing malathion. Tank mixing with post-emergence grass control herbicides is discouraged. See label for rotational restrictions and weeds controlled. Timing of application is very important for most weeds. Apply before susceptible broadleaf weeds exceed 4 in. tall. Does not control tall morningglory, lambsquarters, or common ragweed. Only suppresses sicklepod. Sicklepod control can be enhanced by adding1 pt per acre of MSMA. However, adding MSMA may reduce control of pigweed species. Staple and Envoke are ALS inhibitors. Biotypes of Palmer amaranth and cocklebur resistant to ALS inhibitors have been found in North Carolina; ALS-resistant Palmer amaranth is very common. Resistant biotypes are more likely to be found in fields with a history of ALS-inhibitor usage. Commonly used ALS ihibitors, in addition to Staple and Envoke, include Accent, Cadre, Classic, FirstRate, Harmony SG, Pursuit, Resolve, Resolve Q, Scepter, Steadfast, Stout, and Strongarm. To aid in resistance management, it is suggested that an ALS inhibitor (Staple or Envoke) be applied only once a year.
trifloxysulfuron, MOA 2 (Envoke) 75 WDG	0.1 oz	0.0047	May be applied overtop cotton after it has a minimum of five true leaves up to 60 days prior to harvest. On larger cotton, directed application is preferred for better coverage of weeds. Add nonionic surfactant at 0.25% by volume (1 qt per 100 gal). May make two applications, but do not exceed 0.0188 lb a.i./acre per year of trifloxysulfuron from the combined use of Envoke and Suprend. Do not mix with other pesticides when applying overtop cotton. See label for rotational restrictions and weeds controlled. Controls most broadleaf weeds with timely application; common exceptions include prickly sida, jimsonweed, copperleaf, and spurred anoda. Reduced growth of cotton, due to shortened internodes, is sometimes observed. Shortened internodes are more likely on smaller cotton. Envoke may also be applied overtop at 0.15 oz/acre if needed for larger weeds. Staple and Envoke are ALS inhibitors. Biotypes of Palmer amaranth and cocklebur resistant to ALS inhibitors have been found in North Carolina; ALS-resistant Palmer amaranth is very common. Resistant biotypes are more likely to be found in fields with a history of ALS-inhibitor usage. Commonly used ALS ihibitors, in addition to Staple and Envoke, include Accent, Cadre, Classic, FirstRate, Harmony SG, Pursuit, Resolve, Resolve Q, Scepter, Steadfast, Stout, and Strongarm. To aid in resistance management, it is suggested that an ALS ihibitor (Envoke or Staple) be applied only once per year.
trifloxysulfuron, MOA 2 (Envoke) 75 WDG + pyrithiobac, MOA 2 (Staple LX) 3.2 SL	0.1 oz + 1.3 to 1.9 fl oz	0.0047 + 0.033 to 0.048	See comments for Envoke and Staple applied alone. Compared with Envoke alone, tank mix is more effective on eclipta, jimsonweed, and spurred anoda. Compared with Staple alone, tank mix is more effective on ragweed, lambsquarters, tall morningglory, and sicklepod. Add nonionic surfactant at 0.25% by volume.
POST-EMERGENCE OVERTOP, Annual grasses, any cultivar			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	6 to 8 fl oz 9 to 16 fl oz	0.094 to 0.125 0.068 to 0.121	Apply to actively growing grass not under drought stress. See label for maximum weed size to treat and suggested rate. Apply in 10 to 40 GPA. Add crop oil at 1 qt per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Do not cultivate within 7 days before or after application. A second application may be made if needed. Generic brands of clethodim available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	8 to 12 fl oz	0.125 to 0.188	Apply to actively growing grass not under drought stress. Suggested application rate varies by species and weed size; see label. Apply in 5 to 40 gpa at 40 to 60 psi. Add either crop oil concentrate at 1% by volume (1 gal per 100 gal) or nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not cultivate within 7 days before or after application. A second application may be made if necessary. May use 6 oz per acre for seedling johnsongrass or shattercane.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	7 to 8 fl oz	0.05 to 0.06	Apply to actively growing grass not under drought stress. See label for maximum weed size to treat and suggested rate. Apply in 10 to 40 gpa. Add either crop oil concentrate at 1% by volume (1 gal per 100 gal) or nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not cultivate within 7 days before or after application. A second application may be made if needed. May use 5 oz per acre for seedling johnsongrass or shattercane.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1.0 EC	16 fl oz 24 fl oz	0.19	Apply to actively growing grass not under drought stress. Consult label for maximum grass size to treat. Apply in 5 to 20 gpa at 40 to 60 psi. Add 2 pt per acre of crop oil concentrate. Do not cultivate within 7 days before or after application. A second application may be made if necessary. Consult label for special rates for early treatment or rescue treatment.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE OVERTOP, Bermudagrass, any cultivar			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply to actively growing bermudagrass when runners are up to 6 in. A second application of 8 to 16 fl oz of Select or 12 to 32 fl oz of Select Max may be applied if needed when regrowth is up to 6 in. Add crop oil concentrate at 1 qt per acre for Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Cultivation may improve control, but do not cultivate for 7 days before or after application. Use the higher rate under heavy grass pressure or on larger grass. Spray coverage, especially with second application, may be improved by directing the spray under the cotton canopy. Generic brands of clethodim are available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	12 fl oz	0.19	Apply to actively growing bermudagrass when runners are 4 to 8 in. long. If regrowth occurs, make a second application of 8 fl oz when bermudagrass runners are 4 to 8 in. long. Add either crop oil concentrate at 1 qt per acre or nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Spray coverage, especially with second application, may be improved by directing the spray under the cotton canopy. Cultivation may improve control, but do not cultivate for 7 days before or after application.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply to actively growing bermudagrass when runners are up to 6 in. A second application of 7 fl oz per acre may be applied if needed when regrowth is up to 6 in. Add either a crop oil concentrate at 1% by volume (1 gal per 100 gal) or a nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Cultivation may improve control, but do not cultivate for 7 days before or after application. Spray coverage, especially with second application, may be improved by directing the spray under the cotton canopy.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing bermudagrass before runners exceed 6 in. If regrowth occurs or new plants emerge, make a second application of 16 oz Poast or 24 oz Poast Plus before runners exceed 4 in. Add 2 pt of crop oil concentrate per acre. Spray coverage, especially with second application, may be improved by directing the spray under the cotton canopy. Cultivation may improve control, but do not cultivate for 7 days before or after application.
POST-EMERGENCE OVERTOP, Rhizome johnsongrass, any cultivar			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply to actively growing johnsongrass 12 to 24 in. tall. A second application of 6 to 8 fl oz of Select or 9 to 24 fl oz of Select Max may be applied if needed when regrowth is 6 to 18 in. Add a crop oil concentrate at 1 qt per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Cultivation may improve control, but do not cultivate for 7 days before or after application. Generic brands of clethodim are available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	10 to 12 fl oz	0.156 to 0.19	Apply to actively growing johnsongrass 8 to 18 in. tall and before boot stage. A second application of 8 fl oz per acre may be made when regrowth or new plants are 6 to 12 in. tall. Add either a crop oil concentrate at 1% by volume (1 gal per 100 gal) or a nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not cultivate within 7 days before or after application. Cultivation may improve control. The first application can be reduced to 8 fl oz if a second application is planned.
quizalofop-p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply to actively growing johnsongrass 10 to 24 in. tall. A second application of 7 fl oz per acre may be applied if needed when regrowth is 6 to 10 in. Add either a crop oil concentrate at 1% by volume (1 gal per 100 gal) or a nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Cultivation may improve control, but do not cultivate for 7 days before or after application.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing johnsongrass up to 25 in. tall. Apply in 5 to 20 gpa at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre. Do not cultivate for 7 days before or after application. Cultivation may improve control. A second application of 16 oz of Poast or 24 oz Poast Plus may be made when regrowth or new plants are up to 12 in.
POST-EMERGENCE OVERTOP, Annual broadleaf weeds and most annual grasses, **LIBERTY LINK CULTIVARS ONLY**			
glufosinate-ammonium, MOA 10 (Ignite 280 SL) 2.34 L	29 to 43 fl oz	0.53 to 0.79	**APPLY ONLY TO LIBERTY LINK CULTIVARS.** Can be applied overtop or directed from cotton emergence until the early bloom stage. Good spray coverage is critical. Use flat-fan nozzles and a minimum of 15 gpa. Better coverage may be obtained on larger cotton with a semi-directed application. Multiple applications are allowed. Ignite at 22 to 29 fl oz can be applied three times, with a seasonal maximum of 87 fl oz. If applied at rates greater than 29 oz, only two applications are allowed and the total rate per season cannot exceed 72 fl oz. Glufosinate controls most annual grass and broadleaf weeds, although timing of application on pigweed (including Palmer amaranth) and grasses (especially goosegrass) is critical. Preemergence herbicides are encouraged to help in control of pigweed and grasses. Glufosinate is generally more effective on broadleaf weeds than grasses. Broadleaf weeds should be 2 to 3 in. tall and grasses 1 to 2 in. tall. An adjuvant is not necessary. Glufosinate may be mixed with Staple (1.3 to 1.7 fl oz) for better pigweed control and residual control of susceptible species. Alternatively, glufosinate may be mixed with Dual Magnum (1 to 1.33 pt) for residual control of susceptible species. Do not mix Dual and Staple. Postemergence grass control herbicides, such as Assure, Fusilade, Poast, or Select, should not be mixed with Ignite. Applications of postemergence grass herbicides and Ignite should be separated by at least 5 days.
POST-EMERGENCE OVERTOP, Annual broadleaf weeds and most annual grasses, **PHYTOGEN WIDESTRIKE CULTIVARS**			
glufosinate-ammonium, MOA 10 (Ignite 280 SL) 2.34 L	29 fl oz	0.53	Phytogen cultivars with the Widestrike trait can be treated with Ignite. Tolerance to Ignite in these cultivars is not complete, and varying levels of crop injury may be observed. Greater injury can be expected when Ignite is mixed with insecticides or other herbicides. **Growers assume the liability** of crop injury when cotton with the Widestrike trait is treated with Ignite. It is suggested that the rate not exceed 29 oz per application with a maximum of two applications per year. It is also suggested that Ignite not be applied beyond the 8-leaf stage of cotton and that AMS not be included in the application. See above comments for use of Ignite on LibertyLink cultivars.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE OVERTOP, Annual grasses, broadleaf weeds, perennial grasses, and nutsedge; suppression of perennial broadleaf weeds, **ROUNDUP READY FLEX CULTIVARS ONLY**			
glyphosate, potassium salt, MOA 9 or Glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations)	See labels	0.56 to 1.13 (lb a.e.)	**APPLY ONLY TO ROUNDUP READYFLEX CULTIVARS.** Use only brands specifically labeled for Roundup Ready Flex cotton. Not all brands are registered for this use. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rates in the preceeding column are expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Glyphosate may be applied overtop or directed to Flex cotton any time from cotton emergence until 7 days prior to harvest. See labels for maximum use rates during specific periods of the growing season. Directed application may be preferred in larger cotton to allow better coverage of weeds under the crop canopy or to allow tank mixes with other herbicides. Glyphosate controls most annual weeds; exceptions include dayflower, dove weed (commonly called marsh dayflower), Florida pusley, and hemp sesbania. Timely application is critical for morningglory control. Multiple applications are needed for nutsedge and bermudagrass. See label of brand you use for recommended rates and sizes of weeds to treat. Adjuvant recommendations vary according to glyphosate product. See label of brand used for specific recommendations. Glyphosate-resistant Palmer amaranth is common in North Carolina, and glyphosate-resistant common ragweed is present in several counties. Continued heavy reliance on herbicide programs based predominantly on glyphosate will enhance selection for resistant biotypes. Other chemistry, including preemergence herbicides, tank mixes with glyphosate, and layby herbicides in addition to glyphosate, is recommended as part of a resistance-management strategy. See section on Herbicide Resistance and TABLE 7-11.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + Acetochlor, MOA 15 (Warrant) 3.0 ME	See labels + 3 pt	0.56 to 1.13 (lb a.e.) + 1.125	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** See comments for glyphosate applied alone, including comments on resistance management. Apply after cotton is completely emerged but before first bloom. Warrant will not control emerged weeds, but it will provide residual control of susceptible species such as annual grasses and pigweed species. Optimum timing is 2- to 3-leaf cotton, and before weeds emerge. A second application can be made if directed to the soil surface. Warrant may cause some foliar burn on cotton; mixing with insecticides may increase burn. Warrant rate can be increased to 4 pt on some soils; see label for details. See Warrant label for use restrictions pertaining to ground water.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + S-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC	See labels + 1 to 1.33 pt	0.56 to 1.13 (lb a.e.) + 0.95 to 1.27	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** See comments for glyphosate applied alone, including comments on resistance management. Can apply tank mix overtop cotton from 3 in. tall until 100 days before harvest. S-metolachlor will not control emerged weeds, but it can provide residual control of susceptible species such as annual grasses and pigweed species. This treatment may cause foliar burn on the crop. Burn may be enhanced if applied to cotton with dew, under extremely high temperatures, or when mixed with insecticide. Several products containing metolachlor (not s-metolachlor) are available. Metolachlor products are less effective per unit of formulated product than those with s-metolachlor. In general, it takes 1.5 pt of a metolachlor product to give the activity one gets from 1 pt of s-metolachlor.
glyphosate, MOA 9 + S-metolachlor, MOA 15 (Sequence) 5.5 L	2.5 pt	0.70 (lb a.e.) + 0.94	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** See comments for glyphosate alone, including comments on resistance management. Also see comments on glyphosate + s-metolachlor. Apply to cotton in cotyledonary stage up to 10-leaf stage, but not to cotton taller than 12 inches.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + pyrithiobac sodium, MOA 2 (Staple LX) 3.2 SL	See labels + 1.3 to 3.8 fl oz	0.56 to 1.13 (lb a.e.) + 0.033 to 0.095	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** See comments for glyphosate applied alone, including comments on resistance management. Can apply overtop from cotyledonary stage cotton until 60 days prior to harvest. See directions on Staple label concerning adjuvant usage. Palmer amaranth resistant to both Staple and glyphosate is widespread in North Carolina.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + trifloxysulfuron, MOA 2 (Envoke) 75 WDG	See labels + 0.1 oz	0.56 to 1.13 (lb a.e.) + 0.0047	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** See comments for glyphosate and Envoke applied alone, including comments on resistance management. See Envoke label and glyphosate label for suggestions on adjuvant usage. Tank mix can be applied from 5-leaf cotton stage until 60 days prior to harvest. For better crop safety, however, cotton should have at least 7 to 8 leaves at time of treatment.
POST-EMERGENCE OVERTOP, Volunteer Roundup Ready corn in Roundup Ready Flex cotton			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	See labels + 4 to 8 fl oz 6 to 12 fl oz	0.56 to 1.13 (lb a.e.) + 0.063 to 0.125 0.045 to 0.106	See comments for glyphosate alone. For corn up to 12 in., apply 4 to 6 oz of Select or 6 oz of Select Max. For corn up to 24 in., apply 6 to 8 oz of Select or 9 oz of Select Max. For corn up to 36 in., apply 12 oz of Select Max. Add 2.5 lb per acre ammonium sulfate or equivalent. If brand of glyphosate used does not contain surfactant, add nonionic surfactant at 0.25 to 0.5% by volume. If applying Select or Select Max alone, see label for adjuvant recommendations.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE OVERTOP, Volunteer Roundup Ready corn in Roundup Ready Flex cotton (continued)			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + fluazifop-p-butyl MOA 1 (Fusilade DX) 2 EC	See labels + 4 to 6 fl oz	0.56 to 1.13 (lb a.e.) + 0.063 to 0.094	See comments for glyphosate alone. For corn up to 12 in., apply 4 oz of Fusilade. For corn up to 24 in., apply 6 oz of Fusilade. Add any adjuvants suggested on the label of the glyphosate product used. Additionally, add 0.25% by volume of crop oil concentrate. If applying Fusilade alone, see label for adjuvant recommendations.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + quizalofop-p-ethyl, MOA 1 (Assure II) 0.88 EC	See labels + 5 to 8 fl oz	0.56 to 1.13 (lb a.e.) + 0.034 to 0.055	See comments for glyphosate alone. For corn up to 12 in., apply 4 oz of Assure. For corn up to 18 in., apply 5 oz of Assure. For corn up to 30 in., apply 8 oz of Assure. If the brand of glyphosate used does contains adjuvant, add 0.125% nonionic surfactant by volume. If the brand of glyphosate does not contain adjuvant, add surfactant according to the glyphosate label. If applying Assure alone, see label for adjuvant recommendations.
POST-EMERGENCE OVERTOP, Volunteer Roundup Ready soybean in Roundup Ready Flex cotton			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + trifloxysulfuron, MOA 2 (Envoke) 75 WDG	See labels + 0.1 oz	0.56 to 1.13 (lb a.e.) + 0.0047	See above comments for glyphosate plus Envoke. Cotton should have at least five leaves, and the soybean should have no more than four to five trifoliate leaves. Not adequately effective on soybean with the STS trait.
POST-EMERGENCE DIRECTED, Cocklebur, small annual grasses, and nutsedge			
MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	 2.67 pt 2.5 pt	2	Do not apply overtop at these rates. MSMA can be directed alone or mixed with other postemergence broadleaf herbicides on cotton at least 3 in. tall up to first bloom. Do not apply MSMA after first bloom. Adequate control of nutsedge usually requires two applications. Follow label directions for use of adjuvants.
POST-EMERGENCE DIRECTED, Annual broadleaf weeds, small annual grasses, and nutsedge			
diuron, MOA 7 (Direx) 4 L (Diuron) 4 L + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	1.6 to 2.4 pt + 2.67 pt 2.5 pt	0.8 to 1.2 + 2 	Apply as directed spray only to cotton at least 12 in. tall. Adjust rate according to soil type. See application precautions on label. Add nonionic surfactant at 1 to 2 qt per 100 gal spray solution or crop oil concentrate at 1 gal per 100 gal spray solution. Label prohibits use on sand or loamy sand soils, or on any soil with less than 1% organic matter. See label for rotational restrictions. Do not apply MSMA after first bloom. Aim EC at 1 fl oz or Cobra at 6 to 8 fl oz per acre may be added to improve control of larger morningglory. Cotton should be at least 16 in. tall when applying Aim. Do not allow Aim to contact green stem tissue.
diuron, MOA 7 + linuron, MOA 7 (Layby Pro) 4 L + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	 2 pt + 2.67 pt 2.5 pt	0.5 + 0.5 + 2 	Apply as directed spray only to cotton at least 15 in. tall. See application precautions on label. Add crop oil concentrate at 1 gal per 100 gal spray solution. Label prohibits use on sand or loamy sand soils, or on any soil with less than 1% organic matter. See label for rotational restrictions. Do not apply MSMA after first bloom. Aim at 1 fl oz/acre may be added to improve control of larger morningglory. Do not allow Aim to contact green stem tissue.
flumioxazin, MOA 14 (Valor SX) 51 WDG + MSMA, MOA17 (several brands) 6.0 lb/gal 6.6 lb/gal	2 oz + 2.67 pt 2.5 pt	0.064 + 2 	Apply as directed spray only to cotton at least 16 in. tall. Direct the spray to the lower 2 in. of the cotton stem. Do not allow spray solution to contact green portion of stem. Add nonionic surfactant at 1 qt per 100 gal spray solution. Do NOT use crop oil concentrate, methylated seed oil, organo-silicone adjuvants, or any adjuvant product containing any of these. Do not apply MSMA after first bloom. No rotational restrictions of concern in North Carolina. May be applied under a hood on cotton at least 6 in. tall. Do not allow spray solution to contact cotton.
fluometuron, MOA 7 (Cotoran) 4 L + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	1 to 2 qt + 2.67 pt 2.5 pt	1 to 2 + 2 	Apply as a directed spray only to cotton at least 3 in. tall up to first bloom. Follow label directions for weed size and addition of surfactant. See Cotoran label for maximum application rates per season and rotational restrictions. Other brands of fluometuron may be available.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE DIRECTED, Annual broadleaf weeds, small annual grasses, and nutsedge (continued)			
fluometuron, MOA, 7 (Cotoran) 4 L + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal + S-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	1 to 2 qt + 2.67 pt 2.5 pt + 1 to 1.33 pt	1 to 2 + 2	Apply as directed spray to cotton at least 3 in. tall up to first bloom. Do not apply after first bloom. Add surfactant according to Cotoran label. Dual gives residual control of annual grasses and pigweed species plus suppression of yellow nutsedge. See comments for Cotoran plus MSMA.
lactofen, MOA 14 (Cobra) 2 EC + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	12.5 oz + 2.67 pt 2.5 pt	0.2 + 2	Apply as directed spray or with hooded sprayer. Cotton should be at least 6 to 8 in. tall, preferably larger. See Cobra label for weeds controlled, directions on weed size and application rates, and use of surfactant or crop oil. Do not apply MSMA after first bloom.
lactofen, MOA 14 (Cobra) 2 EC + diruron, MOA 7 (Direx) 4 F (Diuron) 4 F + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	6 to 12.5 fl oz + 0.8 to 1.2 pt + 2.67 pt 2.5 pt	0.094 to 0.2 + 0.4 to 0.6 + 2	Apply as directed spray or with hooded sprayer. Cotton should be at least 12 in. tall. See Cobra label for weeds controlled and directions on weed size and application rates. Add 1 qt per acre of crop oil concentrate. See rotational restrictions on diuron label. Do not apply MSMA after first bloom.
linuron, MOA 7 (Linex) 4 L + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	2 pt + 2.67 pt 2.5 pt	1 + 2	Apply as directed spray only to cotton at least 20 in. tall. See precautions on label. Add 2 qt nonionic surfactant per 100 gal spray solution. Do not apply MSMA after first bloom. No rotational restrictions.
prometryn, MOA 5 (Caparol) 4 F + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	1.3 to 2.8 pt + 2.67 pt 2.5 pt	0.65 to 1.4 + 2	Apply 1.3 pt Caparol as directed spray only to cotton at least 6 in. tall. Increase to higher rate for the soil type after cotton is at least 12 in. tall. See label for rates on various soil types. Add 2 qt nonionic surfactant per 100 gal spray solution. Do not apply after first bloom. Aim at 1 fl oz or Cobra at 6 to 12.5 fl oz may be added to improve control of larger morningglory. Cotton should be at least 16 in. tall when when applying Aim. Do not allow Aim to contact green stem tissue.
prometryn, MOA 5 + trifloxysulfuron, MOA 2 (Suprend) 80 WDG + MSMA, MOA 17 (several brands) 6 lb/gal 6.6 lb/gal	 1 to 1.25 lb + 2.67 pt 2.5 pt	0.8 to 1 + 0.007 to 0.0088 + 2	Apply as directed spray at cotton at least 6 in. tall, preferably taller. Add nonionic surfactant at 1 qt per 100 gal spray solution. See rotational restrictions on label. Do not apply MSMA after first bloom. Do not exceed 0.0188 lb a.i./acre per year of trifloxysulfuron from the combined use of Envoke and Suprend. Suprend is formulated as 79.3% prometryn plus 0.7% trifloxysulfuron.
POST-EMERGENCE DIRECTED, Annual grasses and broadleaf weeds, nutsedge, and suppression of perennial weeds; **ROUNDUP READY FLEX CULTIVARS ONLY**			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations)	See labels	0.75 to 1.13 (lb a.e.)	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Glyphosate alone can be directed to Flex cotton up to 7 days prior to harvest. When using glyphosate alone, contact with the Flex cotton is not of concern; the primary reason to direct is to obtain better coverage of weeds under the crop canopy. Use of other herbicides, in addition to glyphosate, is recommended to aid in resistance management. See the section on Herbicide Resistance Management and TABLE 7-11. When tank mixing, follow directions on label of tank mix partner concerning cotton size for application, application directions (including allowable contact with cotton plant), and rotational restrictions. Glyphosate-resistant Palmer amaranth is widespread in North Carolina, and glyphosate resistant common ragweed is present in several counties. Continued heavy reliance on herbicide programs based predominantly on glyphosate will enhance selection for resistant biotypes. In addition to glyphosate, other chemistry, including preemergence herbicides, tank mixes with glyphosate, and layby herbicides, are recommended as part of a resistance management strategy. See section on Herbicide Resistance Management and TABLE 7-11.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE DIRECTED, Annual grasses and broadleaf weeds, nutsedge, and suppression of perennial weeds; **ROUNDUP READY FLEX CULTIVARS ONLY (continued)**			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + carfentrazone, MOA 14 (Aim EC) 2 EC	See labels + 1 to 1.5 fl oz	0.75 to 1.13 (lb a.e.) + 0.016 to 0.024	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Cotton should be at least 16 in. tall. Extreme care should be exercised in application; see directions and precautions on Aim label. Contact on green stem tissue will lead to severe injury. Add crop oil concentrate according to the Aim label. See comments on Aim label concerning sprayer clean-out. Compared to glyphosate alone, this combination controls larger morninglories. See above comments for glyphosate alone.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + diuron, MOA 7 (Direx) 4 L (Diuron) 4 L	See labels + 1 to 1.5 pt	0.75 to 1.13 (lb a.e.) + 0.5 to 0.75	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Use 1 pt of Direx on cotton 8 to 12 in. tall. Increase rate to 1.5 pt Direx on cotton greater than 12 in. See comments for glyphosate applied alone. Add surfactant according to the label of the glyphosate brand used. Compared to glyphosate alone, this combination controls larger morninglories and provides residual control of small-seeded broadleaf weeds, such as pigweed. This tank mix may give less control of larger grasses than glyphosate alone under dry conditions. See diuron label for rotational restrictions.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 1 to 2 oz	0.56 to 0.75 + 0.031 to 0.063	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Cotton should be at least 16 in. tall. Direct the spray to the lower 1 to 2 in. of the cotton stem; minimize cotton contact as much as possible. Do not allow spray solution to contact green portion of stem. See comments above for glyphosate alone. Do not confuse Valor SX and Valor XLT. Only Valor SX should be applied to cotton. Add nonionic surfactant at 1 qt per 100 gal spray solution. Do NOT use crop oil concentrate, methylated seed oil, organo-silicone adjuvants, or any adjuvant product containing any of these. No rotational restrictions of concern in North Carolina. Compared with glyphosate alone, the combination will give better control of larger morninglories plus residual control of susceptible broadleaf weeds. May be applied under a hood on cotton at least 6 in. tall. Do not allow spray solution to contact cotton.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + prometryn, MOA 5 (Caparol) 4 F	See labels + 0.5 to 1	0.75 to 1.13 (lb a.e.) + 1 to 2 pt	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Direct to cotton at least 6 to 8 in. tall. Use 1 to 1.3 pt Caparol on cotton 6 to 12 in. tall; rate can be increased to 2 pt on cotton at least 12 in. tall. Add surfactant according to the label of the brand of glyphosate used. See precautions and rotational restrictions on Caparol label. Compared to glyphosate alone, this combination will improve control of larger morningglory and may provide residual control of small-seeded broadleaf weeds, such as pigweed. This mixture may give less control of larger grasses than glyphosate alone under drier conditions.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + prometryn, MOA 5 + trifloxysulfuron, MOA 2 (Suprend) 80 WDG	See labels + 1 to 1.25 lb	0.75 to 1.13 (lb a.e.) + 0.8 to 1.0 + 0.007 to 0.0088	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS**. Direct to cotton at least 6 to 8 in. tall. Add surfactant according to label of glyphosate brand used. See precautions and rotational restrictions on Suprend label. Compared to glyphosate alone, this combination will improve control of larger morningglory and nutsedge, and may provide residual control of small-seeded broadleaf weeds, such as pigweed. This mixture may give less control of larger grasses than glyphosate alone under drier conditions.
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + trifloxysulfuron, MOA 2 (Envoke) 75 DF	See labels + 0.1 to 0.2 oz	0.75 to 1.13 (lb a.e.) + 0.0047 to 0.0094	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Direct to cotton from 6 in. tall through layby. Add nonionic surfactant according to the Envoke label. Compared to glyphosate alone, the combination is more effective on nutsedge and morningglory and provides residual control of susceptible broadleaf weeds. See comments above for glyphosate alone.

TABLE 7-2A CHEMICAL WEED CONTROL IN COTTON

Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POST-EMERGENCE DIRECTED, Annual grasses and broadleaf weeds, nutsedge, and suppression of perennial weeds; **ROUNDUP READY FLEX CULTIVARS ONLY (continued)**			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + acetochlor, MOA 9 (Warrant) 3.0 ME	See labels + 3 pt	0.75 to 1.13 (lb a.e.) + 1.125	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS**. Can be directed to cotton up to first bloom. Add surfactant according to label of glyphosate brand used. See comments for glyphosate applied alone. Warrant does not improve control of emerged weeds, but it can give residual control of annual grasses and pigweed species.,
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations) + S-metolachlor, MOA 9 (Brawl, Dual Magnum, or Medal) 7.62 EC	See labels + 1 to 1.33 pt	0.75 to 1.13 (lb a.e.) + 0.95 to 1.27	**APPLY ONLY TO ROUNDUP READYEX CULTIVARS.** Can be applied to cotton 3 in. tall through layby. See comments for glyphosate applied alone. Dual does not improve control of emerged weeds, but it can give residual control of annual grasses, pigweed species, and spreading dayflower plus suppression of yellow nutsedge. Do not apply to sand or loamy sand soils.
glyphosate, MOA 9 + S-metolachlor, MOA 15 (Sequence) 5.25 L	2.5 pt	0.70 (lb a.e.) + 0.94	**APPLY ONLY TO ROUNDUP READY FLEX CULTIVARS.** Direct to cotton up to 12-in tall. Do not add adjuvants or tank mix with other products. Compared with glyphosate alone, Sequence will give residual control of annual grasses, pigweed species, and spreading dayflower plus suppression of nutsedge. See comments above for glyphosate alone.
POST-EMERGENCE (hooded sprayers), Annual grasses, broadleaf weeds, and sedges			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations)	See labels	0.75 (lb a.e.)	On non-Roundup Ready cotton, hoods must be kept close to the ground so that no spray solution contacts the crop. Speed should not exceed 5 mph. Use 5 to 10 gpa and maximum pressure of 25 psi. Do not use liquid nitrogen as the carrier. Other herbicides as discussed in the section on directed application may be mixed with glyphosate to improve burndown and to provide residual control.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	1.2 to 2.4 pt	0.3 to 0.6	Hoods should be kept as close to the ground as possible. Do NOT allow the spray solution to contact cotton plants. Apply in a minimum of 10 gpa at maximum pressure of 25 psi. Do not exceed 5 mph. It is suggested that cotton be at least 6 in. tall. Add nonionic surfactant or crop oil concentrate according to the Gramoxone label. Control will generally be much better if diuron or Caparol is mixed with Gramoxone. Diuron or Caparol may also provide residual control. Generic brands of paraquat containing 3 lb active per gallon are available. These products would be applied at 13 to 26 fl oz per acre.
HARVEST AID, Annual grasses and broadleaf weeds			
glyphosate, potassium salt, MOA 9 or glyphosate, isopropylamine salt, MOA 9 (numerous brands and formulations)	See labels	0.75 to 1.5 (lb a.e.)	Apply to any cultivar after at least 60% of the bolls are open. May be tank mixed with some defoliants; see labels for details. Include nonionic surfactant according to the label of the glyphosate brand used. See Extension publication AG-417, *Cotton Information*, for more details. Can be applied to Roundup Ready Flex cotton up to 7 days before harvest.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	16 to 32 fl oz	0.25 to 0.5	Defoliate cotton as normal. After at least 75 to 80% of the bolls are open, the remaining bolls expected to be harvested are mature, and most of the cotton leaves have dropped, apply Gramoxone in a minimum of 20 gal per acre and add 1 pt nonionic surfactant per 100 gal. Wait 5 days before picking, then pick as soon as possible. Generic brands of paraquat containing 3 lb active per gallon are available. These products would be applied at 11 to 21 fl oz.

Weed Response to Preplant, Preemergence, and Postemergence Overtop Herbicides in Cotton

A. C. YORK, Professor Emeritus, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-2B. WEED RESPONSE TO PREPLANT, PREEMERGENCE, AND POSTEMERGENCE OVERTOP HERBICIDES IN COTTON

Herbicide Key: PPI = Preplant Incorporated; PRE = Preemergence; POT= Postemergence overtop

Species	Cotoran PRE	Direx PRE	Prowl H_2O or Treflan PPI	Prowl H_2O PRE	Reflex PRE	Staple PRE	Assure II POT	Fusilade POT	Poast, Poast Plus POT	Select, Select Max POT	Envoke POT	Glyphosate [1] POT	Glyphosate [1] + Envoke POT	Glyphosate [1] + Staple POT	Ignite [2] POT	Staple POT
Bermudagrass	N	N	N	N	N	N	G	G	F	G	N	F [3]	F [3]	F [3]	N	N
Broadleaf signalgrass	P	P	G	F	FG	P	G	GE	E	E	N	E	E	E	G	N
Crabgrass	FG	FG	E	G	FG	P	G	G	GE	GE	P	E	E	E	FG	N
Crowfootgrass	FG	FG	E	G	-	P	G	F	FG	G	N	E	E	E	G	N
Fall panicum	F	P	G	F	-	PF	GE	GE	E	E	NP	E	E	E	G	N
Foxtails	FG	-	E	G	-	P	E	E	E	E	NP	E	E	E	G	NP
Goosegrass	F	F	E	G	-	PF	G	G	GE	GE	NP	E	E	E	P	NP
Johnsongrass																
Seedling	P	P	E	G	-	FG	E	E	E	E	F	E	E	E	G	P
Rhizome	N	N	P	N	-	N	E	GE	G	GE	P	E	E	E	F	NP
Sandbur	G	G	E	G	-	-	-	G	GE	GE	-	E	E	E	G	P
Texas panicum	P	P	G	F	F	N	G	G	E	E	NP	E	E	E	G	N
Nutsedge																
Purple	N	N	N	N	-	F	N	N	N	N	FG	FG [3]	G	FG	PF	PF
Yellow	N	N	N	N	GE	F`	N	N	N	N	G	F [3]	GE	FG	PF	PF
Citronmelon	FG	F	N	N	-	FG	N	N	N	N	GE	E	E	E	G	GE
Cocklebur	FG	F	N	N	G	NP	N	N	N	N	GE	E	E	E	E	G
Common purslane	E	E	E	G	G	G	N	N	N	N	-	FG	G	G	FG	F
Common ragweed	E	G	N	N	G	NP	N	N	N	N	G	E [4]	E [4,5]	E [4]	E	P
Cowpea	P	P	N	N	-	FG	N	N	N	N	G	E	E	E	G	G
Crotalaria	G	G	N	N	-	-	N	N	N	N	-	G	G	G	-	G
Eclipta	G	G	P	P	GE	-	N	N	N	N	PF	E	E	E	G	G
Florida beggarweed	GE	G	P	N	P	G	N	N	N	N	GE	E	E	E	G	G
Florida pusley	FG	PF	E	FG	P	F	N	N	N	N	NP	PF	PF	PF	F	NP
Hemp sesbania	P	P	N	N	P	P	N	N	N	N	-	PF	-	GE	-	GE
Jimsonweed	G	G	N	N	-	FG	N	N	N	N	N	E	E	E	E	E
Lambsquarters	E	E	GE	G	E	G	N	N	N	N	G	G	E	G	E	N
Morningglory	G	F	P	P	PF	F [6]	N	N	N	N	G	FG [7]	E	GE	E	G [6]
Pigweed species																
Palmer amaranth	F	FG	G	PF	E	GE [5]	N	N	N	N	PF [5]	E [4]	E [4,5]	E [4,5]	FG	F [5]
Redroot or smooth	E	E	GE	FG	E	E	N	N	N	N	FG	E	E	E	G	GE
Prickly sida	G	F	N	N	-	G	N	N	N	N	N	G	G	G	FG	F
Sicklepod	G	F	N	N	P	PF	N	N	N	N	E	E	E	E	E	PF
Smartweed	G	G	N	N	-	G	N	N	N	N	G	G	E	E	GE	G
Spurge	PF	F	N	N	-	G	N	N	N	N	-	G	G	G	FG	FG
Spurred anoda	F	F	N	N	-	E	N	N	N	N	P	E	E	E	P	G
Tropic croton	FG	FG	N	N	FG	FG	N	N	N	N	PF	E	E	E	G	NP
Velvetleaf	F	PF	N	N	-	E	N	N	N	N	G	E	E	E	-	G
Volunteer peanuts	PF	P	N	N	P	P	N	N	N	N	PF	FG	FG	FG	GE	P

[1] Apply to Roundup Ready cultivars only.
[2] Apply only to LibertyLink cultivars or cultivars with the Widestrike trait. See comments in TABLE 7-2a concerning use of Ignite on Widestrike cultivars.
[3] Two applications of glyphosate may be required for good control.
[4] Palmer amaranth and common ragweed resistant to glyphosate are present in North Carolina. Glyphosate will not control these resistant biotypes.
[5] Palmer amaranth resistant to ALS inhibitors, including Staple and Envoke, is common in North Carolina.
[6] Poor control on tall morningglory.
[7] With good timing and a follow-up application as needed, morningglory control can be good.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
- = data not available

Weed Response to Postemergence Directed Herbicides in Cotton

TABLE 7-2C. WEED RESPONSE TO POSTEMERGENCE DIRECTED HERBICIDES IN COTTON

Herbicide Key: PPI = Preplant Incorporated; POT= Postemergence overtop; PRE = Preemergence

Species	Caparol + MSMA	Cobra + MSMA	Cotoran + MSMA	Diuron + MSMA	Layby Pro + MSMA	MSMA	Suprend + MSMA	Valor SX + MSMA	Glyphosate [1]	Glyphosate [1] + Aim	Glyphosate [1] + Caparol	Glyphosate [1] + diuron	Glyphosate [1] + Envoke	Glyphosate [1] + Staple	Glyphosate [1] + Valor SX	Ignite [2]	Gramoxone [3] + diuron or Caparol
Bermudagrass	N	N	N	N	N	N	N	N	F [4]	F [4]	F [4]	F [4]	F [4]	F [4]	F [4]	N	P
Broadleaf signalgrass	FG	F	F	F	G	F	FG	F	E	E	GE	GE	E	E	E	G	GE
Crabgrass	FG	F	F	F	G	F	FG	F	E	E	GE	GE	E	E	E	FG	G
Crowfootgrass	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	G	G
Fall panicum	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	G	G
Foxtails	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	G	G
Goosegrass	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	P	G
Johnsongrass																	
Seedling	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	G	G
Rhizome	P	P	P	P	P	P	P	P	GE	GE	G	G	E	GE	GE	F [5]	P
Sandbur	FG	F	F	F	FG	F	FG	F	E	E	GE	GE	E	E	E	G	G
Texas panicum	F	P	P	P	F	P	F	PF	E	E	GE	GE	E	E	E	G	G
Nutsedge																	
Purple	F	F	F	F	F	F	E	FG	FG [4]	FG [4]	FG [4]	FG [4]	E	FG [4]	G	P	PF
Yellow	FG	FG	FG	G	G	FG	E	G	F [4]	F [4]	F [4]	F [4]	E	FG [4]	G	P	PF
Citronmelon	FG	G	G	G	G	F	-	-	GE	GE	GE	GE	E	E	E	G	E
Cocklebur	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Common purslane	FG	G	FG	G	G	PF	-	G	FG	FG	GE	GE	-	-	GE	F	E
Common ragweed	E	E	GE	E	E	F	E	GE	E [6]	E [6]	E [6]	E [6]	E [6]	E [6]	E [6]	E	G
Cowpea	G	FG	G	G	G	FG	G	G	GE	GE	GE	GE	GE	GE	E	G	E
Crotalaria	G	G	G	G	G	G	G	-	G	G	G	G	-	G	-	-	-
Eclipta																	
Florida	G	E	G	E	E	-	E	E	E	E	E	E	E	E	E	G	G
beggarweed	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	E
Florida pusley	F	F	F	F	F	P	F	FG	PF	G	G	G	PF	PF	GE	F	FG
Hemp sesbania	PF	F	PF	PF	-	N	-	-	PF	GE	-	-	-	GE	-	-	FG
Jimsonweed	G	GE	GE	G	G	F	G	E	E	E	E	E	E	E	E	E	E
Lambsquarters	G	F	G	G	G	PF	GE	G	G	GE	GE	GE	GE	GE	GE	E	G
Morningglory	GE	E	G	GE	GE	F	E	E	FG	E	GE	GE	E	GE	E	E	E
Pigweed																	
Palmer amaranth	FG	G	FG	G	G	P	G	G	E [7]	E [7]	E [7]	E [7]	E [7]	E [7]	E [7]	FG	GE
Redroot or smooth	G	G	G	GE	GE	PF	GE	GE	E	E	E	E	E	E	E	G	E
Prickly sida	GE	GE	FG	GE	GE	P	GE	GE	FG	FG	G	G	FG	G	GE	G	G
Sicklepod	GE	PF	G	GE	GE	F	E	GE	E	E	E	E	E	E	E	E	E
Smartweed	F	F	G	F	F	P	-	G	G	GE	G	G	E	E	G	GE	GE
Spurge	G	G	PF	G	G	N	-	G	G	GE	GE	GE	G	G	G	FG	-
Spurred anoda	F	F	FG	F	F	P	-	G	E	E	E	E	E	E	E	P	G
Tropic croton	G	E	G	G	G	F	GE	E	E	E	E	E	E	E	E	G	G
Velvetleaf	G	G	F	G	G	P	-	G	E	E	E	E	E	E	E	-	-
Volunteer peanuts	FG	PF	FG	G	G	PF	G	FG	F	FG	FG	G	FG	F	FG	GE	FG

[1] Apply to Roundup Ready Flex cultivars only.
[2] Apply to LibertyLink or Widestrike cultivars. See label if directing to conventional cultivars.
[3] Gramoxone should be applied only under a hood to avoid contact with cotton. Caparol or diuron mixed with Gramoxone will greatly improve control.
[4] Good control usually obtained with two applications of glyphosate.
[5] Good control usually obtained with two applications of Ignite.
[6] Common ragweed resistant to glyphosate is present in several counties.
[7] Palmer amaranth resistant to glyphosate and ALS inhibitors (such as Staple or Envoke) is widespread in North Carolina.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
- = data not available

Weed Response to Burndown Herbicides for Conservation Tillage Cotton

TABLE 7-2D. WEED RESPONSE TO BURNDOWN HERBICIDES FOR CONSERVATION TILLAGE COTTON[1]

Species	2,4-D[2]	Glyphosate	Glyphosate + Clarity[2]	Glyphosate + 2,4-D[3]	Glyphosate + Harmony Extra[4]	Glyphosate + Valor SX[5]	Gramoxone	Gramoxone + Direx[6]
Annual bluegrass	N	E	E	E	E	E	GE	E
Little barley	N	E	E	E	E	E	G	E
Buttercups	G	E	E	E	E	E	E	E
Carolina geranium	PF	PF	G	F	GE	G	GE	E
Chickweed	P	E	E	E	E	E	E	E
Cudweed	NP	E	E	E	E	E	FG	G
Curly dock	F	F	GE	FG	E	F	NP	P
Cutleaf eveningprimrose	E	PF	G	E	F	FG	F[7]	G[7]
Field pansy	P	F	F	F	F	F	G	GE
Henbit	PF	G	E	E	E	E	E	E
Horseweed (marestail)	GE[10]	GE[11]	E	E[10]	GE [11]	E[11]	PF	G
Prickly lettuce	G	E	E	E	E	E	P	PF
Ryegrass	N	G	G	G	G	G	F	FG
Smartweed	F	FG	E	G	E	-	F	G
Speedwell	PF	E	E	E	E	E	E	E
Swinecress	F	FG	FG	G	GE	-	P	G
Vetch	E	F	E	E	G	FG	PF	F
Virginia pepperweed	GE	G	GE	E	G	GE	G	G
Wheat or rye cover crop[8]	N	E	E	E	E	E	G[12]	GE[12]
Wild mustard, wild radish	FG[9]	FG	G	E	GE	G	FG	G

[1] Application rates per acre: Clarity: 0.5 pt; 2,4-D: 0.5 to 2 pt; Direx: 1 to 2 pt; glyphosate: 0.75 to 1.13 lb a.e.; Gramoxone: 2.6 to 4 pt; Harmony Extra: 0.75 oz; Valor: 1 to 2 oz.
[2] Following application of Clarity and a minimum of 1 in. of rainfall, a minimum 21-day waiting period is required before planting.
[3] Apply 2,4-D at least 30 days ahead of planting.
[4] Delay cotton planting 14 days after Harmony Extra application.
[5] A minimum of 14 days must pass and 1 inch of ranfall must occur between application of Valor at 1 oz and planting. Delay planting 21 days after application of 1.5 to 2 oz of Valor SX. The waiting interval can be reduced to 14 days if a strip tillage operation will occur after application and before planting.
[6] Direx should be applied 15 to 45 days ahead of planting.
[7] This level of control requires that the primrose be blooming when treated.
[8] Glyphosate rate is 0.56 lb a.e. for wheat less than 12 in. or rye less than 18 in., or 0.75 lb a.e. for wheat and rye greater than 12 and 18 in., respectively.
[9] Wild radish and wild mustard control by 2,4-D is good if application is made before plants begin flowering. Use 1 pt per acre of 2,4-D to control these species.
[10] This level of control requires 2 pt of 2,4-D.
[11] Control of glyphosate-resistant horseweed will be poor. See specific comments on glyphosate-resistant horseweed in TABLE 7-2A.
[12] Wheat or rye must have visible seedheads for this level of control.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%
- = data not available

Chemical Weed Control in Kenaf

D. L. JORDAN, Crop Science Department

TABLE 7-3A. CHEMICAL WEED CONTROL IN KENAF

Herbicide and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
PREPLANT INCORPORATED, Annual grasses and certain small-seeded broadleaf weeds			
trifluralin, MOA 3 (Treflan) 4 EC	1 to 2 pt	0.5 to 1	See label for application rate and depth of incorporation.Treflan incorporation can be delayed 24 hr, although immediate incorporation is suggested.
POSTEMERGENCE OVERTOP, Annual broadleaf weeds			
pyrithiobac sodium, MOA 2 (Staple LX) 3.2 SL	2.6 oz	0.064	Apply to kenaf with at least one true leaf. Apply in 10 to 40 gal/acre at 20 to 40 PSI. Add nonionic surfactant at 0.25% by volume (1 qt per 100 gal). Do not add crop oil. Do not apply more than 5.1 oz per year. Staple LX can cause yellowing of kenaf foliage and can stunt growth. Stunting can persist through mid-season. Application timing is important for most weeds. Does not control tall morningglory, lambsquarters, or common ragweed. Only suppresses sicklepod. Tank mixing with Select is discouraged. Biotypes of Palmer amaranth and other weed species in some N.C. fields are resistant to Staple LX.
POSTEMERGENCE OVERTOP, Annual grasses			
clethodim, MOA 1 (Select) 2 EC (Select MAX) 0.97 EC	 6 to 8 fl oz 9 to 16 fl oz	0.094 to 0.125	Apply to actively growing grass not under drought stress. See label for maximum weed size to treat and suggested rate. Apply in 10 to 40 gal per acre. Add crop oil concentrate at 1 qt per acre to Select 2 EC. Crop oil concentrate (1 pt per acre) or nonionic surfactant (1 qt per 100 gal) should be applied with Select MAX.
POSTEMERGENCE OVERTOP, Bermudagrass			
clethodim, MOA 1 (Select) 2 EC (Select MAX) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25	Apply to actively growing bermudagrass when runners are up to 6 in. Rapid growth of kenaf will most likely prevent adequate coverage with a repeat application. Add crop oil concentrate at 1 qt per acre to Select 2 EC. Crop oil concentrate (1 pt per acre) or nonionic surfactant (1 qt per 100 gal) should be applied with Select MAX.
POSTEMERGENCE OVERTOP, Rhizome johnsongrass			
clethodim, MOA 1 (Select) 2 EC (Select MAX) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25	Apply to actively growing johnsongrass 12 to 24 in. tall. Rapid growth of kenaf will most likely prevent adequate coverage with a repeat application. Add crop oil concentrate at 1 qt per acre to Select 2 EC. Crop oil concentrate (1 pt per acre) or nonionic surfactant (1 qt per 100 gal) should be applied with Select MAX.

Weed Response to Preplant Incorporated and Postemergence Herbicides in Kenaf

D. L. JORDAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-3B. WEED RESPONSE TO HERBICIDES IN KENAF

	Herbicides Key: PPI = Preplant Incorporated; POT= Postemergence overtop		
Species	**Treflan PPI**	**Select POT**	**Staple LX POT**
Bermudagrass	N	G	N
Broadleaf signalgrass	G	E	N
Crabgrass	E	GE	N
Fall panicum	G	E	N
Foxtails	E	E	P
Goosegrass	E	GE	P
Johnsongrass Seedling Rhizome	 G P	 E GE	 P NP
Texas panicum	G	E	N
Nutsedge Purple Yellow	 N N	 N N	 PF PF
Cocklebur	N	N	G
Common ragweed	N	N	P
Cowpea	N	N	G
Jimsonweed	N	N	E
Lambsquarters	G	N	N
Morningglory	P	N	G[1]
Pigweed Palmer amaranth Redroot or Smooth	 F G	 N N	 G E
Prickly sida	N	N	F
Sicklepod	N	N	PF
Smartweed Ladysthumb Pennsylvania	 N N	 N N	 G G
Spurge	N	N	F
Spurred anoda	N	N	G
Tropic croton	N	N	N
Velvetleaf	N	N	G

[1] Staple does not control tall morningglory.

KEY:
E = excellent control, 90% or better;
G = good control, 80% to 90%;
F = fair control, 50% to 80%;
P = poor control, 25% to 50%;
N = no control, less than 25%

Chemical Weed Control in Peanuts

D. L. JORDAN, Crop Science Department

Control of witchweed is part of the State/Federal Quarantine Program. Contact the N.C. Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

TABLE 7-4A. CHEMICAL WEED CONTROL IN PEANUTS

Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREPLANT INCORPORATED, Annual grasses and small-seeded broadleaf weeds			
alachlor (Intrro) 4 EC, MOA 15	2 to 3 qt	2 to 3	Incorporate no deeper than 2 in.; see label for specific instructions. Unless shallowly incorporated, Intrro is more consistently effective when applied preemergence. Weak on Texas panicum. Do not apply more than 4 qt of Intrro per acre per season. **Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.**
ethalfluralin, MOA 3 (Sonalan) 3 EC	1.5 to 2 pt	0.56 to 0.75	Controls common annual grasses including Texas panicum. Use 3 pt of Prowl H2O or 2 pt of Sonalan for control of broadleaf signalgrass, Texas panicum, and fall panicum. Incorporate 3 in. deep for Texas panicum; otherwise, incorporate 2 to 3 in. deep. See labels for maximum waiting period between application and incorporation. Immediate incorporation is best. Dual Magnum or Outlook may be tank mixed with Prowl or Sonalan to suppress yellow nutsedge.
pendimethalin, MOA 3 (Prowl H2O) 3.8	1.5 to 3 pt	0.71 to 1.43	
PREPLANT INCORPORATED, Annual grasses, small-seeded broadleaf weeds, and nutsedge			
dimethenamid, MOA 15 (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	Apply and incorporate in top 2 in. of soil within 14 days of planting. Use high rate of Dual Magnum or Outlook for yellow nutsedge and broadleaf signalgrass. Not effective on purple nutsedge. Weak on Texas panicum. May be tank mixed with Prowl or Sonalan.
metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	
PREPLANT INCORPORATED, Broadleaf weeds and suppression of nutsedge			
diclosulam, MOA 2 (Strongarm) 84 WDG	0.45 oz	0.024	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual Magnum, Outlook, Prowl H2O, Sonalan, or Stalwart. See label for rotation restrictions, especially corn. Growers are cautioned that Strongarm applied at rates exceeding 0.45 oz per acre can injure cotton the following year on soils with a shallow hardpan (less than 10 inches) and/or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptable to carryover of Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton has been increased to 18 months in Camden, Currituck, Pasquotank and Perquimans counties. Some weed species have developed resistance to Strongarm.
PREPLANT INCORPORATED, Annual grasses, broadleaf weeds, and suppression of nutsedge			
diclosulam, MOA 2 (Strongarm) 84 WDG + pendimethalin, MOA 3 (Prowl H2O) 3.8 or ethalfluralin, MOA 3 (Sonalan) 3 EC or metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid (Outlook) 6.0 L	0.45 oz + 1.5 to 3 pt or 1.5 to 2 pt or 1 to 1.33 pt or 16 to 21 fl oz	0.024 + 0.71 to 1.43 or 0.56 to 0.75 or 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Supresses purple and yellow nutsedge. Does not control sicklepod. See Strongarm label for rotation restrictions.
PPI FOLLOWED BY PRE, Annual grasses, broadleaf weeds, and supression of nutsedge			
pendimethalin, MOA 3 (Prowl H2O) 3.8 or ethalfluralin, MOA 3 (Sonalan) 3 EC or metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid, MOA 15 (Outlook) 6.0 L followed by diclosulam, MOA 2 (Strongarm) 84 WDG or flumioxazin, MOA 14 (Valor SX) 51 WDG	1.5 to 3 pt or 1.5 to 2 pt or 1 to 1.33 pt or 16 to 24 fl oz 0.45 oz or 2 oz	0.71 to 1.43 or 0.56 to 0.75 or 0.95 to 1.27 1 to 1.33 or 0.75 to 1 0.024 or 0.063	Controls most broadleaf weeds. Will not control sicklepod and is marginal on certain large-seeded broadleaf weeds. **Do not incorporate Valor-SX.** Valor SX should be applied to the soil surface immediately after planting. Significant injury can occur if Valor is incorporated or applied 3 or more days after planting. Significant injury from Valor SX was noted in 2001, 2004, 2006, and 2009 even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Cotton grown under early season stress from conditions like excessively cool, wet, or crusted soils may be particularly susceptible to carryover of Strongarm. Some weed species have developed resistance to Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton has been increased to 18 months in Camden, Currituck, Pasquotank and Perquimans counties.
SPLIT APPLICATION (PPI + POST), Most broadleaf weeds and nutsedge			
imazethapyr, MOA 2 (Pursuit) 2 AS	2 + 2 oz	0.031 + 0.031	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Pursuit will usually control seedling johnsongrass and foxtails. For control of other annual grasses, Pursuit may be tank mixed with Dual Magnum, Outlook, Prowl H2O, or Sonalan and incorporated. See label for incorporation directions and **rotational restrictions**. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.

TABLE 7-4A. CHEMICAL WEED CONTROL IN PEANUTS

Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREEMERGENCE, Annual grasses and small-seeded broadleaf weeds			
alachlor, MOA 15 (Intrro) 4 EC	2 to 3 qt	2 to 3	Apply as soon after planting as possible. All three herbicides are weak on Texas panicum. Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts. **Before using Intro, check with buyers to determine if there are marketing restrictions on Intro-treated peanut.**
dimethenamid, MOA 15 (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	
metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	
PREEMERGENCE. Broadleaf weeds			
flumioxazin, MOA 14 (Valor SX) 51 WDG	2 oz	0.063	Apply within 2 days after planting. Significant injury can occur if Valor SX is incorporated or applied 3 or more days after seeding. Controls carpetweed, common lambsquarters, Florida pusley, nightshade, pigweeds, prickly sida, and spotted spurge. Does not control sicklepod, yellow and purple nutsedge, or annual grasses. Morningglory control is marginal where Valor-SX is applied at 2 oz/A. Significant injury from Valor SX was noted in 2001, 2004, 2006, and 2009, even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. See product label for comments on sprayer cleanup.
PREEMERGENCE. Annual grasses, broadleaf weeds, and suppression of nutsedge			
flumioxazin, MOA 14 (Valor SX) 51 WDG + metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid, MOA 15 (Outlook) 6.0 L	2 oz + 1 to 1.33 pt or 16 to 21 fl oz	0.063 + 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Apply within 2 days after planting. Significant injury can occur if applied 3 or more days after planting. This combination does not control sicklepod but will control annual grasses (except Texas panicum) and will suppress yellow nutsedge. Significant injury from Valor SX was noted in 2001, 2004, 2006, and 2009, even when applied according to label recommendations. However, injury is generally transient and does not affect yield. Injury may occur if excessive and forceful rainfall occurs when peanut is emerging. Peanut recovers from injury by midseason in most instances. See product label for comments on sprayer cleanup.
PREEMERGENCE. Broadleaf weeds and suppression of nutsedge			
diclosulam, MOA 2 (Strongarm) 84 WDG	0.45 oz	0.024	Effective on common cocklebur, morningglory, common ragweed, eclipta, and common lambsquarters. Suppresses yellow and purple nutsedge. Does not control sicklepod. More effective when applied in combination with Dual Magnum, Outlook, Prowl H2O, Sonalan, or Stalwart. See label for rotation restrictions, especially corn. Growers are cautioned that Strongarm applied at rates exceeding 0.45 oz per acre can injure cotton the following year on soils with a shallow hardpan (less than 10 inches) and/or loam soils. Cotton grown under early season stress resulting from conditions such as excessively cool, wet, dry, or crusted soils may be particularly susceptable to carryover of Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton has been increased to 18 months in Camden, Currituck, Pasquotank and Perquimans counties. Some weed species have developed resistance to Strongarm.
sulfentrazone, MOA 14 + carfentrazone, MOA 14 (Spartan Charge) 0.35 + 3.15 F	3.0 to 5.0 fl oz	0.07 to 0.12	Do not apply Spartan Charge after peanuts crack soil. Application immediately after planting is advised. See Spartan Charge label for specific rates based on soil texture and organic matter content. See product label for comments on applicaton with other herbicides. Rotation restriction for planting cotton following Spartan Charge at recommended rates for peanut is 12 months.
PREEMERGENCE. Annual grasses, broadleaf weeds, and suppression of nutsedge			
diclosulam, MOA 2 (Strongarm) 84 WDG + metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC or dimethenamid, MOA 15 (Outlook) 6.0 L	0.45 oz + 1 to 1.33 pt or 16 to 21 fl oz	0.024 + 0.95 to 1.27 1 to 1.33 or 0.75 to 1	Effective on annual grasses, common cocklebur, common ragweed, eclipta, morningglory, and common lambsquarters. Supresses purple and yellow nutsedge. Does not control sicklepod. See label for rotation restrictions. Some weed species have developed resistance to Strongarm. Cotton grown under early season stress, such as excessively cool, wet, or dry weather, or crusted soils may be particularly susceptible to carryover of Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton has been increased to 18 months in Camden, Currituck, Pasquotank and Perquimans counties. Some weed species have developed resistance to Strongarm.
PREEMERGENCE. Most annual broadleaf weeds and nutsedge			
imazethapyr, MOA 2 (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. Pursuit may be tank mixed with Dual Magnum, Intrro, Outlook, or Stalwart for annual grass control. See label for **rotational restrictions**. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
CRACKING STAGE. Emerged annual grasses and broadleaf weeds			
paraquat, MOA 22 (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L	5.4 fl oz 8 fl oz	0.13	Apply at ground cracking for control of small emerged annual grasses and broadleaf weeds. May be tank mixed with Dual Magnum, Outlook, or Stalwart for residual control. Tank mix may cause severe injury to emerged peanuts. Add 1 pt nonionic surfactant per 100 gal spray solution. Follow all safety precautions on label. May also be tank mixed with Pursuit for residual control of nutsedge and broadleaf weeds. Applying Basagran at 0.5 pt per acre will reduce injury.
CRACKING STAGE, Additional residual control of annual grasses and certain small-seeded broadleaf weeds			
alachlor, MOA 15 (Intrro) 4 EC	2 to 3 qt	2 to 3	Use as a supplement to preplant or preemergence herbicides to provide additional residual control of annual grasses and certain small-seeded broadleaf weeds such as pigweed and eclipta. This treatment will not control emerged grasses or broadleaf weeds. Do not apply more than 4 qt Intrro, 21 oz Outlook, or 2.6 pt Dual Magnum or Stalwart per acre per season. **Before using Intrro, check with buyers to determine if there are marketing restrictions on Intrro-treated peanuts.**
dimethenamid, MOA 15 (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	
metolachlor, MOA 15 (Dual Magnum) 7.62 EC (Stalwart) 8 EC	1 to 1.33 pt	0.95 to 1.27 1 to 1.33	
CRACKING STAGE, Most annual broadleaf weeds and nutsedge			
imazethapyr, MOA 2 (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control ragweed, eclipta, lambsquarters, or croton. If weeds are emerged, add surfactant or crop oil according to label directions. See label for **rotational restrictions**. Pursuit may be tank mixed with paraquat. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.

TABLE 7-4A. CHEMICAL WEED CONTROL IN PEANUTS

Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CRACKING STAGE, Some emerged broadleaf weeds and suppression of eclipta and yellow nutsedge			
diclosulam, MOA 2 (Strongarm) 84 WDG	0.45 oz	0.024	Strongarm can be applied through the cracking stage. Add 1 qt nonionic surfactant per 100 gal. The spectrum of weeds controlled is much narrower when Strongarm is applied to emerged weeds. Strongarm will not control emerged common lambsquarters or pigweeds but will control common ragweed and morningglories. Strongarm will suppress yellow nutsedge and eclipta. See product labels for information on mixing Strongarm with other herbicides. Some weed species have developed resistance to Strongarm. The rotation interval between applying Strongarm to peanut and then planting cotton has been increased to 18 months in Camden, Currituck, Pasquotank and Perquimans counties. Some weed species have developed resistance to Strongarm.
POSTEMERGENCE, Annual broadleaf weeds			
acifluorfen, MOA 14 (Ultra Blazer) 2L	1 to 1.5 pt	0.25 to 0.38	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for species controlled, maximum weed size to treat, and addition of surfactant. Do not apply more than 2 pt postemergence per acre per season. May make sequential applications of 1 pt per acre followed by 1 pt per acre. Allow at least 15 days between sequential applications.
acifluorfen, MOA 14 (Ultra Blazer) 2L + 2,4-DB, MOA 4 (Butyrac 200) 2 L	1 to 1.5 pt + 16 fl oz	0.25 to 0.38 + 0.25	Addition of 2,4-DB to Ultra Blazer improves the control of certain weeds when weed size exceeds that specified on the Ultra Blazer label. See above comments on Ultra Blazer. See label for suggestions on use of surfactant or crop oil. Apply when peanuts are at least 2 weeks old and before pod filling begins. Make only one application per year. Other trade names for 2,4-DB may be available.
bentazon, MOA 6 (Basagran) 4 L	1.5 to 2 pt	0.75 to 1	Apply when weeds are small and actively growing. Use minimum of 20 GPA and high pressure (40 to 60 psi). See label for addition of oil concentrate, species controlled, and maximum weed size to treat. Basagran may also be applied at 1 pt per acre for control of cocklebur, jimsonweed, and smartweed 4 in. or less. Do not apply more than 4 pt of Basagran per acre per season. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
bentazon, MOA 6 (Basagran) 4 L + acifluorfen, MOA 14 (Ultra Blazer) 2 L	1 to 2 pt + 1 to 1.5 pt	0.5 to 1 + 0.25 to 0.38	See above comments for Basagran and Ultra Blazer. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
bentazon, MOA 6 + acifluorfen, MOA 14 (Storm) 4 L	1.5 pt	0.5 + 0.25	Apply when weeds are small and actively growing. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. These rates of bentazon and acifluorfen may not provide consistent control of lambsquarters, prickly sida, and spurred anoda. Do not apply more than 3 pt of Storm per season. Peanuts normally are very tolerant of Storm. However, injury is occasionally noted when Basagran, one of the components of Storm, is applied to peanuts treated with Di-Syston in-furrow.
bentazon, MOA 6 + acifluorfen, MOA 14 (Storm) 4 L + 2,4-DB, MOA 4 (Butyrac 200) 2 L	1.5 pt + 8 to 16 fl oz	0.5 + 0.25 + 0.125 to 0.25	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, pigweed, jimsonweed, and citron. Add surfactant or crop oil according to label directions. Make only one appli-cation per year. Apply when peanuts are at least 2 weeks old. Do not apply after pod filling begins. See comments for Storm alone. Peanuts normally are very tolerant of Storm. However, injury is occasionally noted when bentazon, one of the components of Storm, is applied to peanuts treated with Di-Syston in-furrow. Other trade names for 2,4-DB may be available.
bentazon, MOA 6 (Basagran) 4 L + 2,4-DB, MOA 4 (Butyrac 200) 2 L	1 to 2 pt + 8 fl oz	0.75 to 1 + 0.125	Addition of 2,4-DB to Basagran improves control of morningglories. See above comments for Basagran. Add surfactant or crop oil according to label directions. Do not make more than two applications per year. Apply when peanuts are at least 2 weeks old and not within 45 days of harvest. Peanuts normally are very tolerant of Basagran. However, injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow. Other trade names for 2,4-DB may be available.
imazapic, MOA 2 (Cadre or Impose) 2 AS	4 oz	0.063	Controls most broadleaf weeds except ragweed, croton, lambsquarters, and eclipta. Apply before weeds exceed 2 to 4 in.; see label for specific weed sizes to treat. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. A soil-applied grass control herbicide should be used. However, Cadre and Impose will usually control escaped broadleaf signalgrass, fall panicum, and Texas panicum. See label for **rotational restrictions.** Some weed species have developed resistance to Cadre and Impose.
imazethapyr, MOA 2 (Pursuit) 2 AS	4 oz	0.063	Effective on most common broadleaf weeds and yellow and purple nutsedge. Does not control eclipta, lambsquarters, ragweed, or croton. Apply when weeds are 3 in. tall or less. Add surfactant or crop oil according to label directions. **See label for rotational restrictions**. Pursuit may be tank mixed with Basagran, Ultra Blazer, paraquat formulations, and 2,4-DB. Some weed species have developed resistance to Pursuit. Research in N.C. has generally shown more effective control of a broader spectrum of weeds with split applications of half of the Pursuit applied preplant incorporated followed by the other half applied early postemergence.
2,4-DB, MOA 4 (Butyrac 200) 2 L	1 pt	0.2 to 0.25	Effective on cocklebur and morningglory; pitted morningglory may be only partially controlled. Best results achieved when applied to small weeds. May use two applications per year. Do not apply within 45 days before harvest. Other trade names for 2,4-DB may be available.
lactofen, MOA 14 (Cobra) 2 EC	12.5 fl oz	0.2	Apply after peanuts have at least six true leaves. Apply to actively growing peanut. Controls most annual broadleaf weeds. Use minimum of 10 GPA and high pressure (40 to 60 psi). See label for species controlled and maximum weed size to treat. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate or methylated seed oil at 1 to 2 pt per acre. See label on when to use various adjuvants. Allow at least 14 days between applications. Can be tank mixed with Basagran, Pursuit, Cadre, Impose, 2,4-DB, and/or Select.
lactofen, MOA 14 (Cobra) 2 EC + bentazon, MOA 6 (Basagran) 4 L	12.5 fl oz + 1.5 to 2 pt	0.2 + 0.75 to 1	See above comments for Cobra and Basagran. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants.
lactofen, MOA 14 (Cobra) 2 EC + bentazon, MOA 6 (Basagran) 4 L + 2.4-DB, MOA 4 (Butyrac 200) 2 L	12.5 fl oz + 1.5 to 2 pt + 8 to 16 fl oz	0.2 + 0.75 to 1 + 0.125 to 0.25	Adding 2,4-DB will improve control of larger morningglory, cocklebur, common ragweed, jimsonweed, and citron. See above comments for Cobra, Basagran, and 2,4-DB. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Other trade names for 2,4-DB may be available.
lactofen, MOA 14 (Cobra) 2 EC + imazapic, MOA 2 (Cadre or Impose) 2 AS	12.5 fl oz + 4 oz	0.2 + 0.063	See above comments for Cobra and Cadre and Impose. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Cadre and Impose.
lactofen, MOA 14 (Cobra) 2 EC + imazethapyr, MOA 2 (Pursuit) 2 AS	12.5 fl oz + 4 oz	0.2 + 0.063	See above comments for Cobra and Pursuit. See labels for weeds controlled, maximum weed size to treat, and use of adjuvants. Some weed species have developed resistance to Pursuit.

TABLE 7-4A. CHEMICAL WEED CONTROL IN PEANUTS

Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE, Annual grasses and broadleaf weeds			
paraquat, MOA 22 (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L	 5.4 fl oz 8 fl oz	0.13	See label for weeds controlled and maximum weed size to treat; best results if weeds 1 in. or less. A postemergence application may be made following an at-crack application. Do not make more than two applications per season, do not apply later than 28 days after ground cracking, and do not apply to peanuts under stress. Add 1 pt of nonionic surfactant per 100 gal of spray solution. Will cause foliar burn on peanuts, but crop recovers and yield not affected. Follow all safety precautions on label. Do not apply to peanuts showing symptoms of thrips damage.
paraquat, MOA 22 (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L + bentazon, MOA 6 (Basagran) 4 L	 5.4 fl oz 8 fl oz + 0.5 to 1.5 pt	0.13 0.25 to 0.75	See previous comments for Gramoxone Inteon alone. Adding Basagran improves control of common ragweed, prickly sida, smartweed, lambsquarters, and cocklebur and reduces injury to peanuts from Starfire. May be applied any time from ground cracking up to 28 days after ground cracking. Add 1 pt of nonionic surfactant per 100 gal of spray solution. Peanuts normally are very tolerant of Basagran. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
paraquat, MOA 22 (Firestorm or Parazone) 3.0 SL (Gramoxone INTEON) 2.5 L + bentazon, MOA 6 + acifluorfen, MOA 14 (Storm) 4 L	 5.4 fl oz 8 fl oz + 1.5 pt	0.13 + 0.5 + 0.25	See previous comments for Gramoxone Inteon alone. Storm improves control of common ragweed, smartweed, lambsquarters, common cocklebur, tropic croton, and spurred anoda. May be applied anytime from ground cracking up to 28 days after ground cracking. Add 0.5 pt of nonionic surfactant per 100 gal of spray solution. Peanuts normally are very tolerant of Basagran. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow. The mixture of paraquat and Storm is more injurious than these herbicides applied alone.
POSTEMERGENCE, Florida beggarweed			
chlorimuron, MOA 2 (Classic) 25 DF	0.5 oz	0.008	Use only for control of Florida beggarweed. Apply from 60 days after crop emergence to within 45 days of harvest. Application to peanuts less than 60 days old will result in crop injury and yield reduction. Apply before Florida beggarweed has begun to bloom and before it has reached 10 in. tall. Larger beggarweed may only be suppressed. Add 1 qt of nonionic surfactant per 100 gal spray solution; do not add crop oil. May be tank mixed with 2,4-DB; see label for rates and precautions. **Recommended as a salvage treatment only.**
POSTEMERGENCE, Yellow nutsedge			
bentazon, MOA 6 (Basagran) 4 L	1.5 to 2 pt	0.75 to 1	Apply when nutsedge is 6 to 8 in. tall. A repeat application 7 to 10 days later may be needed. Adding crop oil concentrate at 1 qt per acre will increase control. Do not apply more than 4 pt of Basagran per season. Not effective on purple nutsedge. Peanuts normally are very tolerant of bentazon. However, severe injury is occasionally noted when Basagran is applied to peanuts treated with Di-Syston in-furrow.
POSTEMERGENCE, Yellow and purple nutsedge			
imazapic, MOA 2 (Cadre or Impose) 2 AS	4 oz	0.063	Apply postemergence when nutsedge is 4 in. or less. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. See label for **rotational restrictions.**
imazethapyr, MOA 2 (Pursuit) 2 AS	4 oz	0.063	Apply before nutsedge is larger than 3 in. tall. Add surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. Do not mix with Basagran for nutsedge control. See label for **rotational restrictions.** A split application with half of the Pursuit applied preplant incorporated and half applied early post-emergence may be more effective than applying all of the Pursuit at one time.
POSTEMERGENCE, Annual grasses			
clethodim, MOA 1 (Arrow, Clethodim, Select, Tapout, or Volunteer) 2 EC (Select MAX or Tapout) 0.97 EC	 6 to 8 fl oz 9 to 16 fl oz	 0.094 to 0.125 0.068 to 0.121	Apply Arrow, Poast, Poast Plus, Select 2 EC, Select, Tapout, or Volunteer to actively growing grass not under drought stress. Consult labels for maximum grass size to treat. Apply in 5 to 20 GPA at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre to Poast or Poast Plus. Do not cultivate within 7 days before or after application. Poast Plus is often slightly better than Poast. Add crop oil concentrate at 1 qt per acre to Arrow, Select 2 EC, Select MAX, and Volunteer. Nonionic surfactant at 1 qt per 100 gal can be applied with Select MAX for Tapout rather than crop oil concentrate. Some herbicides and fungicides can reduce the efficacy of Arrow, Select 2 EC, Select MAX, Tapout, Volunteer, Poast, and Poast Plus when applied in tank mixtures. See product labels for specific instructions concerning compatibility with other chemicals. Also see AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and is available at your county Extension center.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 1 pt 1.5 pt	0.19	
POSTEMERGENCE, Bermudagrass			
clethodim, MOA 1 (Arrow, Clethodim, Select, Tapout, or Volunteer) 2 EC (Select MAX or Tapout) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply to actively growing bermudagrass before runners exceed 6 in. In most cases, a second application will be needed. Make second application of 1 pt of Poast or 1.5 pt of Poast Plus per acre if regrowth occurs. Add 2 pt per acre of crop oil concentrate. Poast Plus is often slightly better than Poast. If needed, make a second application of Arrow, Clethodim, Select, Tapout, or Volunteer at 8 to 16 oz per acre when regrowth is less than 6 in. Add crop oil concentrate at 1 qt per acre to Arrow, Clethodim, Select, or Volunteer. Crop oil concentrate (1 qt per acre) or nonionic surfactant (1 qt per 100 gallons) should be applied with Select MAX or Tapout. See product labels for specific instructions concerning compatibility with other chemicals. Also see AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and available at your county Extension center.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 1.5 pt 2.25 pt	0.28	
POSTEMERGENCE, Rhizome johnsongrass			
clethodim, MOA 1 (Arrow, Clethodim, Select, Tapout, or Volunteer) 2 EC (Select MAX or Tapout) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply to actively growing johnsongrass before it exceeds 25 in. tall. Add 2 pt per acre of crop oil concentrate. A second application of the same rates can be made if needed before new plants or regrowth exceeds 12 in. Apply Arrow, Clethodim, Select, Tapout, or Volunteer when johnsongrass is 12 to 24 in. tall. If needed, make a second application of 6 to 8 oz per acre when regrowth is 6 to 18 in. Add crop oil concentrate at 1 qt per acre to Arrow, Select 2 EC, Select MAX, and Voluneer. Crop oil concentrate (1 qt per acre) or nonionic surfactant (1 qt per 100 gallons) should be applied with Select MAX or Tapout. For specific instructions for compatibility concerns with other chemicals, see product labels and AGW-653, *Tank Mixing Chemicals Applied to Peanut, Are the Chemicals Compatible*, which is on the Web at www.peanut.ncsu.edu and available at your county Extension center.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 1 pt 1.5 pt	0.19	

TABLE 7-4A. CHEMICAL WEED CONTROL IN PEANUTS

Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE, Suppression of large Palmer amaranth and other pigweed species that are resistant to the ALS inhibiting herbicides Cadre, Classic, Impose, Pursuit, and Strongarm			
2,4-DB, MOA 4 (Butyrac 200 and others) 2 L + lactofen, MOA 14 (Cobra) 2 EC or acifluorfen, MOA 14 (Ultra Blazer) 2 L	16 oz + 12.5 oz or 1.5 pt	0.25 + 0.20 or 0.38	Suppresses and does not completely control Palmer amaranth and other pigweed species that exceed 8 inches. Suppression of weeds exceeding 12 inches will be less than suppression of smaller weeds. Do not expect suppression to exceed 60%. Applying 2,4-DB 3 to 4 days prior to Cobra or Ultra Blazer may be more effective than tank mixtures of 2,4-DB with Cobra or Ultra Blazer. Cobra is generally more effective on larger Palmer amaranth and other pigweed species than Ultra Blazer. Apply crop oil concentrate at 1 gal (v/v) with Cobra and Ultra Blazer. Do not apply adjuvant with 2,4-DB alone. See product labels for comments on spray volume and effects on peanut especially during pod set and pod fill. Higher spray volumes are more effective by increasing spray coverage of the contact herbicides Cobra and Ultra Blazer. Two applications of 2,4-DB spaced 10 to 14 days apart will suppress Palmer amaranth and other pigweed species. Although suppression by 2,4-DB is lower than sequential or tank mix application of 2,4-DB and Cobra or Ultra Blazer within two weeks after application, suppression by sequential applications of 2,4-DB 4 to 5 weeks after initial application is only slightly lower than suppression by sequential or tank mix applilcation of 2,4-DB and Cobra or Ultra Blazer. For more information on managing herbicide-resistant weeds in peanut, see AG-692, *Managing Herbicide-Resistant Weeds in Peanuts in the United States*, which is on the Web at www.peanut.ncsu.edu.
2,4-DB, MOA 4 (Butyrac 200 and others) 2 L then lactofen, MOA 14 (Cobra) 2 EC or acifluorfen, MOA 14 (Ultra Blazer) 2 L	16 oz then 12.5 oz or 1.5 pt	0.25 then 0.20 or 0.38	
2,4-DB, MOA 4 (Butyrac 200 and others) 2 L then 2,4-DB, MOA 4 (Butyrac 200) 2 L	16 oz then 16 oz	0.25 then 0.25	
dimethenamid, MOA 15 (Outlook) 6.0 L	16 to 21 fl oz	0.75 to 1	Will not control emerged grasses or weeds; apply following a cultivation or appropriate postemergence herbicide if emerged grasses or broadleaf weeds are present. Benefit likely only on very sandy fields heavily infested with annual grasses that receive above normal rainfall during the first 4 to 5 weeks of the growing season. Lay-by of Dual Magnum or Outlook may also be of value in fields with a history of Eclipta problems; the application must be made before Eclipta emerges. Rates are on a broadcast basis; apply in an 18-in. band to row middles. The maximum use rate of Dual Magnum is 2.6 pt per acre per season. The maximum rate of Outlook is 21 fl oz per acre per season. Do not apply Outlook within 80 days of harvest.
metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.67 to 0.88 pt	0.64 to 0.84	
paraquat, MOA 22 (Gramoxone INTEON) 2.5 L	See comments	See comments	Apply in a roller/wiper implement. Best control achieved when at least 60% coverage of weed foliage occurs. Do not allow paraquat to contact peanut foliage. Mix 1 part Gramoxone INTEON with 1 to 1.5 parts water to prepare 40 to 50% solution. Add nonionic surfactant at 0.25% (v/v) or 1 qt/100 gallons. Adjust equipment to apply up to 2 pt/A of the herbicide-water mixture.

Weed Response to Preplant Incorporated, Preemergence, and At-Cracking Herbicides in Peanuts

D. L. JORDAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-4B. WEED RESPONSE TO PREPLANT INCORPORATED, PREEMERGENCE, AND AT-CRACKING HERBICIDES IN PEANUTS

	Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence																				
Species	**Prowl or Sonalan PPI**	**Prowl or Sonalan + Metolachlor PPI**	**Prowl or Sonalan + Outlook PPI**	**Metolachlor PPI**	**Outlook PPI**	**Strongarm PPI or PRE**	**Prowl or Sonalan + Strongarm PPI**	**Metolachlor or Outlook + Strongarm PPI or PRE**	**Pursuit PPI + POST**	**Metolachlor PRE**	**Intrro PRE**	**Outlook PRE**	**Valor SX PRE**	**Prowl or Sonalan PPI + Valor SX PRE**	**Metolachlor or Outlook + Valor SX PRE**	**Metolachlor AC[1]**	**Intrro AC[1]**	**Outlook AC[1]**	**Gramoxone Inteon AC**	**Strongarm AC[2]**	**Paraquat + Strongarm AC[2]**
Bermudagrass	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P	N	P
Black nightshade	N	F	F	F	F	N	N	F	G	F	FG	F	E	E	E	F	FG	F	PF	N	G
Broadleaf signalgrass	G	E	E	G	FG	P	G	G	G	G	FG	FG	P	G	FG	G	FG	FG	E	N	GE
Carpetweed	G	G	G	FG	FG	G	G	G	FG	FG	FG	G	—	G	G	FG	FG	G	FG	—	G
Cocklebur	N	N	N	N	N	G	G	G	GE	N	N	N	PF	PF	PF	N	N	N	E	E	E
Common ragweed	N	P	PF	PF	F	G	G	GE	P	PF	PF	F	FG	G	GE	PF	PF	F	F	E	E
Crabgrass	E	E	E	E	E	P	E	E	F	E	E	E	PF	E	E	E	E	E	G	N	G
Crowfootgrass	E	E	E	E	E	—	—	—	—	E	E	E	PF	G	G	E	E	E	E	N	GE
Dayflower	P	GE	—	GE	—	G	G	GE	—	GE	—	—	F	F	GE	GE	—	—	—	—	G
Eclipta	N	G	G	G	G	GE	GE	GE	P	FG	FG	FG	G	G	GE	FG	FG	FG	FG	NP	FG
Fall panicum	G	E	E	E	E	P	E	E	PF	E	E	E	PF	FG	GE	E	E	E	E	N	GE
Florida beggarweed	N	PF	PF	F	F	F	F	F	P	F	F	F	G	GE	E	F	F	F	E	FG	G
Foxtails	E	E	E	E	E	P	E	E	G	E	E	E	PF	E	E	E	E	E	E	N	GE
Goosegrass	E	E	E	E	E	P	E	E	PF	E	E	E	PF	GE	E	E	E	E	E	N	GE
Jimsonweed	N	N	N	N	N	GE	GE	GE	G	N	N	N	G	G	GE	N	N	N	E	—	E
Johnsongrass, Seedling	G	G	G	PF	PF	N	G	PF	GE	PF	PF	PF	N	FG	PF	PF	PF	PF	E	N	GE
Johnsongrass, Rhizome	P	PF	PF	N	N	N	P	N	FG	N	N	N	N	N	N	N	N	N	P	N	P
Lambsquarters	G	NG	G	F	FG	FG	GE	GE	FG	F	F	FG	GE	GE	GE	F	F	FG	F	N	G
Morningglory	P	P	P	N	N	G	G	G	G	N	N	N	FG	G	G	N	N	N	F	GE	E
Nutsedge, Yellow Nutsedge, Purple	N N	G N	FG N	G N	FG N	FG FG	FG FG	G FG	FG FG	FG N	P N	F N	P P	PF P	FG P	FG N	P N	F N	PF PF	PF NP	G PF
Pigweed	G	E	E	G	G	G	E	E	E	G	GE	GE	E	E	E	G	GE	GE	E	NP	E
Prickly sida	N	P	P	P	P	FG	FG	FG	G	P	P	P	FG	G	G	P	P	P	F	—	G
Purslane	G	GE	GE	G	G	—	G	G	—	G	G	G	G	GE	GE	GE	P	P	—	—	—
Sicklepod	N	NP	NP	NP	NP	P	P	P	P	NP	PF	NP	P	PF	PF	NP	PF	NP	G	N	G
Smartweed	N	N	N	N	N	G	G	G	G	N	N	N	—	—	—	N	N	N	G	—	E
Spurge spp.	P	F	F	PF	PF	—	—	—	P	F	P	F	G	G	G	N	N	N	F[2]	—	F[2]
Spurred anoda	N	N	N	N	N	FG	FG	FG	G	N	N	N	F	FG	FG	N	N	N	P	—	G
Texas panicum	G	G	G	PF	PF	P	G	PF	PF	PF	PF	PF	PF	G	F	PF	PF	PF	E	N	GE
Tropic croton	N	N	N	N	N	PF	PF	PF	P	N	N	N	—	—	—	N	N	N	F	—	F
Velvetleaf	N	N	N	N	N	GE	GE	GE	FG	N	N	N	F	FG	FG	N	N	N	F	—	FG

[1] Residual control only.
[2] Assumes weeds are 1- to 2-in. tall or smaller.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Weed Response to Postemergence Herbicides in Peanuts

D. L. JORDAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-4C. WEED RESPONSE TO POSTEMERGENCE HERBICIDES — PEANUTS

	Herbicides Key: PPI = Preplant Incorporated; PRE = Preemergence; AC = At-Cracking; POST = Postemergence																				
Species	**2,4-DB**	**Paraquat [1]**	**Paraquat + 2,4-DB**	**Paraquat + Basagran**	**Paraquat + Storm**	**Basagran**	**Basagran + 2,4-DB**	**Ultra Blazer**	**Ultra Blazer + 2,4-DB**	**Basagran + Ultra Blazer [2]**	**Storm**	**Storm + 2,4-DB**	**Pursuit + 2,4-DB**	**Cadre or Impose**	**Cobra**	**Cobra + Basagran**	**Cobra + Basagran + 2,4-DB**	**Cobra + Cadre or Impose**	**Cobra + Pursuit**	**Poast or Poast Plus**	**Clethodim**
Bermudagrass	N	P	P	P	P	N	N	N	N	P	N	N	N	N	N	N	N	N	N	FG	G
Black nightshade	N	PF	PF	PF	G	P	P	G [1]	G[1]	G[1]	G[1]	G[1]	G	G	G[1]	G[1]	G[1]	G	G	N	N
Broadleaf signalgrass	N	GE	GE	E	GE	N	N	NP	NP	P	NP	NP	G	G	N	N	N	G	G	E	E
Carpetweed	P	FG	FG	FG	G	P	P	GE	E	E	G	G	FG	FG	G	G	G	G	G	N	N
Cocklebur	E	G	E	E	E	E	E	G	E	E	E	E	E	E	G	G	E	E	E	N	N
Common ragweed	PF	F	F	G	E	G[4]	G[4]	E[1]	E[1]	E[1]	E[1]	E[1]	P	PF	E	E	E	E	E	N	N
Crabgrass	N	G	G	G	G	N	N	N	N	N	N	N	FG	FG	N	N	N	FG	FG	GE	GE
Crowfootgrass	N	GE	GE	G	GE	N	N	P	P	P	P	P	P	G	N	N	N	G	P	F	G
Dayflower	—	G	G	G	FG	G	G	—	—	G	FG	FG	—	G	—	G	G	G	—	N	N
Eclipta	P	F	F	F	FG	FG	FG	G	G	G	FG	FG	P	F	G	G	G	G	G	N	N
Fall panicum	N	GE	GE	G	GE	N	N	PF	PF	P	PF	PF	PF	G	N	N	N	G	PF	E	E
Florida beggarweed	P	G	E	GE	G	N	P	PF	F	F	P	P	P	F	F	F	F	F	F	N	N
Foxtails	N	GE	GE	G	GE	N	N	PF	PF	P	PF	PF	G	G	N	N	N	G	G	E	E
Goosegrass	N	GE	GE	G	GE	N	N	N	N	N	N	N	N	F	N	N	N	F	N	GE	GE
Jimsonweed	P	G	G	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	N	N
Johnsongrass, Seedling	N	GE	GE	GE	GE	N	N	P	P	P	P	P	GE	E	N	N	N	E	GE	E	E
Johnsongrass, Rhizome	N	P	P	P	P	N	N	N	N	N	N	N	F	FG	N	N	N	FG	F	G	GE
Lambsquarters	PF	F	F	G	G	FG	G[4]	G	G	GE	G	G	P	PF	P	FG	G	PF	P	N	N
Morningglory, Pitted	FG	F	G	FG	E	P	G	E	E	E	E	E	G	GE	G	G	G	GE	G	N	N
Morningglory, Others	E	F	E	FG	E	P	E	GE	E	E	GE	E	E	G	G	G	E	G	E	N	N
Nutsedge, Yellow	N	PF	PF	FG	G	G[3]	G	N	N	G	F	F	F	G	N	G[3]	G[3]	G	F	N	N
Nutsedge, Purple	N	PF	PF	PF	PF	NP	P	N	N	P	N	N	FG	G	N	P	P	G	FG	N	N
Pigweed	PF	G	G	G	E	N	P	E	E	E	E	E	E	E	E	E	E	E	E	N	N
Prickly sida	F	F	F	G	G	G	G	N	F	G	FG	G	P	G	G	G	G	G	G	N	N
Purslane	FG	—	FG	G	G	G	G	E	E	E	GE	GE	FG	—	E	E	E	E	E	N	N
Sicklepod	G[3]	G	G	G	G	N	G[6]	NP	G[6]	NP	NP	G[6]	G[6]	E	P	P	G[6]	E	F	N	N
Smartweed	PF	G	G	E	E	E	E	GE	E	E	E	E	G	F	F	E	E	F	G	N	N
Spurge spp.	P	F[1]	F[1]	F[1]	F[1]	P	P	F[1]	F[1]	F[1]	PF[1]	PF[1]	PF[1]	—	F[1]	F [1]	F[1]	F[1]	—	N	N
Spurred anoda	P	P	P	FG	G	G	GE	P	P	G	F	F	F	G	F	G	GE	G	F	N	N
Texas panicum	N	GE	GE	G	GE	N	N	NP	NP	NP	NP	NP	NP	G	N	N	N	G	NP	E	E
Tropic croton	PF	F	F	F	G	F	F	G	G	G	G	G	P	P	G	G	G	G	G	N	N
Velvetleaf	P	F	F	G	FG	G	G	PF	PF	FG	FG	FG	FG	G	G	G	G	G	G	N	N

[1] Assumes weeds are 1- to 2-in. tall or smaller.
[2] Assumes optimum rates and ratios of Basagran and Blazer; see labels.
[3] Two applications, 10 to 14 days apart.
[4] Assumes optimum conditions and addition of crop oil concentrate.
[5] Ratings assume weeds in one- to two-leaf stage.
[6] Assumes follow-up treatment with 2,4-DB.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Sorghum

W. J. Everman, Crop Science Department

NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

TABLE 7-5. CHEMICAL WEED CONTROL IN SORGHUM

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
GRAIN SORGHUM No-Till Burndown, Emerged annual broadleaf and grass weeds, suppression or control of perennials			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-10 for glyphosate rate conversions. Apply before crop emerges. Glyphosate rate depends upon weed species and weed size; see labels for suggested rates. Higher rates can be applied for perennial weeds; see labels for details. See comments on labels concerning nitrogen as the carrier. Apply in 10 to 20 gal of water per acre using flat fan nozzles. For residual grass and broadleaf weed control, glyphosate products may be tank mixed with most preemergence herbicides. See the section on Grain Sorghum—Preemergence. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Adjuvant recommendations vary according to the glyphosate product used. See label of brand used for specific recommendations.
GRAIN SORGHUM No-Till Burndown, Emerged annual broadleaf and grass weeds, top-kill of perennials			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	Apply before, during, or after planting but before crop emerges using clean water or clear fertilizer solution as the carrier. Apply in a minimum of 10 GPA (20 to 40 preferred) using flat fan nozzles. Add either a nonionic surfactant at 1 pt per 100 gal or crop oil concentrate at 1 gal per 100 gal. Use 0.5 to 0.64 lb a.i. on weeds 1 to 3 in., 0.75 lb a.i. on weeds 3 to 6 in., and 1 lb a.i. on weeds 6 in. or larger. Use 0.5 lb a.i. for rye cover crop or 0.75 lb a.i. for wheat cover crop. Rainfast within 30 minutes. For residual grass and broadleaf weed control, paraquat can be tank mixed with most preemergence sorghum herbicides and herbicide combinations. See the section on Grain Sorghum—Preemergence, Conventionally Planted. Refer to specific product labels for application rates, weeds controlled, application directions, and precautions. Better control of emerged weeds will be obtained with tank mixtures of Gramoxone plus an atrazine-containing product. Generic brands of paraquat containing 3 lb active per gal may be applied at 1.3 to 2.7 pt.
GRAIN SORGHUM No-Till Burndown or Premergence			
saflufenacil, MOA 14 (Sharpen)	1.0 to 2.0 fl oz	0.027 to 0.054 (lb a.i.)	Sharpen can be applied to control glyphosate-resistant marestail prior to grain sorghum emergence. See label for application with other herbicides and specifics on adjuvant selection. To avoid injury potential wth burndown or preemergence applications, consult local seed company for possible injury of grain sorghum hybrids or varieties.
GRAIN SORGHUM Preemergence, Annual broadleaf weeds and certain annual grasses			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	1 to 2 qt 1.1 to 2.2 lb	1 to 2	Controls most broadleaf weeds and large crabgrass, crowfootgrass, foxtails, goosegrass, and sandbur. Does not control broadleaf signalgrass, fall panicum, Texas panicum, seedling johnsongrass, or shatter-cane. Do not use on sand, loamy sand, or sandy loam soils. Do not use on medium- or fine-textured soils with less than 1% organic matter. On highly erodible soils (defined by NRCS) with less than 30% plant residue cover, do not exceed 1.6 lb active ingredient. See labels for details on set-back requirements from streams and lakes. See labels for comments on rotational crops. For improved grass control, atrazine may be tank mixed with s-metolachlor, alachlor, or dimethenamid if the seed have been properly treated with a safener. See comments for s-metolachlor, alachlor, or dimethenamid applied preemergence. Generic brands of atrazine are available.
GRAIN SORGHUM Preemergence, Annual grasses and small-seeded broadleaf weeds			
alachlor, MOA 15 (Intrro) 4 EC (Micro-Tech) 4 FME	1.5 to 2.5 qt	1.5 to 2.5	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with a safener containing the active ingredient flurazole. Rate depends upon soil texture; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12 to 21 fl oz	0.56 to 0.98	Use 12 to 18 fl oz on soils with less than 3% organic matter or 14 to 21 fl oz on soils with greater than 3% organic matter. Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel) 7.8 EC (Parallel PCS) 8 EC (Stalwart) 8 EC	1 to 1.67 pt	1 to 1.67	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of a metolachlor product to get the activity one would get from 1 pt of an s-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Brawl II) 7.64 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC	1 to 1.67 pt	0.95 to 1.6	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.
GRAIN SORGHUM Preemergence, Annual grasses and broadleaf weeds			
alachlor, MOA 15 + atrazine, MOA 5 (Bullet) 4 FME (Lariat) 4 F	2.5 to 4 qt	1.56 to 2.5 + 0.94 to 1.5	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on grain sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. See label for comments on rotational crops and details on set-back requirements from streams and lakes.

TABLE 7-5. CHEMICAL WEED CONTROL IN SORGHUM

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
GRAIN SORGHUM Preemergence, Annual grasses and broadleaf weeds (continued)			
dimethenamid-P, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5F	2.5 to 4.6 pt	0.5 to 1 + 1 to 1.9	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep-treated seed. Apply only to medium- or fine-textured soils. Rate depends on soil texture and organic matter; see label for details. See label for comments on rotational crops and set-back requirements from streams and lakes. May be applied postemergence to sorghum up to 12 in. tall.
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.6 to 2.1 qt	0.96 to 1.26 + 1.24 to 1.63	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep-treated seed. Apply only to medium- and fine-textured soils with at least 1% organic matter. See label for comments on rotational crops and details on set-back requirements from streams and lakes. May be applied postemergence to sorghum up to 12 inches tall.
GRAIN SORGHUM Postemergence, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	1.2 qt 1.3 lb	1.2	Apply after sorghum reaches the three-leaf stage but before it exceeds 12 in. tall. Do not use on sand or loamy sand soil. Broadleaf weeds must be 4 in. tall or less. See label for list of weeds controlled. Add 1 qt per acre of crop oil concentrate. If a postemergence application is made following an at-planting application, do not exceed a total of 2.5 lb active ingredient per acre per season. See label for details on set-back requirements from streams and lakes. Generic brands of atrazine are available.
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop or directed any time prior to heading. See label for weeds controlled and recommended weed size for treatment. Adding crop oil concentrate at 1 to 2 pt per acre will improve control. Do not apply more than 2 pt Basagran per acre per season. Basagran also controls or suppresses yellow nutsedge. May be tank mixed with atrazine. When tank mixing, see respective labels for application rates, directions, and precautions.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril 4 EC) 4 EC	1.5 pt 0.75 pt	0.375	Can apply overtop of sorghum from the four-leaf stage until the preboot stage. Use of drop nozzles is suggested after sorghum is 6 to 8 in. tall to ensure better weed coverage. An adjuvant is not needed. Controls cocklebur, morningglory, lambsquarters, ragweed, jimsonweed, smartweed, velvetleaf, and very small pigweed. See label for recommended weed size for treatment. Do not apply when sorghum foliage is wet. May be tank mixed with atrazine, Banvel, Clarity, or 2,4-D. When tank mixing, see respective labels for application rates, directions, and precautions.
carfentrazone, MOA 14 (Aim) 2 EC	0.5 fl oz	0.008	Apply from sorghum emergence through six-leaf stage. Add nonionic surfactant according to label directions. Controls small lambsquarters, morningglory, pigweed. Aim at rates up to 1 fl oz can be applied with drop nozzles.
dicamba, MOA 4 (Banvel) 4 S L (Clarity) 4 SL	0.5 pt 0.5 pt	0.25	Apply from spike stage until sorghum is 8 in. tall. May be tank mixed with atrazine or Buctril. When tank mixing, see respective labels for application rates, directions, and precautions. **Carefully follow all precautions on labels to avoid drift to sensitive crops.**
dicamba, MOA 4 + atrazine, MOA 5 (Marksman) 3. 2 F	2 pt	0.28 + 0.53	Controls most broadleaf weeds. Apply when sorghum has two to five leaves (about 2 to 8 in. tall). Do not add surfactant or crop oil. Do not apply in vicinity of dicamba-sensitive crops. See label for details on set-back requirements from streams and lakes.
prosulfuron, MOA 2 (Peak) 57 WDG	0.75 to 1 oz	0.027 to 0.036	Controls pigweed, lambsquarters, cocklebur, morningglory, jimsonweed, ragweed, smartweed, sicklepod, and velvetleaf. Apply to sorghum 5 to 30 in. tall. Use drop nozzles if sorghum is over 20 in. Add nonionic surfactant at 1 qt per 100 gal or crop oil concentrate at 1 qt per acre. See label for rotational restrictions. May tank mix with atrazine, Banvel, Buctril, Marksman, or 2,4-D. See labels for details. See Peak label for rotational restrictions.
2,4-D amine formulation, MOA 4 (various brands) 3.8 SL	0.5 pt	0.24	Can apply overtop of sorghum 6 to 15 in. tall. Wait until secondary roots are well established. Sorghum is less tolerant of 2,4-D than is corn. Use drop nozzles as soon as possible and certainly after sorghum is 8 in. tall. Note that 2,4-D rates listed here are less than rates on most labels. Less than label-recommended rates are suggested to avoid injury to the crop. Do not apply during boot, flowering, or early dough stages. May be applied in nitrogen solution at lay-by. When mixing 2,4-D amine in nitrogen solution, add 1 pt of 2,4-D amine to 4 pt of water and mix. Then add this mixture to the nitrogen solution in the spray tank with considerable agitation until thoroughly mixed. Do not allow mixture to stand in sprayer. **Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. Ester formulations of 2,4-D may be applied to sorghum. However, use of ester formulations of 2,4-D or acid/ester mixtures, such as Weedone 638, is not suggested if sensitive crops are located within 1 mile of the sorghum.**
GRAIN SORGHUM Postemergence- Directed, Annual grass and broadleaf weeds			
linuron, MOA 7 (Linex) 4 L	1 to 2 pt	0.5 to 1	Apply as directed spray in 25 to 40 gal per acre of water. Add 1 pt of nonionic surfactant per 25 gal of spray mixture. For application with precision directed equipment, apply 0.5 lb active per acre when sorghum is 12 in. tall and weeds are up to 2 in. tall. Apply 0.5 to 1 lb active per acre when sorghum is 15 in. tall and weeds are 2 to 4 in. tall.
FORAGE SORGHUM Preemergence, Annual broadleaf weeds and certain annual grasses			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	1 to 2 qt 1.1 to 2.2 lb	1 to 2	Controls most broadleaf weeds and large crabgrass, crowfootgrass, foxtails, goosegrass, and sandbur. Does not control broadleaf signalgrass, fall panicum, Texas panicum, seedling johnsongrass, or shatter-cane. Do not use on sand, loamy sand, or sandy loam soils. Do not use on medium- or fine-textured soils with less than 1% organic matter. Do not exceed 1.6 lb active ingredient per acre on highly erodible soils (as defined by the NRCS) with less than 30% plant residue cover. See labels for comments on rotational crops. See label for details on set-back requirements from streams and lakes. For improved grass control, atrazine may be tank mixed with Cinch, Dual Magnum, or Dual II Magnum; see comments for Cinch, Dual Magnum, or Dual II Magnum applied preemergence. Generic brands of atrazine are available.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel) 7.8 EC (Parallel PCS) 8 EC (Stalwart) 8 EC	1 to 1.67 pt	1 to 1.67	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of a metolachlor product to get the activity one would get from 1 pt of an s-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Brawl II) 7.64 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.62 EC	1 to 1.67 pt	0.95 to 1.6	Controls most annual grasses and pigweed. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only on sorghum planted with seed properly treated with Concep or Screen protectant. Rate depends upon soil texture and organic matter; see label for details. May be tank mixed with atrazine for broadleaf weed control. See comments for atrazine applied preemergence.

TABLE 7-5. CHEMICAL WEED CONTROL IN SORGHUM

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
FORAGE SORGHUM Preemergence, Annual broadleaf weeds and certain annual grasses (continued)			
S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F (Brawl II ATZ) 5.5 F (Cinch ATZ) 5.5 F (Medal II AT) 5.5 F	1.6 to 2.1 qt	0.96 to 1.26 + 1.24 to 1.63	Controls most annual grasses and broadleaf weeds. Does not control seedling johnsongrass, shattercane, or Texas panicum. Use only with Concep- or Screen-treated seed. Apply only to medium- and fine-textured soils with at least 1% organic matter. See label for comments on rotational crops and details on set-back requirements from streams and lakes.
FORAGE SORGHUM Postemergence, Annual broadleaf weeds			
atrazine, MOA 5 (AAtrex) 4 F (AAtrex Nine-O) 90 WDG	1.2 qt 1.3 lb	1.2	Apply after sorghum reaches the three-leaf stage but before it exceeds 12 in. tall. Do not use on sand or loamy sand soil. Broadleaf weeds must be 4 in. tall or less. See label for list of weeds controlled. Add 1 qt per acre of crop oil concentrate. If a postemergence application is made following an at-planting application, do not exceed a total of 2.5 lb active ingredient per acre per season. Do not graze or feed forage from treated areas for 21 days following application. See label for details on set-back requirements from streams and lakes. Generic brands of atrazine are available.
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	Apply overtop or directed any time prior to heading. See label for weeds controlled and recommended weed size for treatment. Adding crop oil concentrate at 1 to 2 pt per acre will improve control. Do not apply more than 2 pt per acre per season. Basagran also controls or suppresses yellow nutsedge. May be tank mixed with atrazine. When tank mixing, see respective labels for application rates and directions and precautions. Do not graze treated fields for at least 12 days following Basagran application.
bromoxynil, MOA 6 (Buctril) 2 EC (Buctril 4 EC) 4 EC	1.5 pt 0.75 pt	0.375	Can apply overtop of sorghum from the four-leaf stage until the preboot stage. See label for weeds controlled and recommended weed size for treatment. Do not apply when sorghum foliage is wet. May be tank mixed with atrazine, Banvel, Clarity, or 2,4-D. When tank mixing, see respective labels for application directions, precautions, and weeds controlled. Do not cut for feed or fodder or graze within 30 days of application.
carfentrazone, MOA 14 (Aim) 2 EC	0.5 fl oz	0.008	Apply from sorghum emergence through six-leaf stage. Add nonionic surfactant according to label directons. Controls small lambsquarters, morningglory, and pigweed.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.5 pt 0.5 pt	0.25	Apply from spike stage until sorghum is 8 in. tall. May be tank mixed with atrazine or Buctril. When tank mixing, see respective labels for application rates and directions and precautions. Do not cut for silage prior to mature grain stage. Do not remove animals from treated areas for slaughter prior to 30 days after application. For lactating dairy animals, wait 7 days before grazing or 37 days before harvest for hay. There is no waiting period between treatment and grazing for non-lactating animals. **Carefully follow all precautions on labels to avoid drift to sensitive crops**.
dicamba, MOA 4 + atrazine, MOA 5 (Marksman) 3.2 F	2 pt	0.28 + 0.53	Controls most broadleaf weeds. Apply when sorghum has two to five leaves (is about 2 to 8 in. tall). Do not add surfactant or crop oil. Do not apply in the vicinity of dicamba-sensitive crops.See label for set-back requirements from streams and lakes.
2,4-D amine formulation, MOA 4 (various brands) 3.8 SL	0.5 pt	0.24	Can apply overtop of sorghum 6 to 15 in. tall. Wait until secondary roots are well established. Sorghum is less tolerant of 2,4-D than is corn. Note that 2,4-D rates listed here are less than rates on most labels. Less than label-recommended rates are suggested to avoid injury to the crop. Do not apply during boot, flowering, or early dough stages. Do not forage or feed sorghum fodder for 7 days following application. **Use extreme caution to avoid drift to sensitive crops such as cotton and tobacco. Ester formulations of 2,4-D may be applied to sorghum. However, use of ester formulations of 2,4-D or acid/ester mixes, such as Weedone 638, is not suggested if sensitive crops, especially cotton and tobacco, are located within 1 mile of the sorghum.**

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Soybeans

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NOTES: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

Control of witchweed is part of the State/Federal Quarantine Program. Contact the N.C. Department of Agriculture, Plant Industry Division, at 1-800-206-9333.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREPLANT (FOLIAR APPLICATION), CONVENTIONAL OR REDUCED TILLAGE, Control or suppression of emerged weeds to reduce tillage operations			
glyphosate, MOA 9 (numerous brands and) formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-10 for glyphosate rate conversions. Recommended rates depend upon weed species and size; see labels for details. Higher rates can be used for specific situations. Delay tillage at least 3 days after application. Adjuvant recommendations vary by glyphosate brand; follow directions on label of brand used. May add 0.75 to 1 pt of 2,4-D for improved control of specific broadleaf weeds. Delay planting at least 7 days after application of ester formulations of 2,4-D or 15 days after application of amine formulations. Use only a brand of 2,4-D with the preplant application included on the label. Follow all precautions on the 2,4-D label. Use of an ester formulation of 2,4-D is discouraged within 1 mile of cotton.
PREPLANT INCORPORATED, Annual grasses			
ethalfluralin, MOA 3 (Sonalan) 3 EC	1.5 to 3 pt	0.56 to 1.12	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 in. of seedbed within 2 days of application; immediate incorporation suggested. For broadleaf weed control, Sonalan may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of metolachlor product to get the activity one would get from 1 pt of s-metolachlor product.
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	1.2 to 3.6 pt 1.5 to 3 pt	0.5 to 1.5 0.7 to 1.4	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 in. of seedbed within 7 days of application; immediate incorporation suggested. For broadleaf weed control, pendimethalin may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Controls annual grasses and pigweed. At higher rates, controls nightshade and yellow nutsedge. Better yellow nutsedge control if incorporated; see labels for incorporation details. Except for yellow nutsedge, preemergence application preferred. Does not adequately control Texas panicum, seedling johnsongrass, and shattercane. Read labels and adjust rates for soil texture and organic matter. These herbicides may be applied at rates up to 2.5 pt on soils with 6% to 20% organic matter. For broadleaf weed control, S-metolachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 2 pt	0.5 to 1	Controls common annual grasses plus pigweed and lambsquarters. Incorporate in top 2 to 3 in. of seedbed within 8 hr of application; immediate incorporation suggested. For broadleaf weed control, Treflan may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
PREPLANT INCORPORATED, Annual broadleaf weeds			
imazaquin, MOA 2 (Scepter) 70 WDG	2.8 oz	0.123	Controls most broadleaf weeds; a follow-up post-emergence herbicide application often needed for adequate sicklepod control. Follow all precautions on the label, including rotational restrictions. For annual grass control, Scepter may be tank mixed with alachlor, pendimethalin, S-metolachlor, or trifluralin. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
metribuzin, MOA 5 (Sencor) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Controls many broadleaf weeds. Will not adequately control cocklebur or morningglory. Acceptable control of sicklepod may require a follow-up postemergence herbicide application. Activity of metribuzin is highly dependent upon soil texture and organic matter. Follow label directions for application rates, soil type restrictions, etc. Do not use on sand with less than 1% organic matter. Do not use on loamy sand or sandy loam soils with less than 0.5% organic matter. Some varieties are particularly sensitive to metribuzin; see labels for details. Soybeans may be injured when metribuzin is applied to soil treated with organophosphate insecticides and/or nematicides; see precautions on label. For annual grass control, Sencor may be tank mixed with alachlor, pendimethalin, S-metolachlor, or trifluralin. When tank mixing see respective labels for application rates, weeds controlled, specific application directions, and precautions.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	14 to 21 fl oz	0.66 to 0.98	Incorporate 2 in. deep. Not effective on purple nutsedge. Follow label carefully for use rates on various soil types. Do not apply to sandy soils if organic matter is less than 3% and depth to groundwater is 30 ft or less.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of a metolachlor product to get the activity one would get from 1 pt of an s-metolachlor product.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC	1.33 to 2 pt	1.27 to 1.91	Incorporate 2 in. deep. Not effective on purple nutsedge.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BURNDOWN, NO-TILL PLANTING, Emerged grass and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. The rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Apply before crop emergence. Rate depends upon weed species and size; see labels for details. Higher rates (up to 3.75 lb acid equivalent) may be used for perennial weeds. Adjuvant recommendations vary by glyphosate brand. See label of brand used for specific recommendations. For residual grass and broadleaf weed control, glyphsate may be tank mixed with most preemergence soybean herbicides. Refer to the label of the tank mix partner for application rates, directions, limitations, weeds controlled, and precautions.
glyphosate, MOA 9 + fomesafen, MOA 14 (Flexstar GT) 3.29 L	 3 to 4.5 pt	1 to 1.55 (lb a.e.) + 0.25 to 0.37	Apply before crop emergence. See label for adjuvant suggestions. May mix with 2,4-D or dicamba for improved burndown of specific weeds. See waiting intervals between application and planting on labels for 2,4-D or dicamba. Do not exceed 4.5 pt per acre of Fllexstar GT per year. Also, do not exceed 0.375 lb a.i. of fomesafen per year from all sources.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	Apply before crop emergence. Use 2 pt on weeds 1 to 3 in., 3 pt on weeds 3 to 6 in., and 4 pt on weeds 6 in. or taller. Use 2 pt for rye cover crop and 2.5 to 3 pt on wheat cover crops. Add crop oil concentrate or nonionic surfactant according to label directions. Generic brands of paraquat containing 3 lb active per gallon are available. Apply these products at two-thirds of the rates mentioned here. Residual herbicides for grass and broadleaf weed control may be tank mixed with Gramoxone. Control of cutleaf eveningprimrose, wild radish, and most broadleaf weeds will be increased by adding 2,4-D at 0.75 to 1 pt. Delay planting at least 7 days after application of ester formulations of 2,4-D or 15 days after application of amine formulations of 2,4-D. Use of ester formulations is discouraged if sensitive crops, especially cotton and tobacco, are located within 1 mile.
BURNDOWN, NO-TILL PLANTING, Cutleaf eveningprimrose, wild radish, and vetch, plus other weeds controlled by glyphosate			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL	See label + 0.5 to 1 pt	0.56 to 1.13 (lb a.e.) + 0.24 to 0.48	See comments for glyphosate alone. Apply ester formulations of 2,4-D at least 7 days ahead of planting. Apply amine formulations of 2,4-D at least 15 days ahead of planting. Plant soybeans at least 1 in. deep. See comments on 2,4-D labels concerning use on coarse-textured soils with less than 1% organic matter. For 2,4-D formulations other than 3.8 lb per gal, adjust rate accordingly. Use 0.5 pt 2,4-D for primrose; use 1 pt for other weeds. Use of ester formulations is discouraged if senstive crops, particularly cotton or tobacco, are located within 1 mile.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used for limited suppression of small emerged summer annual and winter weeds. See label for adjuvant and spray volume recommedations Research with ET is limited in North Carolina.
BURNDOWN, NO-TILL PLANTING, Glyphosate-resistant horseweed plus other weeds			
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 1.5 to 2 pt + 2 to 3 oz	0.56 to 1.13 (lb a.e) + 0.71 to 0.95 + 0.064 to 0.096	Glyphosate-resistant horseweed (marestail) is relatively common in eastern North Carolina, and continued spread is anticipated. See comments for glyphosate alone. Acceptable control of glyphosate-resistant horseweed requires both a residual herbicide (Valor SX, Valor XLT, or Envive) and either 2,4-D or Clarity. An alternative approach would be application of glyphosate plus either 2,4-D or Clarity preplant followed by Gramoxone plus a residual herbicide at planting. Do NOT till or otherwise disturb the soil surface following application of Valor SX, Valor XLT, or Envive. 2,4-D rates suggested for horseweed should be applied at least 30 days ahead of planting. For 2,4-D formulations other than 3.8 lb per gal, adjust rate accordingly. Use of ester formulations of 2,4-D is discouraged if sensitive crops, especially cotton and tobacco, are located within 1 mile. Following application of Clarity and accumulation of at least 1 in. rainfall, delay soybean planting at least 14 days. Follow precautions on Clarity label concerning drift to sensitive crops. Horseweed cannot be controlled with a burndown prior to planting double-crop soybeans because the combine cuts off the horseweed, leaving little to no foliage to spray. If horseweed is present in wheat, apply 0.75 to 0.9 oz of either Harmony SG or Harmony Extra with TotalSol plus 3 oz of Clarity in February or early March.
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14, + chlorimuron, MOA 2 (Valor XLT) 40.3 WDG	See label + 1.5 to 2 pt + 3 to 5 oz	0.56 to 1.13 (lb a.e) + 0.71 to 0.95 + 0.056 to 0.094+ 0.019 to 0.032	
glyphosate, MOA 9 (numerous brands and formulations) + 2,4-D, MOA 4 (numerous brands and formulations) 3.8 SL + flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	See label + 1.5 to 2 pt 2.5 to 4 oz	0.56 to 1.13 (lb a.e) + 0.71 to 0.95 + 0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
glyphosate, MOA 9 (numerous brands and formulations) + dicamba, MOA 4 (Clarity) 4 SL + flumioxazin, MOA 14 (Valor SX) 51 WDG	See label + 8 fl oz + 2 to 3 oz	0.56 to 1.13 (lb a.e) + 0.25 + 0.064 to 0.096	

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BURNDOWN, NO-TILL PLANTING, Glyphosate-resistant horseweed plus other weeds (continued)			
glyphosate, MOA 9 (numerous brands and formulations) + dicamba, MOA 4 (Clarity) 4 SL + flumioxazin, MOA 14, + chlorimuron, MOA 2 (Valor XLT) 40.3 WDG	See label + 8 fl oz + 3 to 5 oz	0.56 to 1.13 (lb a.e) + 0.25 + 0.056 to 0.094+ 0.019 to 0.032	
glyphosate, MOA 9 (numerous brands and formulations) + dicamba, MOA 4 (Clarity) 4 SL + flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	See label + 8 fl oz + 2.5 to 4 oz	0.56 to 1.13 (lb a.e) + 0.25 + 0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
saflufenacil, MOA 14 (Sharpen) 3.42 SL	1.0 fl oz	0.027 (lb a.i.)	Sharpen can be applied to control glyphosate-resistant marestail. Applying Sharpen with other herbicides will broaden the spectrum of control. See label for specific information on adjuvant selection. **Interval between application and soybean planting for Sharpen varies by soil texture and organic matter content. See Sharpen label for specific information.**
glufosinate, MOA 10 (Ignite 280) 2.34 SL	29 to 36 fl oz	0.53 to 0.66	Ignite 280 SL can be applied prior to emergence of any transgenic or conventional soybean variety to control emerged weeds. See label for adjuvant use. In crop applications to **Liberty-Link soybeans** can be made at 22-29 fl oz following a burndown application with a maximum seasonal use of 65 oz/A.Thorough spray coverage is essential. Apply in minimum of 15 GPA; dense weed canopies require 20 to 40 GPA. Poor performance is likely if daytime temperatures are less than 75°F or if weeds are drought stressed.
BURNDOWN, NO-TILL PLANTING, Curly dock, vetch, and Carolina geranium plus other weeds controlled by glyphosate			
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 (Harmony SG) 50 WDG	See label + 0.75 oz	0.56 to 1.13 (lb a.e.) + 0.023	See comments for glyphosate alone. Harmony SG can be applied anytime prior to soybean planting. Soybean planting should be delayed at least 14 days after application of Harmony Extra.
glyphosate, MOA 9 (numerous brands and formulations) + thifensulfuron, MOA 2 + tribenuron, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	See label + 0.75 oz	0.56 to 1.13 (lb a.e.) + 0.016 + 0.008	
BURNDOWN, NO-TILL PLANTING, Italian ryegrass, wheat, barley, and rye			
glyphosate, MOA 9 (numerous brands and formulations) + clethodim, MOA 1 (Select MAX) 0.97 EC	See label + 9 to 16 fl oz	0.56 to 1.13 (lb a.e.) + 0.067 to 0.12 (lb a.i.)	Apply to weeds 2 to 6 inches tall. See label for instructions on adjuvant used depending o glyphosate formulation.
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Annual grasses			
alachlor, MOA 15 (Intrro) 4 EC (Micro-Tech) 4 FME	2 to 3 qt	2 to 3	Controls annual grasses except Texas panicum, shattercane, and seedling johnsongrass. Also controls pigweed and nightshade. For broadleaf weed control, alachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor SX, Valor XLT, or Envive unless applied 14 or more days ahead of planting. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. May also be shallowly incorporated; see labels for details. Generic brands of alachlor are available.
clomazone, MOA 13 (Command 3 ME) 3 FME	1.3 to 3.3 pt	0.5 to 1.25	Controls most annual grasses; shattercane and Texas panicum are only suppressed. Also controls a number of broadleaf weeds. See label for weeds controlled. Read the label carefully and follow all precautions on label pertaining to off-site movement, buffer zones, drift control agents, and rotational restrictions. For broader spectrum control, Command 3 ME may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	12 to 21 fl oz	0.56 to 0.98	Use 12 to 18 fl oz on soils with less than 3% organic matter or 14 to 21 fl oz on soils with greater than 3% organic matter. Controls annual grasses except seedling johnsongrass, Texas panicum, and shattercane. Also controls pigweed and nightshade. See label for application directions and rates for various soils. May also be shallowly incorporated; see label for details. For broadleaf weed control, Outlook may be tank mixed with most broadleaf herbicides; do not mix with Valor SX, Valor XLT, or Envive unless applied 14 or more days ahead of planting. Do not apply to sandy soils if organic matter is less than 3% and depth to groundwater is 30 ft or less.
metolachlor, MOA 15 (Me-Too-Lachlor) 8 EC (Parallel PCS) 8 EC (Parrlay) 8 EC (Stalwart) 8 EC	1 to 2 pt	1 to 2	See comments for s-metolachlor products. Products containing s-metolachlor are more active on weeds per unit of formulated product than those containing metolachlor. In general, it takes 1.5 pt of a metolachlor product to get the activity one would get from 1 pt of s-metolachlor product.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Annual grasses (continued)			
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Controls annual grasses except Texas panicum, shattercane, and seedling johnsongrass. Also controls pigweed and nightshade on mineral soils. May also be shallowly incorporated; see label for details. For broadleaf weed control, S-metolachlor may be tank mixed with most broadleaf herbicides; do not mix with Valor SX or Valor XLT unless applied 14 or more days ahead of planting. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 L	1.2 to 3 pt 1.5 to 2.5 pt	0.5 to 1.2 0.7 to 1.2	Preemergence application of pendimethalin suggested only where annual grass pressure is expected to be light. Pendimethalin generally performs better when incorporated. For broadleaf weed control, pendimethalin may be tank mixed with most broadleaf herbicides. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands are available.
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Annual broadleaf weeds			
clomazone, MOA 13 (Command 3 ME) 3 FME	1.3 to 3.3 pt	0.5 to 1.25	Command controls selected broadleaf weeds such as balloonvine, velvetleaf, spurred anoda, prickly sida, croton, Pennsylvania smartweed, common ragweed, lambsquarters, and jimsonweed. It also controls most annual grasses. Command does not control pigweed, morningglory, sicklepod, nightshade, and ladysthumb. See label for specific weeds controlled and rates for specific weeds. Read label carefully and follow all precautions on label pertaining to off-site movement, buffer zones, drift control agents, and rotational restrictions. For broader spectrum control, Command may be tank mixed with a number of soil-applied herbicides; see label for details. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
flumetsulam, MOA 2 (Python) 80 WDG	0.8 to 1.33 oz	0.04 to 0.067	Controls most broadleaf weeds; control of ragweed, cocklebur, and morningglory can be variable. Rates of 1.25 to 1.33 oz suggested for sicklepod. Acceptable control of sicklepod may require a follow-up postemergence herbicide application. May be mixed with registered soil-applied grass control herbicides. See label for weeds controlled, **rotational restrictions,** and restrictions on soil type and organic matter.
flumioxazin, MOA 14 (Valor SX) 51 WDG	2 to 3 oz	0.063 to 0.094	Rate depends on weed species and soil texture; follow label directions when selecting rate. May be tank mixed with Prowl or Command for annual grass control. Valor SX, Valor XLT, Envive, or Gangster should not be mixed with alachlor, metolachlor, S-metolachlor, or dimethenamid-P and applied preemergence. Combinations of Valor SX, Valor XLT, Envive, or Gangster plus alachlor, metolachlor, S-metolachlor, or dimethenamid-P can be applied 14 or more days ahead of planting. Do not apply Valor XLT within 14 days before or after application of organophosphate insecticide or any variety that is not DuPont STS or STS/RR due to injury potential.
flumioxazin, MOA 14 + chlorimuron, MOA 2 (Valor XLT) 40.3 WDG	3 to 5 oz	0.056 to 0.094 + 0.019 to 0.032	
flumioxazin, MOA 14 + chlorimuron, MOA 2 + thifensulfuron, MOA 2 (Envive) 41.3 WDG	2.5 to 4 oz	0.046 to 0.074 + 0.0214 to 0.023 + 0.0045 to 0.007	
flumioxazin, MOA 14 + chlorimuron, MOA 2 (Gangster, co-pack of Gangster V [51% flumioxazin] and Gangster FR [84% chloransulam])	1.5 to 3 oz + 0.3 to 0.6 oz	0.047 to 0.094 + 0.016 to 0.032	
imazaquin, MOA 2 (Scepter) 70 WDG	2.8 oz	0.123	Controls most broadleaf weeds if adequate rainfall received for activation. A follow-up postemergence herbicide application often needed for adequate sicklepod control. Follow all precautions on the label, including rotational restrictions. For annual grass control, Scepter may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
linuron, MOA 7 (Linex) 4 L	0.66 to 3 pt	0.33 to 1.5	Rate depends greatly on soil texture and organic matter content; follow label directions carefully when selecting rates. Do not use on sand or loamy sand soils or any soil with less than 0.5% organic matter. Linuron controls pigweed, lambsquarters, and common ragweed. For annual grass control, linuron may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions. Generic brands may be available.
metribuzin, MOA 5 (Sencor) 75 DF	0.33 to 0.67 pt	0.25 to 0.5	Rate depends greatly on soil texture and organic matter content; follow label directions carefully when selecting rates. Do not use Sencor on sand soils with less than 1% organic matter or on any soil with less than 0.5% organic matter. Some varieties are particularly sensitive to metribuzin; see labels for details. Soybeans may be injured when metribuzin is applied to soil treated with organophosphate insecticides and/or nematicides. Does not adequately control cocklebur or morningglory. Adequate sicklepod control may require a follow-up postemergence herbicide application. For annual grass control, metribuzin may be tank mixed with alachlor, Command, dimethenamid-P, pendimethalin, or S-metolachlor. When tank mixing, see respective labels for application rates, weeds controlled, specific application directions, and precautions.
sulfentrazone, MOA 14 + metribuzin, MOA 5 (Authority MTZ) 45 WDG	12 to 20 oz	0.135 to 0.225 + 0.20 to 0.34	Rate depends upon soil texture and organic matter; see label for application rates. Controls most broadleaf weeds, including Palmer amaranth, morningglory, and cocklebur; sicklepod suppressed. See statement on label concerning sensitive varieties. See label for rotational restrictions.
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Annual grasses and broadleaf weeds—packaged herbicide mixtures			
s-metolachlor, MOA 15 + fomesafen, MOA 14 (Prefix) 5.29 L	2 to 3 pt	1.09 to 1.63 + 0.24 to 0.36	Controls most annual grasses (except Texas panicum, seedling johnsongrass, shattercane) and broadleaf weeds, such as pigweed species (including Palmer amaranth), lambsquarters, common ragweed, Florida pusley, smartweed, and nightshade. Does not control sicklepod, and it only suppresses morningglory, cocklebur, and prickly sida.
metribuzin, MOA 5 + S-metolachlor, MOA 15 (Boundary) 7.8 L	1 to 2.5 pt	0.19 to 0.47 + 0.79 to 1.96	See previous comments for metribuzin applied preemergence. Rate depends on soil texture and organic matter content; follow label directions carefully when selecting rate. Do not use on coarse-textured soils with less than 0.5% organic matter. Controls weeds normally controlled by Sencor and Dual Magnum. May be mixed with Command, FirstRate, Prowl, Python, or Scepter. Followup postemergence herbicide needed in most cases.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Annual grasses and broadleaf weeds—packaged herbicide mixtures (continued)			
imazethapyr, MOA 2 + saflufenacil, MOA 14 (OpTILL)	2 oz	0.085 (lb a.i.)	OpTILL is labeled for application up to soybean emergence. Application to emerged soybean can result in significant injury. See lable for adjuvant selection.
PREEMERGENCE, NO-TILL OR CONVENTIONAL, ANY CULTIVAR, Nutsedge			
dimethenamid-P, MOA 15 (Outlook) 6.0 EC	14 to 21 fl oz	0.66 to 1	Dimethenamid and metolachlor control or suppress only yellow nutsedge. These herbicides are more effective on yellow nutsedge when incorporated. However, these herbicides applied preemergence may provide adequate control of lighter infestations of yellow nutsedge. Neither product controls purple nutsedge. Follow labels carefully for use rates on various soil types. Do not apply Outlook to sand soils if organic matter is less than 3% and depth to groundwater is 30 ft or less. Generic brands containing metolachlor, not S-metolachlor, are available. See previous comments concerning these products. Prefix, which contains s-metolachlor, will suppress or control yellow nutsedge.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Cinch) 7.64 EC (Dual Magnum) 7.62 EC (Dual II Magnum) 7.64 EC (Medal) 7.62 EC (Medal II) 7.64 EC	1.33 to 2 pt	1.27 to 1.91	
sulfentrazone, MOA 14 + metribuzin, MOA 5 (Authority MTZ) 45 WDG	12 to 20 oz	0.135 to 0.225 + 0.20 to 0.34	See comments under Annual Grasses and Broadleaf Weeds. Controls yellow and purple nutsedge.
POSTEMERGENCE OVERTOP; ROUNDUP READY CULTIVARS, Annual grasses and broadleaf weeds plus suppression of perennial weeds—**Roundup Ready cultivars ONLY**			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 1.5 (lb a.e)	**APPLY ONLY TO ROUNDUP READY CULTIVARS. See comments on resistance management in TABLE 7-11.** A preemergence herbicide is highly recommended to control weeds not controlled by glyphosate (such as Florida pusley), to reduce early season weed competition, to broaden the window of application for glyphosate, and to aid in resistance management. Any registered soil-applied herbicide can be used on Roundup Ready soybeans. Glyphosate controls most annual weeds; exceptions include dayflower, hemp sesbania, and Florida pusley. Timely application required for morningglory control. Can be applied from cracking stage throughout flowering. Multiple applications can be made, but do not exceed 2.2 lb a.e. per acre per year during this period. Total glyphosate use (preplant, in-crop, and preharvest) should not excced 6 lb a.e. per acre per year. Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See Table 7-10 for glyphosate rate conversions. Adjuvant recommendations vary by glyphosate product: see label of brand used for details. Rate depends upon weed species and size; see labels for details. Timely application is encouraged. The first application should be made 18 to 20 days after planting. Repeat applications can be made if needed. The following products can be mixed with at least some of glyphosate brands. Refer to label of tank mix partner or glyphosate product used for timing of application, weed sizes, and use of adjuvants. **Ultra Blazer** (1 pt): improves control of hemp sesbania, black nightshade, and larger morningglory. Minor antagonism sometimes noted on grasses and pigweed. Use 1.5 pt to control glyphosate-resistant Palmer amaranth up to 4 in. **Classic** (0.25 to 0.33 oz): improves control of hemp sesbania, spreading dayflower, and larger morningglory. **FirstRate** (0.2 to 0.3 fl oz): improves control of spreading dayflower, dove weed, and larger morningglory. **Harmony SG** (0.125 oz/acre): improves control of lambsquarters and velvetleaf. Controls glyphosate-resistant Palmer amaranth unless it is also ALS resistant. Apply before Palmer amaranth exceeds 8 in. Apply after first trifoliate has fully expanded. See label for directions on use of ammonium sulfate. Some soybean injury can be expected. **Reflex, Flexstar** (6 to 12 fl oz): improves control of hemp sesbania, black nightshade, and larger morningglory. Antagonism sometimes noted on grasses and pigweed. Must be applied at 16 fl oz to control glyphosate-resistant Palmer amaranth 4 in. tall, or at 24 fl oz if 6 in. tall. **Resource** (2 to 4 fl oz): improves control of larger morningglory. Minor antagonism sometimes observed on pigweed. Apply at 6 to 8 oz for glyphosate-resistant Palmer amaranth up to 4 in. **Synchrony XP** (0.375 oz): improves control of lambsquarters, morningglory, and velvetleaf. Controls glyphosate-resistant Palmer amaranth unless it is also ALS resistant. Apply before Palmer amaranth exceeds 4 in. **Storm** (0.75 to 1.5 pt): improves control of hemp sesbania, black nightshade, and larger morningglory. Minor antagonism sometimes noted on grasses and pigweed.
glyphosate, MOA 9 + fomesafen, MOA 14 (Flexstar GT) 3.29 L	 3 to 4.5 pt	1 to 1.5 (lb a.e.) + 0.25 to 0.37	Controls grasses and most annual broadleaf weeds. See label for suggested rates according to weed size. Also see label for adjuvant recommendations. Apply with flat fan nozzles. Do not exceed 4.5 pt per acre of Flexstar GT per year. Also do not exceed 0.375 lb a.i. of fomesafen per year from all sources.
glyphosate isopropylamine salt, MOA 9 + imazethapyr, MOA 2 (Extreme) 2.17 SL	 3 pt	0.56 + 0.064	**APPLY ONLY TO ROUNDUP READY CULTIVARS.** Apply before soybean bloom and make only one application per year. Add nonionic surfactant at 1 pt per 100 gal spray solution plus 2.5 lb of ammonium sulfate or 1 to 2 qt of UAN. See label for application directions, precautions, and rotational restrictions. May be more effective on yellow nutsedge and morningglory than glyphosate alone.
glyphosate, MOA 9 + acetachlor, MOA 15 (Warrant) 3.0 ME	See label 1.5 qt	0.56 to 0.75 (lb a.e.) + 1.1	**APPLY ONLY TO ROUNDUP READY CULTIVARS.** Apply overtop soybean with glyphosate at V2-V3 soybean for best results. Apply prior to R3. Warrant can be directed at V5-V6. Warrant provides residual control only.
POSTEMERGENCE OVERTOP; ROUNDUP READY CULTIVARS, Volunteer Roundup Ready corn in Roundup Ready soybeans			
glyphosate, MOA 9 (numerous brands and formulations) + clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	See label + 4 to 8 fl oz 6 to 12 fl oz	0.56 to 0.75 (lb a.e.) + 0.063 to 0.125 0.045 to 0.106	See comments for glyphosate alone. For corn up to 12 in. tall, apply 4 to 6 oz of Select or 6 oz of Select Max. For corn up to 24 in. tall, apply 6 to 8 oz of Select or 9 oz of Select Max. For corn up to 36 in., apply 12 oz Select Max. Add 2.5 lb per acre ammonium sulfate or equivalent. If brand of glyphosate used does not contain surfactant, add nonionic surfactant at 0.25 to 0.5% by volume. If applying Select or Select Max alone, see labels for adjuvant recommendations.
glyphosate, MOA 9 (numerous brands and formulations) + fluazifop-p-butyl, MOA 1 (Fusilade DX) 2 EC	See label + 4 to 6 fl oz	0.56 to 0.75 (lb a.e.) + 0.063 to 0.094	See comments for glyphosate alone. Apply 4 oz Fusilade for corn less than 12 in. Increase rate to 6 oz for corn up to 24 in. Add any adjuvants suggested on the label of the glyphosate product used. Additionally, add 0.25% by volume of crop oil concentrate. If applying Fusilade alone, see label for adjuvant recommendations.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE OVERTOP; ROUNDUP READY CULTIVARS, Volunteer Roundup Ready corn in Roundup Ready soybeans (continued)			
glyphosate, MOA 9 (numerous brands and formulations) + quizalofop-p-ethyl, MOA 1 (Assure II) 0.88 EC	See label + 5 to 8 fl oz	0.56 to 0.75 (lb a.e.) + 0.034 to 0.055	See comments for glyphosate alone. Apply Assure at 4 oz to corn up to 12 in., 5 oz to corn up to 18 in., and 8 oz to corn up to 30 in. If the brand of glyphosate contains adjuvant, add 0.125% nonionic surfactant by volume. If the brand of glyphosate does not contain adjuvant, add surfactant according to the glyphosate label. If applying Assure alone, see label for adjuvant recommendations.
POSTEMERGENCE OVERTOP; LIBERTY LINK CULTIVARS, Annual grasses and broadleaf weeds			
glufosinate-ammonium, MOA 10 (Ignite 280 SL)	29 to 36 fl oz	0.53 to 0.66 (lb a.i.)	APPLY ONLY TO LIBERTY LINK CULTIVARS. Can be applied as single or sequential applications prior to V4 stage of soybean. Do not apply more than 36 oz as a single application. If applied as a burndown prior to planting, Ignite 280 SL can be applied in season to soybean with a maximum seasonal use of 65 oz/A. See product label for possible tank mixtures with other herbicides.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Annual grasses			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 6 to 8 fl oz 9 to 16 fl oz	 0.094 to 0.125 0.068 to 0.121	Apply to actively growing grasses not under drought stress. See label for specific rates and weed size to treat. Add crop oil concentrate at 1 qt per acre to Select. To Select Max, add nonionic surfactant at 0.25% volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Do not cultivate for 7 days before or after application. Generic brands are available.
fluazifop-p-butyl, MOA 1 (Fusilade DX) 2 EC	6 to 12 fl oz	0.094 to 0.188	Apply to actively growing grass not under drought stress. Suggested application rate varies by species; see label for application directions, rates, maximum weed sizes to treat, etc. Add either 1% crop oil concentrate (1 gal per 100 gal) or 0.25% nonionic surfactant (1 qt per 100 gal). Do not cultivate for 7 days before or after application.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	5 to 8 fl oz	0.034 to 0.055	Apply to actively growing grass not under drought stress. Suggested application rate varies by species; see label for application directions, rates, maximum weed sizes to treat, etc. Add 1% (1 gal per 100 gal) crop oil concentrate or 0.25% (1 qt per 100 gal) nonionic surfactant. Do not cultivate for 7 days before or after application. Generic brands are available.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 16 fl oz 24 fl oz	0.19	Apply to actively growing grass not under drought stress. Consult label for maximum grass size to treat, application directions, etc. Add 2 pt per acre of crop oil concentrate. Do not cultivate for 7 days before or after application.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Annual broadleaf weeds			
acifluorfen, MOA 14 (Ultra Blazer) 2 SL	0.5 to 1.5 pt	0.13 to 0.38	See label for weeds controlled, recommended rates for specific weeds, and maximum weed size to treat. Label recommends nonionic surfactant at 1 to 2 pt per 100 gal spray solution. For broader spectrum control, acifluorfen may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Raptor, Resource, Scepter, Synchrony, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
acifluorfen, MOA 14 + bentazon, MOA 6 (Storm) 4 SL	 1.5 pt	0.25 + 0.5	See label for weeds controlled and maximum weed size to treat. Add 1 pt per acre of crop oil concentrate or nonionic surfactant at 1 qt per 100 gal. For broader spectrum control, Storm may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Raptor, Resource, or Scepter. See respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	See label for weeds controlled, recommended rates for specific weeds, and maximum weed size to treat. Add 1.25% by volume (not to exceed 2 pt per acre) of crop oil concentrate when treating for lambsquarters, common ragweed, or hemp sesbania. If velvetleaf is primary target, add 0.5 to 1.0 gal per acre of liquid nitrogen instead of crop oil. For broader spectrum control, Basagran may be tank mixed with Classic, Cobra, FirstRate, Flexstar, Pursuit, Raptor, Reflex, Resource, Scepter, Storm, Ultra Blazer, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
cloransulam-methyl, MOA 2 (FirstRate) 84 WDG	0.3 oz	0.016	Controls cocklebur, jimsonweed, morningglory, ragweed, smartweed, velvetleaf, spreading dayflower, dove weed, and small horseweed. See label for recommended weed size to treat. FirstRate will usually control sicklepod in the cotyledonary to first leaf stage; larger sicklepod will not be controlled. Add either nonionic surfactant at 1 to 2 pt per 100 gal or crop oil concentrate at 1.2 gal per 100 gal. If velvetleaf is the target weed, also add 2.5 gal 30% UAN per 100 gal. FirstRate can be applied twice per season. For broader spectrum control, FirstRate may be tank mixed with Basagran, Classic, Cobra, Flexstar, Pursuit, Raptor, Reflex, Resource, Storm, Synchrony, or Ultra Blazer.
chlorimuron ethyl, MOA 2 (Classic) 25 WDG	0.5 to 0.75 oz	0.008 to 0.012	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, rotational restrictions, and sprayer cleanup. Add 0.25% by volume (1 qt per 100 gal) of nonionic surfactant. Under hot, dry conditions, 1% crop oil concentrate may be used instead of surfactant; crop oil increases potential for injury. See label for specific adjuvant recommendations when treating velvetleaf. For broader spectrum control, Classic may be tank mixed with Basagran, Ultra Blazer, Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
chlorimuron ethyl, MOA 2 + thifensulfuron methyl, MOA 2 (Synchrony XP) 28.4 WDG	 0.375 to 1.125 oz	0.005 to 0.015 + 0.0016 to 0.0049	**For non-STS cultivars, use only 0.375 oz rate.** Rate can be increased to 1.125 oz on STS cultivars. See label for weeds controlled, maximum weed size to treat, and rotational restrictions. Add crop oil concentrate at 1% by volume except when tank mixing with a product whose label precludes use of crop oil concentrate; in that case, use nonionic surfactant at 0.25% by volume. Under dry conditions, adding 2 qt per acre of UAN may enhance control. Synchrony may be tank mixed with Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, or Ultra Blazer.
flumiclorac pentyl ester, MOA 14 (Resource) 0.86 EC	4 to 8 fl oz	0.027 to 0.054	Suggested for use where velvetleaf is a problem. Excellent control of velvetleaf. Also controls small lambsquarters, pigweed species, prickly sida, and common ragweed. See label for weeds controlled and recommended weed size for treatment. Add 1 qt per acre of crop oil concentrate. Resource may be tank mixed with Basagran, Classic, Cobra, FirstRate, Flexstar, Harmony GT, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony, or Ultra Blazer.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Annual broadleaf weeds (continued)			
fomesafen, MOA 14 (Flexstar) 1.88 SL (Reflex) 2 SL (Dawn) 2 SL (Rythm) 1.88 SL	1 to 1.5 pt	 0.25 to 0.38 0.24 to 0.35 0.24 to 0.35 0.25 to 0.38	See labels for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Add 1% crop oil concentrate by volume (4 qt per 100 gal) or 0.25% nonionic surfactant (1 qt per 100 gal). For broader spectrum control, Reflex or Flexstar may be tank mixed with Basagran, Classic, FirstRate, Harmony GT, Pursuit, Raptor, Resource, Scepter, Synchrony, or 2,4-DB. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions. Flexstar is somewhat more active than Reflex and can be more effective on lambsquarters, prickly sida, spurred anoda, and velvetleaf. Foliar burn on the crop may also be greater with Flexstar under conditions of high moisture and high temperatures. See label for tax mix partners with Dawn and Rythm.
s-metolachlor, MOA 15 + fomesafen, MOA 14 (Prefix) 5.29 L	 2 to 2.33 pt	1.09 to 2.27 + 0.24 to 0.28	Apply from cracking to third trifoliate of soybean. Add 0.25% by volume of nonionic surfactant; do not use crop oil. Do not exceed 3 pt per acre of Prefix per year, and do not exceed 0.375 lb a.i. of fomesafen from all sources combined.
imazamox, MOA 2 (Raptor) 1S L	5 fl oz	0.04	Controls many common broadleaf weeds. Foxtails, fall panicum, broadleaf signalgrass, seedling johnsongrass, and shattercane usually adequately controlled. Does not control sicklepod. May not adequately control ragweed, prickly sida, or Palmer amaranth. May tank mix with Basagran, FirstRate, Flexstar, Reflex, Resource, Storm, or Ultra Blazer for improved control of ragweed and Palmer amaranth; tank mixes may reduce grass control. Suppresses yellow and purple nutsedge. Add either crop oil concentrate at 2 pt per acre or nonionic surfactant at 1 qt per 100 gal. See label concerning addition of nitrogen-containing fertilizer.
imazaquin, MOA 2 (Scepter) 70 WDG	1.4 to 2.8 oz	0.063 to 0.125	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Primarily for control of cocklebur and pigweed. Add 0.25% by volume (1 qt per 100 gal) nonionic surfactant. Alternatively, a crop oil concentrate can be used at the rate recommended on crop oil label. For broader spectrum control, Scepter may be tank mixed with Basagran, Cobra, Flexstar, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
imazethapyr, MOA 2 (Pursuit) 70 WDG	1.44 oz	0.063	See label for weeds controlled, recommended rates for specific weeds, maximum weed size to treat, and rotational restrictions. Also suppresses johnsongrass, broadleaf signalgrass, and foxtails. Add 0.25% by volume (1 qt per 100 gal) nonionic surfactant or 1.5 to 2 pt per acre of crop oil concentrate. For broader spectrum control, Pursuit may be tank mixed with Basagran, Cobra, FirstRate, Flexstar, Harmony GT, Reflex, Resource, Storm, or Ultra Blazer. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
lactofen, MOA 14 (Cobra) 2 EC	6 to 12.5 fl oz	0.094 to 0.2	See label for weeds controlled, recommended rates, weed size to treat, and recommended adjuvants. At higher rates, Cobra usually causes excessive foliar burn on soybeans. Lower rates tank mixed with other herbicides may be of some value in specific situations. Cobra may be tank mixed with Basagran, Classic, FirstRate, Pursuit, Resource, Scepter, Synchrony, or 2,4-DB. See labels for weeds controlled and specific use directions.
thifensulfuron methyl, MOA 2 (Harmony SG) 50 WDG	0.125 oz	0.004	See label for weeds controlled, maximum weed size to treat, and sprayer cleanup. Add 0.125% to 0.25% by volume (1 to 2 pt per 100 gal) of nonionic surfactant when applying Harmony SG alone or 0.125% in tank mixes. Under dry or cool conditions, a crop oil concentrate may be used; see label for details. In addition to surfactant or crop oil, Harmony SG label specifies use of an ammonium nitrogen fertilizer. This is usually of value only when treating for velvetleaf. For broader spectrum control, Harmony SG may be tank mixed with Classic, Flexstar, Pursuit, Reflex, Resource, or Synchrony. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be applied from emergence to V6 soybean to suppress small broadleaf weeds. Some leaf speckling can occur but is transient. Do no apply crop oil concentrate. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Annual grasses and broadleaf weeds—tank mixtures			
quizalofop p-ethyl, MOA 1 (Assure II) + Basagran, Classic, Cobra, FirstRate, Flexstar, Harmony SG, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-11 for MOAs)	See labels	See labels	The listed two-way tank mixes are covered on one or more of the respective labels. Consult the labels of the products to be used for specific application rates, directions, precautions, and adjuvant usage. Formulations and active ingredients of the various products can be found elsewhere in this publication. A number of three-way tank mixes (not listed here) also are registered. While mixing postemergence grass and broadleaf herbicides is convenient and saves time and trips across the field, best results often are obtained when the grass and broadleaf herbicides are applied separately. Antagonism of the grass herbicide (reduced grass control) often occurs when the grass herbicide is mixed with a broadleaf herbicide. Antagonism is more likely to occur under marginal spraying conditions, such as large grasses and dry weather. Some of the broadleaf herbicides also are more antagonistic than others. The antagonism may be partially or completely overcome by increasing the rate of the grass herbicide; labels for some of the grass herbicides suggest increased rates when tank mixing. The adjuvants needed for good activity of the grass herbicide also may enhance crop injury from the broadleaf herbicide; follow label directions carefully for use of adjuvants. Tank mixing should be considered only when the optimum timing for application of the grass and broadleaf herbicides coincides. Tank mixes generally should not be used when treating for rhizome johnsongrass or bermudagrass. If sequential applications are made, the recommended waiting interval between application of the grass and broadleaf herbicides varies depending upon the herbicides used and the order in which they are applied. See the labels for specific recommendations. However, the following are general guidelines: 1) If the grass herbicide is applied first, the broadleaf herbicide can be applied 24 hr later; 2) if Basagran or Resource is applied first, the grass herbicide can be applied 24 hr later; 3) if Classic, FirstRate, Harmony SG, or Synchrony STS is applied first, wait at least 3 days before applying the grass herbicide; 4) if Pursuit, Raptor, or Scepter is applied first, wait at least 5 days before applying the grass herbicide; and 5) if Cobra, Flexstar, Reflex, Storm, or Ultra Blazer is applied first, delay application of the grass herbicide until the grass resumes active growth with development of new leaves.
fenoxaprop-ethyl, MOA 1 (Fusilade DX) + Basagran, Classic, Cobra, Flexstar, Pursuit, Raptor, Reflex, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-11 for MOAs)			
sethoxydim, MOA 1 (Poast or Poast Plus) + Basagran, Classic, Cobra, FirstRate, Flexstar, Pursuit, Reflex, Resource, Scepter, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-11 for MOAs)			
clethodim, MOA 1 (Select or Select Max) + Basagran, Classic, Cobra, FirstRate, Flexstar, Pursuit, Raptor, Reflex, Resource, Storm, Synchrony STS, or Ultra Blazer (See TABLE 7-11 for MOAs)			

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Rhizome johnsongrass			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply when johnsongrass is 12 to 24 in. tall. If needed, make second application of 6 to 8 oz of Select or 9 to 24 fl oz of Select Max when regrowth is 6 to 18 in. Add crop oil concentrate at 1 qt per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Generic brands available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	12 fl oz	0.19	Apply when johnsongrass is 8 to 18 in. tall and before boot stage. Add either a nonionic surfactant at 0.25% by volume (1 qt per 100 gal) or a crop oil concentrate at 1% by volume (1 gal per 100 gal). If needed, make second application of 8 fl oz when regrowth is 6 to 12 in.
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply when johnsongrass is 10 to 24 in. tall. If needed, make second application of 7 fl oz per acre when regrowth is 6 to 10 in. Add either crop oil concentrate at 1% (1 gal per 100 gal) or nonionic surfactant at 0.25% (1 qt per 100 gal). Generic brands available.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Rhizome johnsongrass (continued)			
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing johnsongrass 20 to 25 in. tall. Add 2 pt per acre of crop oil concentrate. A second application of 16 oz of Poast or 24 oz of Poast Plus may be made when regrowth is 12 in.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Bermudagrass			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	 8 to 16 fl oz 12 to 32 fl oz	 0.125 to 0.25 0.091 to 0.24	Apply before bermudagrass runners exceed 6 in. If needed, make second application of 8 to 16 oz of Select or 12 to 32 fl oz of Select Max when regrowth is less than 6 in. Add crop oil concentrate at 1 qt per acre to Select. To Select Max, add nonionic surfactant at 0.25% by volume, crop oil concentrate at 1% by volume, or methylated seed oil at 1% by volume. Generic brands available.
fluazifop p-butyl, MOA 1 (Fusilade DX) 2 EC	12 fl oz	0.19	Apply when bermudagrass runners are 4 to 8 in. If regrowth occurs, apply 8 fl oz when regrowth is 4 to 8 in. Add crop oil concentrate at 1% by volume (1 gal per 100 gal) or nonionic surfactant at 0.25% by volume (1 qt per 100 gal).
quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC	10 fl oz	0.07	Apply when bermudagrass is 3 in. tall or has up to 6 in. runners. If regrowth occurs, make second application of 7 fl oz/A when runners are 6 in. Add either crop oil concentrate at 1% (1 gal per 100 gal) or nonionic surfactant at 0.25% (1 qt per 100 gal). Generic brands available.
sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	 24 fl oz 36 fl oz	0.28	Apply to actively growing bermudagrass before runners exceed 6 in. Add 2 pt per acre of crop oil concentrate. A second application of 16 oz of Poast or 24 oz Poast Plus may be made when regrowth is 4 in.
POSTEMERGENCE OVERTOP; ANY CULTIVAR, Nutsedge			
bentazon, MOA 6 (Basagran) 4 SL	1.5 to 2 pt	0.75 to 1	For yellow nutsedge only; Basagran does not control purple nutsedge. Apply when yellow nutsedge is 6 to 8 in. tall. Add 2 pt per acre of crop oil concentrate. If needed, make second application of same rate 7 to 10 days later.
chlorimuron ethyl, MOA 2 (Classic) 25 WDG	0.5 to 0.75 oz	0.008 to 0.012	Controls yellow nutsedge; suppresses purple nutsedge. Apply when yellow nutsedge is 2 to 4 in. tall. Add surfactant according to label directions.
chlorimuron ethyl, MOA 2 + thifensulfuron methyl, MOA 2 (Synchrony STS SP) 42 WDG	0.5 oz	0.01 + 0.003	Controls yellow nutsedge; suppresses purple nutsedge. Apply when yellow nutsedge is 2 to 3 in. tall. Add crop oil concentrate according to label directions. **Apply only to STS soybean.**
imazethapyr, MOA 2 (Pursuit) 70 WDG	1.44 oz	0.063	Apply when nutsedge is 1 to 3 in. tall. Add surfactant or crop oil according to label directions. Pursuit is more effective on purple nutsedge than on yellow nutsedge.
LATE POSTEMERGENCE OVERTOP, SALVAGE TREATMENT; ANY CULTIVAR, Cocklebur and morningglory			
2,4-DB, MOA 4 (various brands) 2 SL 1.75 SL 75 WP	 1 pt 1.1 pt 0.33 lb	0.25	Spray overtop soybeans from 1 week before bloom up to midbloom. This treatment may be used when needed as an aid to control cocklebur and morningglory and as a supplement to but not a replacement for early postemergence treatments. Salvage treatment only—substantial crop injury may occur. Do not add surfactant or crop oil. Not suggested for use on soybeans to be saved for seed.
POSTEMERGENCE DIRECTED; ANY CULTIVAR, Small grasses and broadleaf weeds			
metribuzin, MOA 5 (Sencor) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Apply only as a directed spray to soybeans at least 8 in. tall. Do not spray higher than 2 to 3 in. on the soybean stem. Add surfactant according to label directions. Do not use if soil has been wet for 2 to 3 days. Do not use on sandy soils or any soil having less than 0.5% organic matter. Some varieties of soybeans are sensitive to metribuzin; see label for details.
POSTEMERGENCE DIRECTED; ANY CULTIVAR, Cocklebur and morningglory			
2,4-DB, MOA 4 (various brands) 2 SL 1.75 SL 75 WP	 13 fl oz 15 fl oz 4.3 oz	0.2	Soybeans must be at least 8 in. tall. Contact no more than the lower third of soybean plant. Follow other precautions on label.
POSTEMERGENCE WITH WIPER APPLICATORS; ANY CULTIVAR, Certain weeds taller than crop, especially grasses			
glyphosate, MOA 9 (numerous brands and formulations)	Not applicable; see label	Not applicable; see label	Apply glyphosate above crop with wiper-type applicator. Follow label directions carefully. Do not let glyphosate contact crop plants. Johnsongrass and tall annual grasses such as fall panicum are very susceptible; broadleaf weeds are less susceptible. Use only as supplement to a good early season weed management program.
POSTEMERGENCE WITH HOODED SPRAYER; ANY CULTIVAR, Annual and perennial grasses and broadleaf weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Glyphosate rate depends upon weed species and size; see labels for specific rates. Higher rates can be used for perennial weeds; see labels for details. Keep hoods as close to the ground as possible. Contact of spray with foliage of non Roundup Ready soybeans will cause severe injury.

TABLE 7-6A. CHEMICAL WEED CONTROL IN SOYBEANS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
HARVEST AID; ANY CULTIVAR, Annual and perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 to 2.25 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. See labels for weeds controlled, maximum weed size to treat, and specific application rates for various species. Apply after pods have set and lost all green color. Apply at least 7 days before harvest. Can be applied by ground or air. Do not apply to soybeans grown for seed.
HARVEST AID; ANY CULTIVAR, Annual grasses and broadleaf weeds			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	8 to 16 fl oz	0.13 to 0.25	Apply when pods are fully developed and at least one-half of leaves have dropped and leaves left on plants are turning yellow. Can be applied by ground or air. Generic brands containing 3 lb active per gallon are available. These product would be used at 5.3 to 10.7 fl oz.
HARVEST AID; ANY CULTIVAR, Annual broadleaf weeds			
carfentrazone, MOA 14 (Aim) 2 EC	1.5 fl oz	0.023	Desiccates morningglory, pigweed, and cocklebur. Apply 3 or more days ahead of harvest. Add 1 gal crop oil concentrate per 100 gal spray solution. Thorough coverage is essential; use a minimum of 20 GPA by ground equipment. May be applied by air. May tank mix with Gramoxone. Tank mixes with Gramoxone should be applied 15 days ahead of harvest.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Weed Response to Preplant Incorporated and Preemergence Herbicides in Soybeans

W. J. EVERMAN, Crop Science Department

Ratings are based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-6B. WEED RESPONSE TO PREPLANT INCORPORATED AND PREEMERGENCE HERBICIDES IN SOYBEANS

Herbicides
Key: **PPI = Preplant Incorporated; PRE = Preemergence**

Species	Prowl or Treflan PPI	Sonalan PPI	Authority MTZ PRE	Command PRE	Dual Magnum, Dual II Magnum PRE	Outlook PRE	Intrro or Micro-Tech PRE	Reflex PRE	Sencor PRE	Linex PRE	Prefix PRE	Prowl PRE	Python PRE	Scepter PRE	Valor SX PRE	Valor XLT PRE	Envive PRE
Bermudagrass	N	N	N	PF	N	N	N	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	G	G	F	E	G	FG	FG	FG	PF	P	G	P	N	PF	N	N	N
Crabgrass	E	E	F	E	E	E	E	FG	F	FG	E	F	P	NP	N	N	N
Fall panicum	G	G	P	E	E	E	E	—	NP	F	E	PF	N	NP	N	N	N
Foxtails	E	E	F	E	E	E	E	—	NP	FG	E	F	P	FG	N	N	N
Goosegrass	E	E	FG	E	E	E	E	—	F	FG	E	PF	P	NP	N	N	N
Johnsongrass, Seedling	G	G	—	G	PF	PF	PF	—	PF	NP	PF	PF	N	FG	N	N	N
Johnsongrass, Rhizome	P	P	N	N	N	N	N	—	N	N	N	N	N	N	N	N	N
Shattercane	G	G	—	F	P	P	P	—	N	N	P	PF	N	F	N	N	N
Texas panicum	G	G	PF	F	PF	PF	PF	F	N	PF	F	PF	N	NP	N	N	N
Nutsedge, Yellow	N	N	E	N	FG[3]	F	P	GE	N	N	GE	N	N	PF	N	N	N
Nutsedge, Purple	N	N	E	N	N	N	N	—	N	N	—	N	N	NP	N	N	N
Balloonvine	N	N	—	G	N	N	N	—	G	F	—	N	P	F	—	—	—
Eastern black nightshade	N	F	—	P	F	F	FG	—	N	NP	—	P	PF	PF	E	E	E
Burcucumber [1]	N	N	—	NP	N	N	N	—	P	N	—	N	P	PF	—	—	—
Cocklebur	N	N	G	F	N	N	N	G	PF	N	G	N	G	E	P	FG	FG
Cowpea	N	N	—	N	N	N	N	—	PF	N	—	N	NP	N	—	—	—
Crotalaria	N	N	—	—	N	N	N	—	NP	N	—	N	—	—	—	—	—
Florida beggarweed	N	N	G	FG	F	F	F	P	G	F	F	N	F	F	E	E	E
Florida pusley	E	E	—	P	G	G	G	G	G	G	E	G	G	GE	GE	GE	GE
Hemp sesbania	N	N	GE	N	N	N	N	P	GE	F	P	N	N	N	G	G	G
Jimsonweed	N	N	E	G	N	N	N	—	G	F	—	N	G	FG	E	E	E
Lambsquarters	G	G	E	G	F	FG	F	E	E	GE	E	G	E	G	E	E	E
Morningglory	P	P	E	P[2]	N	N	N	PF	P	P	PF	N	F	G	G	G	G
Palmer amaranth	G	G	G	N	FG	G	GE	E	G	PF	E	PF	G [4]	GE [4]	E	E	E
Pigweed, Redroot and Smooth	G	G	E	N	G	GE	GE	E	E	E	E	FG	E	E	E	E	E
Prickly sida	N	N	GE	E	P	P	P	—	G	F	—	N	E	G	E	E	E
Ragweed, Common	N	N	GE	G	PF	F	PF	G	G	G	G	N	FG	G	G	G	G
Ragweed, Giant	N	N	—	PF	N	N	N	G	P	P	G	N	PF	G	F	F	F
Sicklepod	N	N	G	P	NP	NP	PF	P	G	NP	P	N	G	FG	P	F	F
Smartweed	N	N	E	E	N	N	N	—	G	F	—	N	G	G	F	—	—
Spurred anoda	N	N	G	E	N	N	N	—	G	P	—	N	E	P	E	E	E
Tropic croton	N	N	—	E	N	N	N	FG	FG	PF	FG	N	—	NP	E	E	E
Velvetleaf	N	N	GE	E	N	N	N	—	G	P	—	N	GE	F	F	G	G

[1] Multiple flushes of germination; one application of any herbicide will seldom be adequate.
[2] Fair on pitted morningglory.
[3] Good on yellow nutsedge when incorporated.
[4] Palmer amaranth resistant to ALS inhibitors is common in NC. This ALS-inhibiting herbicide will perform poorly on resistant biotypes.

E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Weed Response to Postemergence Herbicides in Soybeans

W. J. EVERMAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-6C. WEED RESPONSE TO POSTEMERGENCE HERBICIDES IN SOYBEANS

	Herbicides																				
Species	**Assure II**	**Fusilade**	**Poast**	**Select, Select Max**	**Basagran**	**Classic**	**Cobra**	**FirstRate**	**Flexstar**	**Flexstar GT**	**Glyphosate [1]**	**Harmony SG**	**Pursuit**	**Raptor**	**Reflex**	**Resource**	**Scepter**	**Storm**	**Synchrony STS [2]**	**Ultra Blazer**	**Ignite**
Bermudagrass	G	G	FG	G	N	N	N	N	N	—	G[3]	N	N	N	N	N	N	N	N	N	N
Broadleaf signalgrass	GE	GE	E	E	N	N	N	N	N	E	E	N	G	G	N	N	N	NP	N	NP	G
Crabgrass	G	G	GE	GE	N	N	N	N	N	E	E	N	PF	PF	N	N	N	N	N	N	FG
Fall panicum	E	E	E	E	N	N	P	N	N	E	E	N	F	G	N	N	N	P	N	P	G
Foxtails	E	E	E	E	N	N	P	N	N	E	E	N	G	G	N	N	N	P	N	P	G
Goosegrass	GE	GE	GE	GE	N	N	N	N	N	E	E	N	NP	NP	N	N	N	N	N	P	P
Johnsongrass, Seedling	E	E	E	E	N	NP	P	N	N	E	E	N	GE	GE	N	N	N	P	NP	P	G
Johnsongrass, Rhizome	E	GE	G	GE	N	N	N	N	N	E	E	N	G[5]	G[5]	N	N	N	N	N	N	F
Shattercane	E	E	E	E	N	N	P	N	N	E	E	N	G	G	N	N	N	P	N	P	—
Texas panicum	G	G	E	E	N	N	N	N	N	E	E	N	PF	PF	N	N	N	N	N	N	G
Nutsedge, Purple	N	N	N	N	NP	PF	N	PF	N	G	G	N	G	—	N	N	N	N	PF	N	P
Nutsedge, Yellow	N	N	N	N	G[3]	G	N	PF	F	—	FG[4]	N	FG	FG	F	N	P	F	G	N	P
Balloonvine	N	N	N	N	P	FG	GE	P	G	E	G	—	P	—	G	P	P	G	FG	GE	—
Eastern black nightshade	N	N	N	N	P	F	G	N	G	E	FG	N	G	G	G	P	P	G	F	G	—
Burcucumber [6]	N	N	N	N	P	G	G	F	FG	G	F	G	PF	PF	FG	F	P	F	G	FG	—
Cocklebur	N	N	N	N	E	E	GE	E	E	E	E	FG	E	E	E	G	E	E	E	G	E
Cowpea	N	N	N	N	N	GE	F	P	PF	E	E	—	N	—	P	—	N	P	GE	PF	G
Crotalaria	N	N	N	N	P	G	G	—	G	E	G	—	N	—	G	—	N	E	G	E	—
Florida beggarweed	N	N	N	N	N	E	FG	FG	P	G	G	—	N	—	P	P	NP	P	E	PF	G
Hemp sesbania	N	N	N	N	P	E	G	PF	E	E	PF	—	N	—	E	P	N	GE	E	E	—
Jimsonweed	N	N	N	N	E	E	GE	E	E	E	E	F	GE	E	E	G	NP	E	E	E	E
Lambsquarters	N	N	N	N	FG	N	P	PN	F	E	E	E	PF	G	PF	G	P	G	E	G	E
Morningglory	N	N	N	N	P	G	G	E	GE	E	FG[8]	FG	FG	FG	P	G	P	GE	G	GE	E
Palmer amaranth	N	N	N	N	N	F[11]	G	P	G	E[10]	E[10]	GE[11]	GE[11]	—	G	FG	G[11]	G	E[11]	G	FG
Pigweed, Redroot or Smooth	N	N	N	N	N	G	E	P	GE	E	E	E	E	E	GE	G	E	E	E	E	G G
Prickly sida	N	N	N	N	G	N	G	P	F	G	G	N	P	G	NP	N	PF	FG	P	N	
Ragweed, Common	N	N	N	N	G[9]	G	E	E	GE	E	E	F	PF	F	GE	G	F	E	G	E	E
Ragweed, Giant	N	N	N	N	GE	FG	G	GE	E	E	G	P	F	F	E	P	P	GE	FG	GE	E
Sicklepod	N	N	N	N	N	G	NP	F[7]	P	E	E	P	N	N	P	N	FG	NP	G	NP	E
Smartweed	N	N	N	N	E	E	F	E	G	E	G	E	GE	G	G	P	FG	E	E	GE	GE
Spurred anoda	N	N	N	N	G	F	F	F	F	E	E	N	F	F	P	P	NP	F	F	P	P
Tropic croton	N	N	N	N	F	NP	G	P	G	E	E	N	N	N	G	P	N	G	NP	G	G
Velvetleaf	N	N	N	N	G	F	G	G	F	E	E	G	F	E	P	E	NP	FG	G	PF	—

[1] Apply to Roundup Ready (glyphosate-resistant) cultivars only.
[2] Apply only to STS cultivars.
[3] Assumes two applications.
[4] Yellow nutsedge control is good with two applications of glyphosate.
[5] Follow-up treatment with a postemergence grass herbicide may be necessary.
[6] Multiple flushes of germination; one application of any herbicide will seldom be adequate.
[7] FirstRate is good on sicklepod if applied at cotyledonary to first leaf stage.
[8] With good timing and a follow-up application as needed, morningglory control can be good.
[9] Assumes addition of crop oil concentrate.
[10] Palmer amaranth resistant to glyphosate is common in NC. Glyphosate will perform poorly on resistant biotypes.
[11] Palmer amaranth resistant to ALS-inhibiting herbicides is common in NC. ALS-inhibiting herbicides will perform poorly on resistant biotypes.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Sunflowers

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

TABLE 7-7. CHEMICAL WEED CONTROL IN SUNFLOWERS

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREPLANT FOLIAR, Burndown of weeds and cover crops before planting			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply before or after planting but before sunflowers emerge. See labels for suggested weed sizes to treat and for application rates. Add nonionic surfactant or crop oil concentrate according to Gramoxone label. The need for an adjuvant with glyphosate depends upon the brand used; see the label of the brand used. See TABLE 7-10 for glyphosate rate conversions.
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	
EPTC, MOA 8 (Eptam) 7 EC	2.5 to 3.5 pt	2.2 to 3	Controls annual grasses and small-seeded broadleaf weeds. Incorporate immediately after application according to label directions.
PREPLANT INCORPORATED, Annual grasses and small-seeded broadleaf weeds			
ethalfluralin, MOA 3 (Sonalan HFP) 3 EC	1.5 to 3 pt	0.56 to 1.13	Controls common annual grasses plus pigweed and lambsquarters. Incorporate into top 2 to 3 in. of seedbed. See label for application rate based upon soil texture. Generic brands of pendimethalin and trifluralin are available.
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_20) 3.8 L	1.2 to 3.6 pt 1.5 to 3.0 pt	0.5 to 1.5 0.71 to 1.43	
trifluralin, MOA 3 (Treflan HFP) 4 EC	1 to 2 pt	0.5 to 1	
PREPLANT INCORPORATED, Annual grasses, pigweed, and yellow nutsedge			
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.91	Controls common annual grasses except Texas panicum, seedling johnsongrass, and shattercane. Also controls pigweed. At higher rates, controls yellow nutsedge. Incorporate into top 2 to 3 in. of seedbed. See label for application rate based upon soil texture.
PREEMERGENCE, Annual grasses and small-seeded broadleaf weeds			
pendimethalin, MOA 3 (Prowl H_20) 3.8 L (Prowl) 3.3 EC	1.5 to 3 pt 1.2 to 3.6 pt	0.71 to 1.43 0.5 to 1.5	See above comments for pendimethalin applied preplant incorporated. Pendimethaln is more consistently effective when incorporated.
S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC	1 to 2 pt	0.95 to 1.91	See above comments for Dual Magnum applied preplant incorporated. Dual Magnum is more consistently effective on yellow nutsedge when incorporated.
PREEMERGENCE, Annual broadleaf weeds and nutsedge			
sulfentrazone, MOA 14 (Spartan) 4 F	3 to 8 oz	0.094 to 0.25	Controls nutsedge and most common annual broadleaf weeds. Only fair control of cocklebur, and no control of ragweed or sicklepod. May tank mix with other registered preemergence herbicides for annual grass control. Adjust Spartan and Spartan Charge application rate according to soil texture and organic matter as specified on label. May also be shallowly incorporated in the top 2 in. of seed bed. Do not plant corn, sweet potatoes, or cotton for 10, 12, and 12 months, respectively, after Spartan or Spartan Charge application. See label for rotational restrictions on other crops.
sulfentrazone, MOA 14 + carfentrazone, MOA 14 (Spartan Charge) 0.35 + 3.15 F	3.75 to 10.2 fl oz		
POSTEMERGENCE, Annual grasses			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	6 to 8 fl oz 9 to 16 fl oz	0.094 to 0.125 0.068 to 0.121	Apply to actively growing grasses not under drought stress. See label for grass size, application rates, and directions. Add 2 pt of crop oil concentrate to Select or Poast. To Select Max, add one of the following: nonionic surfactant at 0.25% by volume; crop oil concentrate at 1.0% by volume; or methylated seed oil at 1% by volume. Other formulation sof clethodim are available.
sethoxydim, MOA 1 (Poast) 1.5 EC	16 fl oz	0.19	
POSTEMERGENCE, Bermudagrass			
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	6 to 8 fl oz 12 to 32 fl oz	0.094 to 0.125 0.091 to 0.24	Apply before bermudagrass runners exceed 6 in. If needed, make second application of 8 to 16 fl oz of Select or 12 to 32 fl oz of Select Max when regrowth is less than 6 in. Add crop oil concentrate to Select at 1 qt per acre. To Select Max, add nonionic surfactant at 0.25% by voume, crop oil concentrate at 1.0% by voume, or methylated seed oil at 1% by volume. Other formulation sof clethodim are available.
sethoxydim, MOA 1 (Poast) 1.5 EC	24 fl oz	0.28	Apply before bermudagrass runners exceed 6 in. If needed, make second application of 16 fl oz per acre when regrowth is less than 4 in. Add crop oil concentrate at 1 qt per acre.
clethodim, MOA 1 (Select) 2 EC (Select Max) 0.97 EC	8 to 16 fl oz 12 to 32 fl oz	0.125 to 0.25 0.091 to 0.24	Apply when johnsongrass is 12 to 24 in. tall. If needed, make second application of Select at 6 to 8 fl oz or 9 to 24 fl oz of Select Max when regrowth is 6 to 18 in. Add crop oil concentrate to Select at 1 qt per acre. To Select Max, add nonionic surfactant at 0.25% by voume, crop oil concentrate at 1.0% by voume, or methylated seed oil at 1% by volume. Other formulation sof clethodim are available.
sethoxydim, MOA 1 (Poast) 1.5 EC	24 fl oz	0.28	Apply when johnsongrass is 20 to 25 in. tall. If needed, make second application of 16 fl oz per acre when regrowth is 12 in. Add crop oil concentrate at 1 qt per acre.
POSTEMERGENCE, Annual grasses and broadleaf weeds: **CLEARFIELD CULTIVARS ONLY**			
imazamox, MOA 2 (Beyond) 1 L	4 fl oz	0.031	**APPLY ONLY TO CLEARFIELD CULTIVARS**. Beyond will severely injure or kill non-Clearfield cultivars. Apply to sunflower in the 2- to 8-leaf stage when broadleaf weeds are 3 in. or less. Add crop oil concentrate or nonionic surfactant plus nitrogen according to label directions. Controls many common broadleaf weeds plus some annual grasses. See label for weeds controlled.
POSTEMERGENCE WITH HOODED SPRAYER, Annual broadleaf weeds, annual and perennial grasses			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Apply to row middles using hooded or shielded sprayer that allows no contact of sunflowers by spray solution.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Tobacco

L. R. FISHER, J. A. PRIEST, and D. S. WHITLEY, Crop Science Department

NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

TABLE 7-8A. CHEMICAL WEED CONTROL IN TOBACCO

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
FLUE-CURED Plant beds, Annual grass weeds and various broadleaf weeds			
metam sodium (Vapam) 3.18 L	2 gal/100 yd^2		
methyl bromide 98%	9 lb/100 sq yd		Thoroughly prepare bed. Apply when moisture level is average and air temperature is above 50°F. Release gas under plastic cover that is well sealed around edges. Allow cover to remain on bed for 24 hr. Bed can be seeded 24 to 48 hr after removal of cover. Will not control white clover; may not control certain large-seeded broadleaf weeds, such as morningglory and sicklepod.
FLUE-CURED Plant beds, Annual grasses and volunteer wheat			
sethoxydim, MOA 1 (Poast) 1.5 EC	1 pt/A or 0.33 fl oz/ 100yd^2	0.19	Apply to actively growing grass not under drought stress. Apply in 5 to 20 GPA at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre (or 0.67 per 100 yd^2). Use hollow cone or flat fan nozzles. Remove plant bed cover and allow plants to dry before application. Do not replace cover until spray solution has dried on plants. Do not apply more than 1 pt of Poast per acre in the plant bed per season. Do not apply to plants smaller than 1 in. in diameter.
FLUE-CURED Field (before transplanting), Most annual grasses and some broadleaf weeds plus nutsedge suppression			
pebulate, MOA 8 (Tillam) 6 EC	2.7 qt	4	Apply to soil surface before bedding and immediately incorporate according to label instructions. Transplant as soon as possible. Early season stunting may occur under unfavorable growing conditions. Does not control cocklebur, morningglory, ragweed, or perennial weeds. Cultivate tobacco at least twice. See label for tank mixes with other pesticides.
FLUE-CURED Field (before transplanting), Some annual grasses and some broadleaf weeds			
napropamide (Devrinol), MOA 17 2 EC or 50 DF	2 to 4 qt (broadcast, see label for band application)	1 to 2	Lower rates usually adequate for most soils. Apply to soil surface and incorporate according to label instructions. Some early season stunting may occur under unfavorable growing conditions. Does not control cocklebur, morningglory, or perennial weeds. Gives some suppression of ragweed. NOTE: Do not seed crops not specified on label for 12 months after application.
FLUE-CURED Field (before transplanting), Most annual grasses and some broadleaf weeds			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O	 1.8 to 2.4 pt 1.6 to 2.1 pt	0.75 to 1	Can be applied up to 60 days before transplanting. Apply before bedding and incorporate into soil according to label instructions. Some early season stunting may occur under unfavorable growing conditions. Does not control cocklebur, morningglory, ragweed, or perennial weeds.
FLUE-CURED Field (before transplanting), Annual grasses and some broadleaf weeds			
clomazone, MOA 13 (Command 3 ME) 3 FME	2 to 2.67 pt	0.75 to 1	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Some whitening of lower leaves may occur but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application. Apply no more than once per season.
FLUE-CURED Field (before transplanting), Broadleaf weeds, nutsedges, and some grasses			
sulfentrazone, MOA 14 (Spartan) 4 F sulfentrazone + carfentrazone, 0.35 + 3.15 F MOA 14 (Spartan Charge)	8 to 12 fl oz 5.7 to 15.2 fl oz	0.25 to 0.38 lb 0.16 to 0.42 lb	Excellent control of pigweed, morningglories, and nutsedges. Application rate is based on soil type and organic matter. See Spartan 4 F or Spartan Charge label for rate determination and application methods. Early season stunting may occur especially when incorporated. Rainfall or irrigation needed within 7 to 10 days of application for maximum weed control, particularly when surface applied. Observe rotational crop guidelines on label.
FLUE-CURED Field (after transplanting), Most annual grasses and some broadleaf weeds			
napropamide (Devrinol), MOA 17 50 DF	2 to 4 lb (broadcast, see label for band application)	1 to 2	Apply overtop immediately after transplanting tobacco. See remarks for Devrinol under "Before Transplanting." NOTE: Do not seed crops not specified on label for 12 □months after application. Small grain seeded for cover crop in fall may be stunted. Do not use small grain for food or feed.
FLUE-CURED Field (after transplanting)			
clomazone, MOA 13 (Command 3 ME) 3 FME	2 to 2.67 pt	0.75 to 1	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Make a single broadcast application in a minimum of 20 gal of water. Apply no more than once per season. Apply over the top of tobacco plants immediately, or up to 7□days after, transplanting but prior to emergence of weeds. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application.
FLUE-CURED Field (after transplanting), Postemergence control of annual grasses			
sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.19 to 0.28	Apply to actively growing grass not under drought stress. Apply in 5 to 20 gal of spray at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre. Do not apply within 42 days of harvest. Do not apply more than 4 pt per acre per season. Complete coverage of grass required for control.
FLUE-CURED Field (after transplanting), Postemergence control of some broadleaf weeds			
Carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024 lb	Apply using SHIELDED SPRAYER or HOODED SPRAYER to emerged, actively growing weeds PRIOR TO LAYBY. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See Label for further instruction.
FLUE-CURED Lay-by, Most annual grasses and some broadleaf weeds			
napropamide (Devrinol), MOA 17 50 DF	2 to 4 lb (band, see label for band application)	1 to 2	Apply in a band to row middles immediately after last cultivation. Lower rates usually adequate for most tobacco soils. Incorporate lightly or sprinkler irrigate, if no rainfall within 3 days after application. Do not apply more than a total of 4 lb of Devrinol per acre in a season. See remarks for Devrinol under "Before Transplanting" and "After Transplanting."

TABLE 7-8A. CHEMICAL WEED CONTROL IN TOBACCO

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
FLUE-CURED Lay-by, Most annual grasses and some broadleaf weeds (continued)			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O	 1.8 to 2.4 pt 1.6 to 2.1 pt	0.75 to 1	Apply to row middles immediately after last cultivation. Avoid contact with tobacco leaves. Use higher rate on medium- or fine-textured soils where grass infestation is heavy or if no herbicide was used previously. Rainfall or irrigation is needed within 7 days. Does not control emerged weeds.
FLUE-CURED After first harvest, Postemergence control of some broadleaf weeds			
Carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024 lb	Apply AFTER FIRST HARVEST for control of actively growing, emerged weeds. Position nozzles 3 to 4 inches above the soil and directed underneath the crop canopy. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See label for further instruction.
BURLEY Plant beds, Annual grass weeds and various broadleaf weeds			
metam sodium (VAPAM) 3.18 L	2 gal/100 sq yd		
methyl bromide 98%	9 lb/100 sq yd		Thoroughly prepare bed. Apply when moisture level is average and air temperature is above 50°F. Release gas under supported plastic cover that is well sealed around edges. Allow cover to remain on bed for 24 hr. Bed can be seeded 24 to 48 hr after removal of cover. Will not control white clover; may not control certain large-seeded broadleaf weeds such as morningglory and sicklepod.
BURLEY Plant beds, Annual grasses and volunteer wheat			
sethoxydim, MOA 1 (Poast) 1.5 EC	1 pt/A or 0.33 fl oz/ 100 sq yd	0.19	Apply to actively growing grass not under drought stress. Apply in 5 to 20 GPA at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre (or 0.67 fl oz per 100 □ yd^2). Use hollow cone or flat fan nozzles. Remove plant bed cover and allow plants to dry before application. Do not replace cover until spray solution has dried on plants. Do not apply more than 1 pt of Poast per acre in the plant bed per season. Do not apply to plants smaller than 1 in. in diameter.
BURLEY Field (before transplanting), Most annual grasses and some broadleaf weeds plus nutsedge suppression			
pebulate, MOA 8 (Tillam) 6 EC	2.7 qt	4	See remarks for Tillam under "Flue-Cured." Tank mix suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
BURLEY Field (before transplanting), Some annual grasses and broadleaf weeds			
napropamide, MOA 17 (Devrinol) 2 EC	2 to 4 qt (broadcast, see label for band application)	1 to 2	See remarks for Devrinol under "Flue-Cured." Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
BURLEY Field (before transplanting), Most annual grasses and some broadleaf weeds			
pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) H_2O	 2.4 to 3 pt 2.1 to 2.6 pt	1 to 1.25	See remarks for Prowl under "Flue-Cured." The higher labelled rates may be needed for soils where burley tobacco is grown in N.C. Add hairy galinsoga to weeds not controlled.
BURLEY Field (before transplanting), Annual grasses and some broadleaf weeds			
clomazone, MOA 13 (Command 3 ME) 3 FME	2 to 2.67 pt	0.75 to 1	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Some whitening of lower leaves may occur but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after Command application. Apply no more than once per season.
BURLEY Field (before transplanting), Broadleaf weeds, nutsedges, and some grasses			
sulfentrazone, MOA 14 (Spartan) 4 F sulfentrazone + carfentrazone, 0.35 + 3.15 F MOA 14 (Spartan Charge)	8 to 12 fl oz 5.7 to 15.2 fl oz	0.25 to 0.38 lb 0.16 to 0.42 lb	Excellent control of pigweed, morningglories, and nutsedges. Application rate is based on soil type and organic matter. See Spartan 4 F or Spartan Charge label for rate determination and application methods. Early season stunting may occur especially when incorporated. Rainfall or irrigation needed within 7 to 10 days of application for maximum weed control, particularly when surface applied. Observe rotational crop guidelines on label.
BURLEY Field (after transplanting), Most annual grasses and some broadleaf weeds			
napropamide, MOA 17 (Devrinol) 50 DF	2 to 4 lb (broadcast, see label for band application)	1 to 2	Apply overtop immediately after transplanting tobacco. See remarks for Devrinol under "After Transplanting" in flue-cured section. Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).
BURLEY Field (after transplanting), Annual grasses and some broadleaf weeds			
clomazone, MOA 13 (Command 3 ME) 3 FME	2 to 2.67 pt	0.75 to 1	Excellent annual grass control plus control of certain broadleaf weeds, such as prickly sida, jimsonweed, tropic croton, smartweed, and common ragweed. Partial control of cocklebur; does not control pigweed, sicklepod, or morningglory. Make a single broadcast application in a minimum of 20 gal of water. Apply no more than once per season. Apply over the top of tobacco plants immediately, or up to 7 □ days after transplanting, but prior to emergence of weeds. Some whitening of lower leaves may occur, but plants should recover. Do not plant small grains or alfalfa in the fall or following spring after applying Command.
BURLEY Field (after transplanting), Postemergence control of annual grasses			
sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.19 to 0.28	Apply to actively growing grass not under drought stress. Apply in 5 to 20 gal of spray at 40 to 60 psi. Add 2 pt of crop oil concentrate per acre. Do not apply within 42 days of harvest. Do not apply more than 4 pt per acre per season. Complete coverage of grass required for control.
BURLEY Field (after transplanting), Postemergence control of some broadleaf weeds			
Carfentrazone MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.0125 to 0.024 lb	Apply using SHIELDED SPRAYER or HOODED SPRAYER to emerged, actively growing weeds PRIOR TO LAYBY. Do not apply when conditions favor drift. MUST PREVENT CONTACT OF SPRAY SOLUTION WITH TOBACCO PLANT. See Label for further instruction.
BURLEY Lay-by, Most annual grasses and some broadleaf weeds			
napropamide, MOA 17 (Devrinol) 50 DF	2 to 4 lb (band, see label for band application)	1 to 2	Apply in a band to row middles immediately after last cultivation. Lower rates usually adequate for most tobacco soils. Incorporate lightly or sprinkler irrigate if no rainfall within 3 days after application. Do not apply more than a total of 4 lb of Devrinol 50 WP per acre in a season. See remarks for Devrinol under "After Transplanting" in flue-cured section. Suppresses hairy galinsoga under ideal conditions (ample rainfall after application).

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Weed Response to Herbicides in Tobacco

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Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-8B. WEED RESPONSE TO HERBICIDES IN TOBACCO

	Herbicides						
Species	**Command**	**Devrinol**	**Poast**	**Prowl**	**Spartan**	**Tillam**	**Aim**
Barnyardgrass	E	GE	E	GE	F	GE	N
Bermudagrass	PF	P	FG	P	P	P	N
Broadleaf signalgrass	E	G	E	G	F	P	N
Crabgrass	E	E	GE	E	F	E	N
Crowfootgrass	E	E	FG	E	F	E	N
Fall panicum	E	G	E	GE	—	G	N
Foxtails	E	E	E	E	F	E	N
Goosegrass	E	E	GE	E	F	G	N
Sandbur	G	—	FG	G	—	G	P
Seedling johnsongrass	G	F	E	G	—	G	N
Texas panicum	G	—	E	G	F	P	N
Nutsedge	P	P	N	P	E	FG	N
Cocklebur	F	P	N	P	FG	P	G
Common purslane	FG	E	N	P	G	G	G
Ragweed							
Common	G	F	N	P	P	P	N
Giant	PF	PF	N	P	—	P	N
Hairy galinsoga	G	PF	N	P	G	P	P
Jimsonweed	G	P	N	P	—	P	G
Lambsquarters	G	G	N	G	E	G	G
Morningglory	P	P	N	P	E	P	E
Pigweed	P	G	N	G	E	G	E
Prickly sida	E	P	N	P	G	P	P
Sicklepod	P	P	N	P	P	P	P
Smartweed	G	P	N	P	E	P	G

KEY
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Chemical Weed Control in Wheat, Barley, Oats, Rye, and Triticale

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See Table 7-11, Herbicide Resistance Management, for details.

TABLE 7-9A. CHEMICAL WEED CONTROL IN WHEAT, BARLEY, OATS, RYE, AND TRITICALE

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
WHEAT Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, top-kill of perennials			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL (Gramoxone Max) 3 SL	2 to 4 pt	0.5 to 1	Rate depends upon weed size; see label. Apply before crop emerges. Add nonionic surfactant at 1 pt per 100 gal spray solution or crop oil concentrate at 1 gal per 100 gal spray solution. See application directions on label. May be tank mixed with Hoelon. Generic formulations of paraquat containing 3 lb active per gal are available. Apply these products at 1.3 to 2.7 pt.
WHEAT Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.38 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Rate depends upon weed species and size; see label. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 in. tall, apply 4 to 6 fl oz of Select or 6 fl oz of Select Max. For corn up to 24 in. increase Select rate to 6 to 8 fl oz or Select Max rate to 9 fl oz. Select or Select Max must be applied at least 30 days ahead of wheat planting. Valor SX at 1 to 2 oz per acre will suppress ryegrass and bluegrass and controls several broadleaf weeds. Do not till after application and apply at least 30 days prior to planting.
WHEAT Preplant No-Till or Preemergence, Broadleaf weeds			
saflufenacil, MOA 14 (Sharpen) 3.42	1.0 to 2.0 fl oz	0.027 to 0.054	See label for broadleaf weeds controlled. Sharpen does not control grasses. Apply with amonium sulfate (1 to 2 gal/100 gal) and methylated seed oil (1 gal/100 gal). Do not apply if wheat has germinated. See label for tank mixtures.
flumioxazin, MOA 14 (Valor SX) 51 WDG + paraquat, MOA 22 (Gramoxone Inteon) 2.5 SL OR glyphosate, MOA 9 (numerous brands and formulations)	2.0 oz 2 to 4 pt See label	0,063 0.5 to 1 0.38 to 1.13 (lb a.e.)	Use only on no-till or minimum till fields where stubble from the previous crop has not been incorporated. Valor SX must be applied at least 30 days ahead of planting wheat. Residual control of broadleaf weeds and Italian ryegrass. Apply with nonionic surfactant at 1 qt/100 gal. Can be applied with nitrogen carriers. Do no perform tillage after application. Carefully follow label directions for sprayer cleaning after each day's use.
WHEAT Preplant No-Till or Preemergence, Emerged annual broadleaf weeds			
pyraflufen-ethyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used for limited suppression of small emerged summer annual and winter weeds. See label for adjuvant and spray volume recommendations. Research with ET is limited in North Carolina.
WHEAT Preemergence, Italian ryegrass and annual broadleaf weeds			
chlorsulfuron, MOA 2 + metsulfuron methyl, MOA 2 (Finesse) 75 WDG	0.5 oz	0.0195 + 0.0039	Ryegrass control is variable; expect only suppression. May stunt wheat on sandy soils. Suggested primarily for fields with Hoelon-resistant ryegrass. Also controls most annual broadleaf weeds. Do not use where a later application of Osprey or PowerFlex is anticipated. Plant only STS soybeans following wheat harvest. May cause severe injury in non-STS soybeans.
WHEAT Spike Stage, Italian ryegrass			
flufenacet, MOA 15 + metribuzin, MOA 5 (Axiom) 68 WDG	4 to 10 oz	0.136 to 0.034 + 0.34 to 0.085	Apply to wheat in the spike stage. Preemergence application can cause severe injury on coarse-textured soils. Application rate depends on soil type; see label. In general, North Carolina research has shown best results with 6 to 7 oz on coarse soils and 8 to 9 oz on medium and heavy soils. If rainfall is received timely, Axiom controls ryegrass well. It also controls chickweed, henbit, and wild radish.
WHEAT Postemergence, Italian ryegrass			
diclofop-methyl, MOA 1 (Hoelon) 3 EC	1.33 to 2.67 pt	0.5 to 1	Apply when ryegrass is in the one- to five-leaf stage. See label for specific rates depending upon weed size. Application to smaller ryegrass is more effective. Make only one application per season. Do not tank mix with broadleaf herbicides or use liquid nitrogen as the carrier. Apply before the first wheat node (joint) develops. May add 1 to 2 pt per acre of crop oil concentrate under dry conditions or when ryegrass is large. In most cases, crop oil is not necessary. See precautions on label concerning temperatures. Biotypes of ryegrass resistant to Hoelon are common within the state. Hoelon should not be applied to fields where resistance is suspected.
mesosulfuron, MOA 2 (Osprey) 4.5 WDG	4.75 oz	0.013	Apply when ryegrass is in one-leaf to two-tiller stage. Add adjuvant as directed on label. In North Carolina, nonionic surfactant at 1 to 2 qt per 100 gal spray solution plus 1 to 2 qt of 30% liquid nitrogen per acre is preferred. See label for broadleaf weeds controlled. For additional control, Osprey may be mixed with Harmony Extra. Do not tank mix with 2,4-D or dicamba. Do not apply using liquid nitrogen as the carrier. Do not topdress wheat within 14 days of Osprey application. In fields with Hoelon-susceptible ryegrass, it is recommended that Osprey or PowerFlex and Hoelon or Axial be used on an alternating basis (i.e., rotated) as part of a resistance management strategy. See comments for Axial. Ryegrass with multiple resistance to Axial, PowerFlex, Hoelon, Osprey, and PowerFlex occurs in North Carolina.
pinoxaden, MOA 1 (Axial XL) 0.42 EC	16.4 fl oz	0.054	Apply to wheat with two or more leaves when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial. No adjuvants are necessary. May be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial. Mix thoroughly, and then add the nitrogen. Axial and Hoelon have the same mode of action. Ryegrass resistant to Hoelon may be cross-resistant to Axial, although in some cases Axial will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial on limited acreage is suggested to determine if the biotype is susceptible to Axial.

TABLE 7-9A. CHEMICAL WEED CONTROL IN WHEAT, BARLEY, OATS, RYE, AND TRITICALE

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
WHEAT Postemergence, Italian ryegrass (continued)			
pyroxsulam, MOA 2 (PowerFlex) 7.5 WDG	3.5 oz	0.0164	Can be applied to wheat from the 3-leaf stage until jointing. Apply after the majority of the ryegrass has emerged but before it exceeds the 2-tiller stage. Add nonionic surfactant at 1 to 2 qt/100 gal spray solution. See label for broadleaf weeds controlled. For addiitional control, PowerFlex may be mixed with Harmony Extra. Do not mix with dicamba or with amine formulations of 2,4-D or MCPA. Can be applied in water-nitrogen mixtures containing up to 50% liquid nitrogen by volume, or a maximum of 30 lb/acre. If applying in liquid nitrogen, reduce surfactant rate to 1 pt/100 gal. Rainfast in 4 hours. Do not apply to wet foliage. Current labeling specifies a 5-month rotation for soybeans. Limited research in North Carolina has shown no problems with soybeans double-cropped behind PowerFlex-treated wheat. Corn, cotton, or peanuts can be planted 9 months after application. See comments under mesosulfuron (Osprey) and pinoxaden (Axial) concerning resistance management.
WHEAT Postemergence, Cheat			
pyroxsulam, MOA 2 (PowerFlex) 7.5 WDG	3.5 oz	0.0164	See comments for PowerFlex under Italian Ryegrass.
WHEAT Postemergence, Annual bluegrass			
mesosulfuron, MOA 2 (Osprey) 4.5 WDG	4.75 oz	0.013	See comments for Osprey under Italian Ryegrass. Apply to bluegrass from the 1-leaf to 2-tiller stage. Application when plants are about the size of a quarter coin has worked well.
WHEAT Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after the two-leaf stage of wheat but before flag leaf is visible. Use 0.45 to 0.6 oz for most winter annual weeds. Use 0.75 to 0.9 oz for wild garlic and wild radish. Wild garlic should be less than 12 in. tall and should have 2 to 4 in. of new growth. Control is enhanced when application is made during warm temperatures (50°F or more) to actively growing garlic plants. Add 1 qt of nonionic surfactant per 100 gal of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 lb active ingredient of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Do not tank mix with Hoelon. May be tank mixed with Axial or Osprey.
WHEAT Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	 1 pt 1 pt 0.67 pt 1 pt	 0.48 0.48 0.48 0.35	Apply after wheat is fully tillered (usually 4 to 8 in. tall; stages 4 and 5 on Feekes scale) but before jointing. Spraying wheat too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when day-time temperatures are above 50°F. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.
WHEAT Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 pt	0.125	Apply after wheat is fully tillered but before jointing. Better results will be obtained if applied when daytime temperatures are above 50°F. Liquid nitrogen may be used as the carrier.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL + 2,4-D amine, MOA 4 (various brands) 3.8 SL or 2,4-D ester, MOA 4 (various brands) 3.8 SL	 0.25 pt 0.25 pt + 0.5 to 0.75 pt or 0.5 to 0.75 pt	0.125 + 0.24 to 0.36 or 0.24 to 0.36	Apply after wheat is fully tillered (usually 4 to 8 in. tall; stages 4 and 5 on Feekes scale) but before jointing. Compared to dicamba alone, tank mixture is more effective on buttercup, cornflower, field pennycress, Virginia pepperweed, shepherdspurse, wild mustard, and wild radish. Use this tank mix only if both herbicides are necessary for weed control. Tank mix may injure wheat.
pyraflufen-methyl, MOA 14 (ET) 1 SL	0.5 to 2.0 fl oz	0.003 to 0.015 (lb a.i.)	ET can be used to suppress small annual winter weeds. Although application is registered to flag leaf appearance, coverage of small weeds is necessary but difficult when wheat is tall. See label for adjuvant and spray volume and carrier recommendations. Research with ET is limited in North Carolina.
WHEAT Preharvest, Annual broadleaf and grass weeds, suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after hard dough stage of grain (30% or less grain moisture) and at least 7 days before harvest. Do not apply to wheat grown for seed. Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions.
WHEAT Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	 1 to 2 pt 1 to 2 pt 0.67 to 1.3 pt 1 to 2 pt	 0.48 to 0.95 0.48 to 0.95 0.48 to 0.95 0.35 to 0.7	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops (be especially careful with ester formulations). Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton and tobacco.
BARLEY Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, top-kill of perennials			
paraquat, MOA 22 (Gramoxone Inteon) 2 SL	2 to 4 pt	0.5 to 1	Rate depends upon weed size; see label. Apply before crop emerges. Add nonionic surfactant at 1 pt per 100 gal spray solution or crop oil concentrate at 1 gal per 100 gal spray solution. See application directions on label. Generic formulations of paraquat containing 3 lb active per gal are available. Apply these products at 1.3 to 2.7 pt.

TABLE 7-9A. CHEMICAL WEED CONTROL IN WHEAT, BARLEY, OATS, RYE, AND TRITICALE

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
BARLEY Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 in. tall, apply 4 to 6 fl oz of Select or 6 fl oz of Select Max. For corn up to 24 in. increase Select rate to 6 to 8 fl oz or Select Max rate to 9 fl oz. Select or Select Max must be applied at least 30 days ahead of barley planting.
BARLEY Postemergence, Italian ryegrass			
diclofop-methyl, MOA 1 (Hoelon) 3 EC	1.33 to 2.67 pt	0.5 to 1	Apply when ryegrass is in the one- to four-leaf stage and after tiller initiation but prior to jointing of barley. Make only one application per year. Do not tank mix with broadleaf herbicides or use liquid nitrogen as the carrier. Do not add crop oil. Apply only to the following varieties of barley: Anson, Boone, Henry, Milton, Molly Bloom, Mulligan, Nomini, Pennco, Starling, Sussex, and Wysor. Cold (lower than 40°F) and/or prolonged wet conditions increase barley sensitivity to Hoelon. Biotypes of ryegrass resistant to Hoelon are becoming more common within the state. Hoelon should not be applied to fields where resistance is suspected.
pinoxaden, MOA 1 (Axial XL) 0.42 EC	16.4 fl oz	0.054	Apply to barley with two or more leaves when ryegrass has one to five leaves on the main stem. More effective when applied to smaller ryegrass. May be tank mixed with Harmony Extra. When mixing, add Harmony Extra first, then Axial. May be applied in water/nitrogen mixtures containing up to 50% liquid nitrogen by volume. Add water to tank, then add Axial. Mix thoroughly, and add the nitrogen. Axial and Hoelon have the same mode of action. Ryegrass resistant to Hoelon may be cross-resistant to Axial, although in some cases Axial will control Hoelon-resistant ryegrass. If Hoelon resistance is expected, trial use of Axial on limited acreage is suggested to determine if the ryegrass biotype is susceptible to Axial.
BARLEY Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after the two-leaf stage of barley but before flag leaf is visible. Use 0.45 to 0.6 oz for most winter annual weeds. Use 0.75 to 0.9 oz for wild garlic and wild radish. Wild garlic should be less than 12 in. tall and should have 2 to 4 in. of new growth. Control is enhanced when application is made during warm temperatures (50°F or more) to actively growing garlic plants. Add 1 qt of nonionic surfactant per 100 gal of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 lb a.i. of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Do not tank mix with Hoelon.
BARLEY Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	1 pt 1 pt 0.67 pt 1 pt	0.48 0.48 0.48 0.35	Apply after barley is fully tillered but before jointing. Spraying barley too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when day-time temperatures are above 50°F. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.
BARLEY Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 pt	0.125	Apply before jointing stage of growth. Risk of crop injury is least if applied after winter dormancy and before grain begins to joint. Better results will be obtained if applied when daytime temperatures are above 50°F. Liquid nitrogen may be used as the carrier.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL + 2,4-D amine, MOA 4 (various brands) 3.8 SL or 2,4-D ester, MOA 4 (various brands) 3.8 SL	0.25 pt 0.25 pt + 0.5 pt or 0.5 pt	0.125 + 0.24 or 0.24	Apply after barley is fully tillered but before jointing. Compared to dicamba alone, tank mixture is more effective on buttercup, cornflower, field pennycress, Virginia pepper-weed, shepherdspurse, and wild mustard. Use this tank mix only if both herbicides are necessary for weed control. Tank mix may injure barley.
BARLEY Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL 2,4-D acid/ester, MOA 4 (Weedone 638) 2.8 SL	1 to 2 pt 1 to 2 pt 0.67 to 1.3 pt 1 to 2 pt	0.48 to 0.95 0.48 to 0.95 0.48 to 0.95 0.35 to 0.7	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops (be especially careful with ester formulations). Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
BARLEY Preharvest, Annual broadleaf and grass weeds, suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.75 (lb a.e.)	Apply after hard dough stage of grain (and 20% or less moisture) and at least 7 days before harvest. Do not apply to barley grown for seed. Glyphosate is available as an isopropylamine salt and a potassium salt. Compare glyphosate formulations and application rates on the basis of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceeding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions.
OATS Preplant No-Till, Emerged annual broadleaf and grass weeds, volunteer corn, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 in. tall, apply 4 to 6 fl oz of Select or 6 fl oz of Select Max. For corn up to 24 in., increase Select rate to 6 to 8 fl oz or Select Max rate to 9 fl oz. Select or Select Max must be applied at least 30 days ahead of planting oats.

TABLE 7-9A. CHEMICAL WEED CONTROL IN WHEAT, BARLEY, OATS, RYE, AND TRITICALE

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
OATS Postemergence, Wild garlic, curly dock, and most winter annual broadleaf weeds except cornflower and vetch			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.6 oz	0.0094 to 0.0125 + 0.0047 to 0.0063	Apply after the two-leaf stage of oats but before flag leaf is visible. Wild garlic should be less than 12 in. tall and should have 2 to 4 in. of new growth. Control is enhanced when application is made during warm temperatures (50°F or more) to actively growing garlic plants. Add 1 qt of nonionic surfactant per 100 gal of spray solution. Liquid nitrogen may be used as the carrier. May tank mix Harmony Extra with 0.125 to 0.375 lb a.i. of 2,4-D for improved control of wild radish. Follow mixing instructions on the label when using nitrogen as the carrier or when mixing with 2,4-D. Reduce surfactant rate according to label instructions when using nitrogen as the carrier or when mixing with 2,4-D. Oats are more sensitive to 2,4-D than wheat.
OATS Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL	1 pt	0.48	Apply after oats are fully tillered but before jointing. Spraying oats too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Also, oats are less tolerant of 2,4-D than wheat. Better results are obtained when daytime temperatures are above 50°F. Liquid nitrogen may be used as the carrier for 2,4-D. Premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation.
OATS Postemergence, Most winter annual broadleaf weeds			
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	 0.25 pt 0.25 pt	0.125	Apply before jointing stage of growth. Risk of crop injury is least if applied after winter dormancy and before grain begins to joint. Better results will be obtained if applied when daytime temperatures are above 50°F. Liquid nitrogen may be used as the carrier.
OATS Preharvest, Annual broadleaf weeds			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL	 1 to 2 pt 1 to 2 pt	0.48 to 0.95	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops, especially cotton and tobacco. Amine formulations strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
RYE Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 in. tall, apply 4 to 6 fl oz of Select or 6 fl oz of Select Max. For corn up to 24 in., increase Select rate to 6 to 8 fl oz or Select Max rate to 9 fl oz. Select or Select Max must be applied at least 30 days ahead of planting rye.
RYE Postemergence, Most winter annual broadleaf weeds except chickweed, henbit, and knawel			
2,4-D amine, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL	 1 pt 1 pt 0.67 pt	0.48	Apply after rye is fully tillered but before jointing. Spraying rye too young or after jointing can cause deformed heads, reduced yields, and uneven ripening. Better results are obtained when daytime temperatures are above 50°F. Increase the rate of 2,4-D by 50% to control corn cockle. Liquid nitrogen may be used as the carrier for 2,4-D. Ester formulations can be added directly to the nitrogen. If using amine formulation, premix in water (1 part 2,4-D to 4 parts water) and add mixture to nitrogen with strong agitation. Amine formulations give less burn than ester formulations in nitrogen.
RYE Preharvest, Annual broadleaf weeds			
2,4-D ester, MOA 4 (various brands) 3.8 SL 2,4-D ester, MOA 4 (various brands) 5.7 SL	 1 to 2 pt 0.67 to 1.3 pt	0.48 to 0.95	Apply when grain is in hard dough stage or later. Do not allow drift to sensitive crops, especially cotton and tobacco. Amine formulations are strongly encouraged if sensitive crops are nearby, especially cotton or tobacco.
TRITICALE Preplant No-Till, Emerged annual broadleaf and grass weeds, control or suppression of perennial weeds			
glyphosate, MOA 9 (numerous brands and formulations)	See label	0.56 to 1.13 (lb a.e.)	Glyphosate is available as an isopropylamine salt and a potassium salt. Glyphosate formulations and application rates should be compared on the basis of pounds of glyphosate acid equivalent (a.e.) per gallon and per acre, respectively. Rate in the preceding column is expressed as a.e. See TABLE 7-10 for glyphosate rate conversions. Rate depends upon weed species and size; see labels. Apply before crop emergence. Adjuvant recommendations vary by glyphosate brand; see label of brand used for details. Select or Select Max may be mixed with glyphosate to control volunteer Roundup Ready corn. For corn up to 12 in. tall, apply 4 to 6 fl oz of Select or 6 fl oz of Select Max. For corn up to 24 in., increase Select rate to 6 to 8 fl oz or Select Max rate to 9 fl oz. Select or Select Max must be applied at least 30 days ahead of planting triticale.
TRITICALE Preemergence, Italian ryegrass and annual broadleaf weeds			
chlorsulfuron, MOA 2 + metsulfuron methyl, MOA 2 (Finesse) 75 WDG	0.5 oz	0.0195 + 0.0039	See comments under WHEAT, Preemergence.
TRITICALE Postemergence, Wild garlic and annual broadleaf weeds			
thifensulfuron-methyl, MOA 2 + tribenuron-methyl, MOA 2 (Harmony Extra SG with TotalSol) 50 WDG	0.45 to 0.9 oz	0.0094 to 0.0188 + 0.0047 to 0.0094	Apply after two-leaf stage of triticale but before flag leaf is visible. See comments for Harmony Extra under WHEAT-Postemergence.
TRITICALE Postemergence, Annual broadleaf weeds			
2,4-D, MOA 4 (Amine 4 2,4-D) 3.8 SL (Weedar 64) 3.8 L	1 pt	0.48	See comments for 2,4-D under WHEAT- Postemergence.
dicamba, MOA 4 (Banvel) 4 SL (Clarity) 4 SL	0.25 oz	0.125	See comments for dicamba under WHEAT- Postemergence.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Weed Response to Herbicides in Small Grains

W. J. EVERMAN, Crop Science Department

Ratings based upon average to good soil and weather conditions for herbicide performance and upon proper application rate, technique, and timing.

TABLE 7-9B. WEED RESPONSE TO HERBICIDES IN SMALL GRAINS

	Herbicides								
Species	**Axial**	**Axiom**	**Banvel/Clarity**	**Finesse[2]**	**2,4-D**	**Harmony Extra**	**Hoelon**	**Osprey**	**PowerFlex [7]**
Annual bluegrass	N	G[4]	N	N	N	N	N	G	-
Annual ryegrass	GE[6]	G[4]	N	F	N	N	E[1]	E[5]	E[5]
Buttercup	N	-	F	G	G	G	N	-	-
Chickweed, common	N	G	G	G	P	G	N	FG	-
Cornflower	N	-	FG	F	G	P	N	P	-
Curly dock	N	N	F	-	P	E	N	P	-
Cutleaf eveningprimrose	N	-	G	-	E	G	N	P	-
Field pennycress	N	-	F	G	G	G	N	-	-
Henbit	N	GE[4]	F	G	P	G	N	G	-
Knawel	N	-	G	-	P	G	N	-	-
Shepherd's-purse	N	-	FG	G	GE	E	N	-	-
Swinecress	N	-	G	-	G	E	N	E	-
Vetch	N	-	E	-	G	P	N	N	-
Virginia pepperweed	N	-	F	-	E	G	N	-	-
Wild garlic	N	N	F	P	F	E	N	P	-
Wild mustard	N	G[4]	F	G	GE	G	N	E[3]	GE
Wild radish	N	G[4]	F	G	GE	G	N	E[3]	GE

[1] A biotype of ryegrass resistant to Hoelon is common in North Carolina, especially in the piedmont. If resistance is suspected, do not apply Hoelon.
[2] Applied preemergence.
[3] Rating assumes mustard or radish is 1 to 2 in. Osprey is less effective on larger plants.
[4] Assumes adequate rainfall for activation prior to weed emergence.
[5] A biotype of ryegrass resistant to Osprey and PowerFlex has been found in the southern piedmont.
[6] May not control Hoelon-resistant ryegrass. See comments under "Wheat-Postemergence."
[7] Inadequate research has been conducted in North Carolina to determine response of most broadleaf weeds to PowerFlex. The label claims control of a number of broadleaf species, including Carolina geranium, chickweed, hairy bittercress, field pennycress, sheperdspurse, buttercup, Virginia pepperweed, and vetch.

Key:
E = excellent control, 90% or better
G = good control, 80% to 90%
F = fair control, 50% to 80%
P = poor control, 25% to 50%
N = no control, less than 25%

Glyphosate Formulations

W. J. EVERMAN, Crop Science Department

TABLE 7-10 GLYPHOSATE FORMULATIONS

Brand Names[1]	Formulation	Active Ingredient (lb formulated salt/gal)	Acid Equivalent	Equivalent Rates	
				lb a.e./acre	fl oz product/acre
Allecto **Buccaneer** **Buccaneer Plus** **Cornerstone** **Cornerstone Plus** **Credit** **Credit Extra** **CropSmart Glyphosate 41 Plus** **Gly-Flo** **Gly-4** **Gly-4 Plus** **Glyfos** **Glyfos X-TRA** **Glyphogan** **Glyphomax** **Glyphomax Plus** **Glyphosate 4** **Gly Star Original** **Gly Star Plus** **GlySupreme Plus** **Honcho** **Honcho Plus** **Hoss Ultra** **Mad Dog** **Mad Dog Plus** **Meychem 41%** **Makaze** **Mirage** **Mirage Plus** **Rascal** **Rascal Plus** **Rattler** **Rattler Plus** **Wise Up Plus**	Isopropylamine salt	4	3	0.375 0.56 0.75	16 24 32
Cinco **Durango** **Glyphomax XRT**	Isopropylamine salt	5.4	4	0.375 0.56 0.75	12 18 24
Roundup POWERMAX **Roundup WEATHERMAX**	Potassium salt	5.5	4.5	0.375 0.56 0.75	10.7 15.9 21.3
Touchdown HiTech	Potassium salt	6	5	0.375 0.56 0.75	9.6 14.3 19.2
Touchdown Total **Traxion**	Potassium salt	5	4.17	0.375 0.56 0.75	11.5 17.2 23
Credit Duo **Credit Duo Extra**	Isopropylamine salt + Monoammonium salt	3.64 + 0.33	3	0.375 0.56 0.75	16 24 32
Nufarm Credit **Nufarm Credit Extra**	Isopropylamine salt + Potassium salt	1.8 + 1.6	3	0.375 0.56 0.75	16 24 32

[1] Other brands may be available. See comments on resistance management in TABLE 7-11. Warning: Some generic brands of glyphosate are of inferior quality. They may be somewhat less effective on weeds, and they may cause injury to Roundup Ready crops, especially cotton.

Herbicide Resistance Management

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Herbicide resistance is becoming a serious problem in North Carolina and across the country. Herbicide resistance is not a new phenomenon in North Carolina. Goosegrass resistant to dinitroaniline herbicides was first reported in North Carolina in the 1970s. Since then, smooth pigweed and common lambsquarters resistant to triazines, cocklebur resistant to organoarsenicals and ALS inhibitors, Palmer amaranth resistant to ALS inhibitors, Italian ryegrass resistant to ACCase inhibitors and ALS inhibitors, and common ragweed resistant to ALS inhibitors have been observed. Of greatest concern is weed resistance to glyphosate. Horseweed (2003), Palmer amaranth (2005), common ragweed (2006), and Italian ryegrass (2009). resistant to glyphosate have been found. Resistance of common lambsquarters to glyphosate is suspected. Weed resistance to glyphosate is a highly significant concern in light of the extensive use of glyphosate for burndown in conservation tillage systems and in Roundup Ready cotton, soybeans, and corn.

Crop rotation, along with appropriate herbicide rotation, should be employed to the extent possible. Additionally, cultivation, where feasible, can be very helpful in herbicide resistance management. However, the most important component of a resistance management strategy is rotation of herbicide modes of action and use of multiple herbicide modes of action within each crop.

Mode of action describes the process whereby a herbicide kills susceptible plants. Table 7-11 lists the mode of action, along with the chemical family, of all the herbicides likely to be used on agronomic and horticultural crops in North Carolina. Each herbicide mode of action is assigned a numerical code for ease of use. Wherever possible, at least two modes of action should be used within each crop. This can be accomplished by preemergence herbicide applications followed by postemergence applications and by tank mixtures of herbicides with two or more modes of action. Also, within a rotation, one should try to avoid dependance on herbicides with the same mode of action in all crops in the rotation. For example, in a corn and soybean rotation, it is best not to use an ALS inhibitor (#2) in each crop. Alternatively, if an ALS inhibitor is used in each crop, herbicides with other modes of action should also be included. Similarly, it would be best to not rely exclusively on glyphosate in both crops.

In Roundup Ready corn and soybeans, it is recommended that glyphosate plus herbicides with at least one other mode of action be used. In Roundup Ready cotton, it is recommended that at least two modes of actions, in addition to glyphosate, be used.

TABLE 7-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
AAtrex	atrazine	triazine	5
Accent	nicosulfuron	sulfonylurea	2
Acumen	pendimethalin	dinitroalinine	3
Aim	carfentrazone	triazolinone	14
Alachlor	alachlor	chloroacetamide	15
Alanap	naptalam	phthalamate simicarbazone	19
Arrow	clethodim	cyclohexanedione	1
Atrazine	atrazine	triazine	5
Assure II	quizalofop	aryloxyphenoxy-propionate	1
Authority Assist	sulfentrazone + imazethapyr	triazolinone + imidazdinone	14 + 2
Authority First	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Authority MTZ	sulfentrazone + metribuzin	triazolinone + triazinone	14 + 5
Axial	pinoxaden	phenylpyrazoline	1
Axiom	flufenacet + metribuzin	oxyacetamide + triazinone	15 + 5
Banvel	dicamba	benzoic acid	4
Banvel-K + Atrazine	dicamba + atrazine	benzoic acid + triazine	4 + 5
Basagran	bentazon	benzothiadiazinone	6
Basis	rimsulfuron + thifensulfuron	sulfonylurea	2 + 2
Beyond	imazamox	imidazolinone	2
Bicep II Magnum	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Blazer	acifluorfen	diphenylether	14
Boundary	s-metolachlor + metribuzin	chloroacetamide + triazinone	15 + 5
Brawl, Brawl II	s-metolachlor	chloroacetamide	15
Brawl II ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Breakfree ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Break-Up	pronamide	benzamide	3
Buctril	bromoxynil	nitrile	6
Bullet	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Butoxone	2,4-DB	phenoxy-carboxylic acid	4
Butyrac	2,4-DB	phenoxy-carboxylic acid	4
Cadre	imazapic	imidazolinone	2
Callisto	mesotrione	triketone	27
Camix	mesotrione + s-metolachlor	triketone + chloroacetamide	27 + 15
Canopy	metribuzin + chlorimuron	triazine + sulfonylurea	5 + 2
Canopy EX	chlorimuron + tribenuron	sulfonylurea + sulfonylurea	2 + 2

TABLE 7-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Canopy XL	sulfentrazone + chlorimuron	diphenylether + sulfonylurea	14 + 2
Caparol	prometryn	triazine	5
Capreno	tembotrione + thiencarbazone	benzoyl pyrazole + triazolone	27 + 2
Celebrity, Celebrity Plus	nicosulfuron + dicamba	sulfonylurea + benzoic acid	2 + 4
Charger Basic	s-metolachlor	chloroacetamide	15
Cinch	s-metolachlor	chloroacetamide	15
Cinch ATZ	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Clarity	dicamba	benzoic acid	4
Classic	chlorimuron	sulfonylurea	2
Clethodim	clethodim	cyclohexanedione	1
Clopyr AG	clopyralid	pyridine carboxylic acid	4
Cobra	lactofen	diphenylether	14
Command	clomazone	isoxazolidinone	13
Confidence	acetochlor	chloroacetamide	15
Confidence Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Cotoran	fluometuron	urea	7
Cotton-Pro	prometryne	triazine	5
Curbit	ethalfluralin	dinitroaniline	3
Dacthal	DCPA	benzoic acid	3
Dawn	fomesafen	diphenyl ether	14
Define	flufenacet	oxyacetamide	15
Degree	acetochlor	chloroacetamide	15
Degree Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Devrinol	napropamide	acetamide	15
Diablo	dicamba	benzoic acid	4
Dicamba DMA Salt	dicamba	benzoic acid	4
Direx	diuron	urea	7
Distinct	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19
Diuron	diuron	urea	7
Double Team	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
DSMA, numerous brands	DSMA	organoarsenical	17
Dual II, Dual II Magnum	s-metolachlor	chloroacetamide	15
Envive	flumioxazim + chlorimuron + thifensulfuron	n-phenylphthalimide + triazolopyrimidine + sulfonylurea	14 + 2 + 2
Envoke	trifloxysulfuron	sulfonylurea	2
Eptam	EPTC	thiocarbamate	8
Equip	formasulfuron + iodosulfuron	sulfonylurea	2 + 2
Eradicane	EPTC	thiocarbamate	8
Establish	dimethenamid	chloroacetamide	15
Establish ATZ	dimethenamid + atrazine	chloroacetamide + triazine	15 + 5
ET	pyraflufen ethyl	phenylpyrazole	14
Evik	ametryne	triazine	5
Expert	glyphosate + s-metolachlor + atrazine	glycine + chloroacetamide + triazine	9 + 15 + 5
Express	tribenuron	sulfonylurea	2
Extreme	glyphosate + imazethapyr	glycine + imidazolinone	9 + 2
Finesse	chlorsulfuron + metsulfuron	sulfonylurea + sulfonylurea	2 + 2
Firestorm	paraquat	bipyridylium	22
Firstrate	cloransulam	triazolopyrimidine	2
Flexstar	fomesafen	diphenylether	14
Fultime	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Fusilade DX	fluazifop	aryloxyphenoxy-propionate	1
Fusion	fluazifop + fenoxaprop	aryloxyphenoxy-propionate + aryloxyphenoxy-propionate	1 + 1
Galigan	oxyfluorfen	diphenylether	14
Gangster	flumioxazin + cloransulam	n-phenylphthalimide + triazolopyrimidine	14 + 2
Guardsman Max	dimethenamide + atrazine	chloroacetamide + triazine	15 + 5
Glyphosate (numerous brands)	glyphosate	glycine	9

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Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Goal	oxyflurofen	diphenylether	14
Goal Tender	oxyfluorfen	diphenylether	14
Gramoxone (Inteon)	paraquat	bipyridylium	22
Halex GT	s-metolachlor + glyphosate + mesotrione	chloroacetamide + glycine + triketone	15 + 9 + 27
Harmony Extra	thifensulfuron + tribenuron	sulfonylurea + sulfonylurea	2 + 2
Harmony GT, Harmony SG	thifensulfuron	sulfonylurea	2
Harness	acetochlor	chloroacetamide	15
Harness Xtra	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Hoelon	diclofop	aryloxyphenoxy-propionate	1
Ignite, Ignite 280	glufosinate	phosphinic acid	10
Impact	topramazone	triketone	27
Intrro	alachlor	chloroacetamide	15
Karmex	diuron	urea	7
Kerb	pronamide	benzamide	3
Keystone	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Lariat	alachlor + atrazine	chloroacetamide + triazine	15 + 5
Laudis	tembotrione	benzoyl pyrazole	27
Layby Pro	diuron + linuron	urea + urea	7 + 7
Lexar	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + triazine	27+15+5
Liberty	glufosinate	phosphinic acid	10
Liberty ATZ	glufosinate + atrazine	phosphinic acid + triazine	10 + 5
Lightning	imazethapyr + imazapyr	imidazolinone + imidazolinone	2 + 2
Linex	linuron	urea	7
Lorox	linuron	urea	7
Lumax	mesotrione + s-metolachlor + atrazine	triketone + chloroacetamide + atrazine	27+15+5
Marksman	dicamba + atrazine	benzoic acid + triazine	4 + 5
Matrix	rimsulfuron	sulfonylurea	2
Medal, Medal II	s-metolachlor	chloroacetamide	15
Medal II AT	s-metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Me-Too-Lachlor	metolachlor	chloroacetamide	15
Metribuzin	metribuzin	triazinone	5
Metri DF	metribuzin	triazinone	5
Micro-Tech	alachlor	chloroacetamide	15
Moxy	bromoxynil	nitrile	6
MSMA (numerous brands)	MSMA	organoarsenical	17
OpTILL	imazethapyr + saflufenacil	imidazolinone + pyrimidinedione	2 + 14
Option	foramsulfuron	sulfonylurea	2
Osprey	mesosulfuron	sulfonylurea	2
Outlook	dimethenamid	chloroacetamide	15
OxiFlo	oxyfluorfen	diphenylether	14
Parallel, Parallel PCS	metolachlor	chloroacetamide	15
Parallel Plus	metolachlor + atrazine	chloroacetamide + atrazine	15 + 5
Parazone	paraquat	bipyridylium	22
Parrlay	metolachlor	chloroacetamide	15
Peak	prosulfuron	sulfonylurea	2
Pendant	pendimethalin	dinitroaniline	3
Pendimax	pendimethalin	dinitroaniline	3
Permit	halosulfuron	sulfonylurea	2
Poast, Poast Plus	sethoxydim	cyclohexanedione	1
PowerFlex	pyrosulam	triazolopyrimidine	2
Prefar	bensulide	phosphorodithioate	8
Prefix	s-metolachlor + fomesafen	chloroacetamide + diphenylether	15 + 14
Princep	simazine	triazine	5
Prometryn	prometryn	triazine	5
Prowl, Prowl H_2O	pendimethalin	dinitroaniline	3

TABLE 7-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Pursuit	imazethapyr	imidazolinone	2
Pyramin	pyrazon	pyridazinone	6
Python	flumetsulam	triazolopyrimidine	2
Raptor	imazamox	imidazolinone	2
Reflex	fomesafen	diphenylether	14
Resolve	rimsulfuron	sulfonylurea	2
Resolve Q	rimsulfuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Resource	flumiclorac-pentyl	n-phenylphthalimide	14
Ro-Neet	cycloate	thiocarbamate	8
Roundup (and other brands)	glyphosate	glycine	9
Rythm	fomesafen	diphenyl ether	14
Sandea	halosulfuron	sulfonylurea	2
Scepter	imazaquin	imidazolinone	2
Select, Select Max	clethodim	cyclohexanedione	1
Sencor	metribuzin	triazinone	5
Sequence	glyphosate + s-metolachlor	glycine + chloroacetamide	9 + 15
Sharpen	saflufenacil	pyrimidinedione	14
Simazine	simazine	triazine	5
Sim-Trol	simazine	triazine	5
Sinbar	terbacil	uracil	5
Sonalan	ethalfluralin	dinitroaniline	3
Sonic	sulfentrazone + cloransulam	triazolinone + triazolopyrimidine	14 + 2
Spartan	sulfentrazone	triazolinone	14
Spartan Charge	sulfentrazone + carfentrazone	triazolinone + triazolinone	14 + 14
Spin-Aid	phenmedipham	phenyl-carbamate	6
Squadron	imazaquin + pendimethalin	imidazolinone + dinitroaniline	2 + 3
Stalwart, Stalwart C	metolachlor	chloroacetamide	15
Stalwart Xtra	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Staple	pyrithiobac	pyrimidinyl(thio)benzoate	2
Status	dicamba + diflufenzopyr	benzoic acid + semicarbazone	4 + 19
Steadfast, Steadfast Q	nicosulfuron + rimsulfuron	sulfonylurea + sulfonylurea	2 + 2
Steadfast ATZ	nicosulfuron + rimsulfuron + atrazine	sulfonylurea + sulfonylurea + triazine	2 + 2 + 5
Stealth	pendimethalin	dinitroaniline	3
Sterling	dicamba	benzoic acid	4
Stinger	clopyralid	pyridine carboxylic acid	4
Storm	acifluorfen + bentazon	diphenylether + benzothiadiazinone	14 + 6
Stout	nicosulfuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Strategy	ethalfluralin + clomazone	dinitroaniline + isoxazolidinone	3 + 13
Strongarm	diclosulam	triazolopyrimidine	2
Suprend	prometryn + trifloxysulfuron	triazine + sulfonylurea	5 + 2
Sutan[+]	butylate	thiocarbamate	8
Surpass	acetochlor	chloroacetamide	15
Synchrony XP	chlorimuron + thifensulfuron	sulfonylurea + sulfonylurea	2 + 2
Targa	quizalofop	aryloxyphenoxy-propionate	1
Tillam	pebulate	thiocarbamate	8
TopNotch	acetochlor	chloroacetamide	15
Treflan	trifluralin	dinitroaniline	3
Triangle	metolachlor + atrazine	chloroacetamide + triazine	15 + 5
Trifluralin	trifluralin	dinitroaniline	3
Trigger	clethodim	cyclohexanedione	1
Trilin	trifluralin	dinitroaniline	3
Trizmet II	atrazine + metolachlor	triazine + chloroacetamide	5 + 15
Trust	trifluralin	dinitroaniline	3
Ultra Blazer	acifluorfen	diphenylether	14
Valor SX	flumioxazin	n-phenylphthalimide	14

TABLE 7-11A. HERBICIDE MODES OF ACTION

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Valor XLT	flumioxazin + chlorimuron	n-phenylphthalimide + sulfonylurea	14 + 2
Vision	dicamba	benzoic acid	4
Volley	acetochlor	chloroacetamide	15
Volley ATZ	acetochlor + atrazine	chloroacetamide + triazine	15 + 5
Volunteer	clethodim	cyclohexanedione	1
Warrant	acetachlor	chloroacetamide	15
Weedmaster	2,4-D + dicamba	phenoxy-carboxylic acid + benzoic acid	4 + 4
Yukon	halosulfuron + dicamba	sulfonylurea + benzoic acid	2 + 4
2,4-D (numerous brands)	2,4-D	phenoxy-carboxylic acid	4
2,4-DB (numerous brands)	2,4-DB	phenoxy-carboxylic acid	4

Mode of Action Code Key:

1 ACCase inhibition
2 ALS inhibition
3 Microtubule assembly inhibition
4 Synthetic auxin
5 Photosystem II inhibition, different binding behavior than groups 6 and 7
6 Photosystem II inhibition, different binding behavior than groups 5 and 7
7 Photosystem II inhibition, different binding behavior than groups 5 and 6
8 Inhibition of lipid synthesis - not ACCase inhibition
9 EPSP synthase inhibition
10 Glutamine synthase inhibition
12 Inhibition of carotenoid biosynthesis at PDS
13 Inhibition of carotenoid biosynthesis, unknown target
14 PPO inhibition
15 Inhibition of very long-chain fatty acids
17 Unknown mode of action
19 Auxin transport inhibition
22 Photosystem I electron diversion
27 Inhibition of HPPD

Herbicide Modes of Action for Hay Crops, Pastures, Lawns and Turf

TABLE 7-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Aatrex, Aatrex Nine-O, Atrazine	atrazine	triazine	5
Acclaim Extra	fenoxaprop	aryloxyphenoxy propionate	1
Aim, QuickSilver	carfentrazone	triazinone	14
Asulox	asulam	carbamate	18
Balan	benefin	dinitroaniline	3
Banvel, Vanquish	dicamba	benzoic acid	4
Barricade, ProClipse, Prodiamine, Regalkade	prodiamine	dinitroaniline	3
Basagran T/O, Lescogran	bentazon	benzothiadiazole	6
Bensumec, Betasan, Presan	bensulide	organophosphorus	8
Blade, Cimarron, Manor, MSM Turf, Patriot	metsulfuron	sulfonylurea	2
Blindside	sulfentrazone + metsulfuron	triazinone + sulfonylurea	14 + 2
Boa, Gramoxone Max	paraquat	bipyridylium	22
Buctril	bromoxynil	nitrile	6
Campaign	2,4-D + glyphosate	phenoxy-carboxylic acid + glycine	4 + 9
Celsius	thiencarbazone + iodosulfuron + dicamba	triazolinone + sulfonylurea + benzoic acid	14 + 2 + 4
Certainty, Outrider	sulfosulfuron	sulfonylurea	2
Chaparral	aminopyralid + metsulfuron	pyradinecarboxylic acid + sulfonylurea	4 + 2
Cimarron Max	metsulfuron + 2,4-D + dicamba	sulfonylurea + phenoxy-carboxylic acid + benzoic acid	2 + 4 + 4
Cimarron Plus	metsulfuron + chlorsulfuron	sulfonylurea + sulfonylurea	2 + 2
Confront, Redeem R&P	triclopyr + clopyralid	pyradinecarboxylic acid + pyradinecarboxylic acid	4 + 4
Cool Power	MCPA ester + triclopyr ester + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Corsair, Telar XP	chlorsulfuron	sulfonylurea	2
Crossbow	2,4-D + triclopyr	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4

TABLE 7-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Curtail	2,4-D + clopyralid	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Devrinol	napropamide	acetamide	15
Dimension, Dithiopyr, Dynamo	dithiopyr	pyridine	4
Direx	diruon	phenylurea	7
Dismiss	sulfentrazone	triazinone	14
Dismiss South	sulfentrazone + imazethapyr	triazinone + imidazolinone	14 + 2
Drive, Drive XLR8, Quinclorac, Quinclorac SPC	quinclorac	quinoline carboxylic acid	(27 + 4)
Echelon	sulfentrazone + prodiamine	triazinone + dinitroaniline	14 + 3
Envoy Plus, Select	clethodim	cyclohexanedione	1
Eptam	EPTC	thiocarbamate	8
Escalade, Escalade 2	2,4-D + fluroxypyr + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Finale	glufosinate	organophosphorus	10
Forefront	2,4-D + aminopyralid	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Fusilade II	fluazifop	aryloxyphenoxy propionate	1
Gallery	isoxaben	benzamide	21
Glypro, Glyphosate T&O, Razor, Razor Pro, Roundup formulations, Touchdown Pro	glyphosate	glycine	9
Goosegrass / Crabgrass Control	bensulide + oxadiazon	organophosphorus + oxadiazole	8 + 14
Grazon P+D	2,4-D + picloram	phenoxy-carboxylic acid + pyridinecarboxylic acid	4 + 4
Harrier WDG, Oryzalin 4 Pro, Surflan	oryzalin	dinitroaniline	3
Horsepower	MCPA amine + triclopyr amine + dicamba	phenoxy + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Illoxan	diclofop	aryloxyphenoxy propionate	1
Image	imazaquin	imidazolinone	2
Journey	imazapic + glyphosate	imadazolinone + glycine	2 + 9
Katana	flazasulfuron	sulfonylurea	2
Kerb	pronamide	benzamide	3
Lockup	penoxsulam	triazolopyrimidine	2
Lontrel	clopyralid	pyridinecarboxylic acid	4
MCPP-p4 Amine, Mecomec	mecoprop	phenoxyalkanoic acid	4
Milestone	aminopyralid	pyradinecarboxylic acid	4
Millennium Ultra	2,4-D + clopyralid + dicamba	phenoxycarboxylic acid + pyridinecarboxylic acid + benzoic acid	4 + 4 + 4
Millennium Ultra Plus	monosodium methylarsonate + 2,4-D + clopyralid + dicamba	organic arsenical + phenoxycarboxylic acid + pyridinecarboxylic acid + benzoic acid	17 + 4 + 4 + 4
Monument	trifloxysulfuron	sulfonylurea	2
MSMA	monosodium methylarsonate	organic arsenical	17
Octane	pyraflufen ethyl	phenylpyrazole	14
Onetime	quinclorac + mecoprop + dicamba	quinoline carboxylic acid + phenoxyalkanoic acid + benzoic acid	(27 + 4) + 4 + 4
Oxadiazon and Ronstar formulations, Starfighter L	oxadiazon	oxadiazole	14
Overdrive	diflufenzopyr + dicamba	semicarbazone + benzoic acid	19 + 4
Panoramic, Plateau	imazapic	imadazolinone	2
Pastora	nicosulfuron + metsulfuron	sulfonylurea + sulfonylurea	2 + 2
PastureGard	triclopyr + fluroxypyr	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
Pendulum, Pendulum Aquacap, Pre-M, Prowl H2O, Signature	pendimethalin	dinitroaniline	3
Pennant, Pennant Liquid	metolachlor	chloroacetamide	15
Poa Constrictor, Prograss	ethofumesate	benzofuranes	8
Poast, Poast Plus, Segment, Sethoxydim SPC	sethoxydim	cyclohexanedione	1
Power Zone	carfentrazone + MCPA + mecoprop + dicamba	triazinone + phenoxy + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Princep, Regal Wynstar, Simazine, Sim-Trol	simazine	triazine	5
Prompt	bentazon + atrazine	benzothiadiazole + triazine	6 + 5
Prosedge, Sedgehammer	halosulfuron	sulfonylurea	2
Pursuit	imazethapyr	imidazolinone	2
Q4, Q4 Plus	quinclorac + sulfentrazone + 2,4-D + dicamba	quinoline carboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	(27 + 4) + 14 + 4 + 4
QuikPRO, Razor Burn	glyphosate + diquat	glycine + bipyridilium	9 + 22
Quincept	quinclorac + 2,4-D + dicamba	quinoline carboxylic acid + phenoxy-carboxylic acid + benzoic acid	(27 + 4) + 4 + 4
Rage D-Tech	2,4-D + carfentrazone	phenoxy-carboxylic acid + triazolinone	4 + 14
Regalstar	oxadiazon + benefin	oxadiazole + dinitroaniline	14 + 3
Regalstar II	oxadiazon + prodiamine	oxadiazole + dinitroaniline	14 + 3
Remedy, Remedy Ultra, Turflon Ester Ultra	triclopyr	pyradinecarboxylic acid	4
Revolver	foramsulfuron	sulfonylurea	2
Reward LS	diquat	bipyridilium	22

TABLE 7-11B. HERBICIDE MODES OF ACTION FOR HAY CROPS, PASTURES, LAWNS AND TURF

Brand Names	Active Ingredient(s)	Chemical Family	Mode of Action[1]
Rubigan	fenarimol	substituted pyrimidine	-
Segment, Sethoxydim SPC	sethoxydim	cyclohexanedione	4
Sencor	metribuzin	triazinone	5
Sinbar	terbacil	uracil	5
Solitare	sulfentrazone + quinclorac	triazinone + quinoline carboxylic acid	14 + (27 + 4)
Specticle	indaziflam	benzamide	21
Speed Zone, Speed Zone Southern	carfentrazone + 2,4-D + mecoprop + dicamba	triazinone + phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Spike	tebuthiuron	thiadiazolyurea	7
Spoiler, Triamine	2, 4-D + mecoprop + dichlorprop	Phenoxycarboxylic acid + phenoxyalkanoic acid + chlorinated phenoxy	4 + 4 + 4
Spotlight	fluroxypyr	pyridinyloxyacetic acid	4
SquareOne	carfentrazone + quinclorac	triazinone + quinoline carboxylic acid	14 + (27 + 4)
Surge	sulfentrazone + 2,4-D + mecoprop + dicamba	triazinone + phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	14 + 4 + 4 + 4
Surmount	picloram + fluroxypyr	pyradinecarboxylic acid + pyradinyloxyacetic acid	4 + 4
Team, Team Pro	benefin + trifluralin	dinitroaniline + dinitroaniline	3 + 3
Tenacity	mesotrione	benzoylcyclohexanedione	27
Tower	dimethenamid	chloroacetamide	15
TranXit GTA	rimsulfuron	sulfonylurea	2
Treflan	trifluralin	dinitroaniline	3
Tri-Power	MCPA + mecoprop + dicamba	mcpa + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
Trimec, Triplet, Three-Way	2,4-D + mecoprop + dicamba	phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	4 + 4 + 4
Trimec Plus	monosodium methylarsonate + 2,4-D + mecoprop+ dicamba	organic arsenical + phenoxycarboxylic acid + phenoxyalkanoic acid + benzoic acid	17 + 4 + 4 + 4
Tupersan	siduron	phenylurea	7
Tzone	triclopyr + sulfentrazone + 2,4-D + dicamba	pyridinecarboxylic acid + triazinone + phenoxy-carboxylic acid + benzoic acid	4 + 14 + 4 + 4
Velocity	bispyribac-sodium	pyrimidinyloxybenzoic acid	2
Weedmaster	2,4-D + dicamba	phenoxy-carboxylic acid + benzoic acid	4 + 4
2,4-DB	2,4-DB	phenoxy-carboxylic acid	4
2,4-D amine	2,4-D	phenoxy-carboxylic acid	4

Chemical Weed Control in Clary Sage

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TABLE 7-12. CHEMICAL WEED CONTROL IN CLARY SAGE

Herbicide, Mode of Action Code[1], and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PREPLANT AND PREEMERGENCE, Annual and perennial grass and broadleaf weeds. Stale bed applicaiton.			
glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup Weather Max) 5.5 L	 1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulation formulated with nonionic surfactant may result in reduced weed control.
POSTEMERGENCE, Cutleaf eveningprimrose and certain other broadleaf weeds			
linuron, MOA 7 (Linex) 4L	1 to 1.5 pt	0.5 to 0.75	Crop must be a minimum of 4 inches in diameter for application. Do not use on clary sage grown for food or feed purposes. Do not use on sands or loamy sands or on soils with less than 1% organic matter. Temporary yellowing or stunting of crop may occur.
POSTEMERGENCE, Henbit and other winter annual broadleaf weeds			
oxyfluorfen, MOA 14 (Goal 2XL) 2EC (Galigan) 2E GoalTender) 4E Galigan H_2O) 4EC	 0.5 to 1 pt 0.5 to 1 pt 0.25 to 0.5 pt 0.25 to 0.5 pt	0.12 to 0. 25	Apply to 2-4 leaf henbit. Additional applications may be needed for subsequent henbit emergence. Do not apply more than 6 pt of Goal 2XL or Galigan per acre per year. Do not apply more than 3 pt of GaolTender or Galigan H_2O per acre per year. Clary sage may exhibit phytotoxicity on leaf margins after application, but recovery should occur quickly.
POSTEMERGENCE, Emerged weeds			
paraquat, MOA 22 (Gramoxone Inteon) 2SL	2 to 3 pt	0.5 to 0.75	Apply to dormant crop before spring growth begins. Apply to weeds less than 6 inches tall. Do not apply more than twice per season and no more than 3 pt/a/season. Do not use on clary sage grown for food or feed.
POSTEMERGENCE, Emerged weeds and perennial grasses			
clethodim, MOA 1 (Arrow, Clethodim) 2EC	6 to 8 oz	0.09 to 0.125	Arrow and Clethodim require addition of crop oil concentrate to spray mixture. See label for precautions regarding crop oil concentrates. Do not apply Arrow within 14 days of harvest.
(Select Max) 1EC	9 to 32 oz	0.07 to 0.25	Select Max allows the use of a nonionic surfactant, methylated seed oil, or crop oil concentrate in the mixture. Label suggests different rate ranges for annual and perennial grasses. See label for details. Do not apply within 14 days of harvest.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Small Fruit Crops

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See TABLE 7-11, Herbicide Resistance Management, for details.

TABLE 7-13A. CHEMICAL WEED CONTROL IN SMALL FRUIT CROPS

Timing/Targeted Weeds	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BLUEBERRIES				
PREPLANT Annual and perennial weeds	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup WeatherMax) 5.5 L	 1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	Apply to emerged weeds at least 30 days before crop transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. See label for further instruction.
PREEMERGENCE Annual weeds and some perennial weeds	hexazinone, MOA 5 (Velpar) 2 SL (Velpar) 80 WDG	 0.5 to 1 gal 1.3 to 2.6 lb	1 to 2	Apply as a directed spray to soil and weeds before blueberry leaf emergence but at least 90 days before harvest. Use lower rates on poorly drained or sandy soils. DO NOT USE ON FIRST YEAR PLANTINGS.
	dichlobenil, MOA 20 (Casoron) 4 G (Casoron CS) 1.4 L	 100 lb 1.4 to 2.8 gal	 4 2 to 3.92	Apply in the early winter, no later than mid-February, to plants that have been established 1 year or longer. Casoron 4G may be used in blueberry planted at least 4 weeks earlier. Apply 100 lb only to blackberries and raspberries. Rate may increase to 150 lb per acre for blueberries. Casoron should be used in established blackberry and raspberry plantings only. DO NOT apply when primocanes are emerging.
PREEMERGENCE Annual broadleaf weeds and some annual grasses	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.375	Do not apply to blueberries established less than 2 years unless they are protected from spray contact by nonporous wrap, grow tubes, or waxed containers. Do not apply after budbreak through final harvest. Do not apply more than 12 oz per acre during a 12-month period. Do not make a sequential application within 30 days of the first application. Do not apply more than 6 oz per application to bushes less than 3 years old on soils having a sand plus gravel content greater than 80%. Apply at the base of the bush. Chateau should be tank-mixed with a registered burndown herbicide to control emerged weeds. Residual weed control will be reduced if vegetation prevents Chateau from reaching soil surface.
PREEMERGENCE Annual broadleaf weeds and some annual grasses	diuron, MOA 7 (Karmex) 80 DF (Karmex XP) 80 DF (Direx) 4 L	 1.5 to 2 lb 1.5 to 2 lb 1.2 to 1.6 qt	1.2 to 1.6	Use only in fields that have been established for at least 1 year. Apply as a band treatment at the base of bushes. The addition of a surfactant will kill many small emerged weeds.
	simazine, MOA 5 (Princep) 90 WDG (Princep) 4 L	 2.2 to 4.4 lb 2 to 4 qt	2 to 4	Apply half the maximum annual application in the spring before buds break and weeds emerge, and half after harvest. Do not apply more than 1 lb a.i. simazine on newly planted blueberries.
	Pronamide, MOA 3 (Kerb) 50 W	2 to 4 lb	1 to 2	Apply as a directed spray in established blueberries only for early postemergence control of
PREEMERGENCE Most annual broadleaf and grass weeds plus many perennials	Terbacil, MOA 5 (Sinbar) 80 WP	0.5 to 2 lb	0.4 to 1.6	Apply as directed spray in early fall or in spring prior to fruit set. Use in spring or after harvest either before weeds emerge or shortly after weeds emerge. Use only in plantings established 1 year or longer. Do not use on sandy soils with less than 3% organic matter. This herbicide can be very active but injurious on blueberries. See label for further information.
PREEMERGENCE Annual broadleaf weeds	mesotrione, MOA 27 (Callisto) 4L	3 to 6 oz	0.094 to 0.185	May be applied as split applications of 3 oz per acre followed by 3 oz per acre. If two applications are made, do not apply less than 14 days apart. Do not apply more than 6 oz per acre per year. Do not apply after the onset of bloom stage or illegal residues may occur.
PREEMERGENCE Annual grasses and small seeded broadleaf weeds	napropamide, MOA 15 (Devrinol) 50 DF (Devrinol) 10 G	 8 lb 40 lb	4	Apply to weed-free soil surface. Enough irrigation or rainfall to wet the soil to a depth of 4 in. is necessary within 24 hours of application. Apply as a directed spray to the base of the blueberry plant. May be used on first-year plantings. NOTE: Use only half this rate the first year if root pieces are planted.
	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Apply as a directed spray from fall to early spring when the crop is dormant and before weeds emerge. Also controls some seedling perennials. Make only one application per year. Blueberries must be established 6 months prior to Solicam use. Application of Solicam may result in temporary bleaching or chlorosis of the leaves. Preharvest interval is 60 days.
	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS	2 to 4 qt	2 to 4	This treatment may be used on first year plants.
POSTEMERGENCE NON-SELECTIVE Most annual broadleaves and grasses and a few perennials	glufosinate, MOA 10 (Rely) 1 SL (Rely 200) 1.67 SL	 3 to 5 qt 1.8 to 3 qt	 0.75 to 1.5 0.75 to 1.25	Apply as a directed application. Do not allow spray to contact or drift to desirable vegetation. Avoid contact with green or uncallused bark on young bushes or crop injury may occur. Do not apply within 14 days of harvest. See label for more information.
Most annual broadleaves and grasses and a few perennials	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL (Roundup WeatherMax) 5.5 L	 1 to 3 pt 0.8 to 2.4 pt 11 to 32 oz	0.5 to 1.5	DO NOT SPRAY GREEN CANES, BARK, OR FOLIAGE. Apply as a directed shielded spray to base of established plants. Do not apply within 14 days of harvest. Wiper applications may also be used. Perennial weeds may require higher rates of glyphosate. Certain glyphosate formulations require the addition of a surfactant. See label for specific rates for herbicide and surfactant.
POSTEMERGENCE NON-SELECTIVE Contact kill of all green foliage	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.56 to 1	Apply as a directed spray in a minimum of 50 gal per acre spray mix to weeds before new canes emerge. Avoid paraquat contact with new canes, as injury will occur. Direct spray with low pressure to produce a coarse spray. Add a nonionic surfactant at a rate of 16 to 32 oz per 100 gal of spray mix, or 1 gal approved crop oil concentrate per 100 gal spray mix. Use of paraquat in rabbiteye blueberry can increase incidence of stem blight if herbicide contacts green stems. Rabbiteye producers should consider using other non-selective herbicides.

TABLE 7-13A. CHEMICAL WEED CONTROL IN SMALL FRUIT CROPS

Timing/Targeted Weeds	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BLUEBERRIES (continued)				
POSTEMERGENCE Broadleaf weeds	carfentrazone-ethyl, MOA 14 Aim 2EC	1 to 2 oz	0.015 to 0.031	Apply as a hooded spray with application equipment designed to prevent spray deposit on green stems, leaf tissue, flowers, or fruit. Use in established fields only; do not use on newly set plants. May be used alone or tank-mixed with other herbicides. Add crop oil concentrate at 1% by volume (1 gal/100 gal of spray solution) or a nonionic surfactant at 0.25% by volume (1 qt/100 gal of spray solution).
POSTEMERGENCE Yellow nutsedge and some broadleaf weeds	bentazon, MOA 6 (Basagran) 4SL	1.5 to 2 pt	0.75 to 1	NONBEARING ONLY. For yellow nutsedge control, two applications may be needed. Apply when plants are 6 to 8 in. tall. If needed, make a second application at the same rate 7 to 10 days later. Add oil concentrate to the spray soultion at a rate of 2 pt in 20 to 50 gal of water per acre.
POSTEMERGENCE Annual and perennial grasses	clethodim, MOA 1 (Select) 2 EC (Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.09 to 0.125 0.07 to 0.125	USE ON NONBEARING CROP ONLY. Postemergence grass control. Very effective in controlling bluegrass. Add 1% crop oil concentrate to all sprays. Do not apply within 1 year of harvest. See label for all other instructions.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	USE ON NONBEARING CROP ONLY. Postemergence grass control. Check label for specific rates and timings. Do not apply within 1 year of the first harvest. Use of a crop oil or surfactant will be necessary. Sequential applications are necessary for adequate control of perennial grasses.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	Check label for specific rates and timings. Use a crop oil at a rate of 1 qt per acre. May be used on bearing blueberries but not within 30days of harvest.
GRAPES				
PREEMERGENCE Directed Underneath Vines, Annuals and many perennials	dichlobenil, MOA 20 (Casoron) 4 G (Casoron CS) 1.4 CS	 100 to 150 lb 1.4 to 2.8 gal	 4 to 6 2 to 4	Do not apply Casoron 4G within 4 weeks of transplanting. Apply in January and February. High rate is necessary for perennial weed control. Casoron CS may only be used in vineyards established at least 1 year.
PREEMERGENCE Directed Underneath Vines, Annual broadleaf and grass weeds	simazine, MOA 5 (Princep Simazine) 90 WDG (Princep Simazine) 4 L	 2.2 to 4.4 lb 2 to 4 qt	 2 to 4	Apply before germination of annual weeds. Do not apply in vineyards less than 3 years old. Tank mix with glyphosate, paraquat, or Rely for POST weed control. Tank mixing simazine with oryzalin or Prowl H2O will improve residual control of annual grasses and certain broadleaf weeds.
PREEMERGENCE Directed Underneath Vines, Annual grasses and some broadleaf weeds	diuron, MOA 7 (Diuron, Karmex DS, Karmex XP)	2 to 3 lb	1.6 to 2.4	Apply before germination of annual weeds. Vineyards must be at least 3 years old. Higher rate may be used on soils with greater than 2% organic matter and high clay content. Do not use on sandy loam or coarser soils. Tank mix with glyphosate, paraquat, or Rely for POST weed control. Applications in vineyards having less than 2% organic matter may cause injury if heavy rainfall occurs soon after application. This risk is assumed by user.
PREEMERGENCE Directed Underneath Vines, Annual grasses and small-seeded broadleaf weeds	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.375	Apply as a directed spray using hooded or shielded application equipment. The trunks of grape vines established less than 2 years must be shielded from contact with spray solution using grow tubes. Bearing table grapes cannot be treated with Chateau after bud break until final harvest is completed due to risk of fruit speckling resulting from drift. DO NOT tank mix with glyphosate when applying Chateau after bud break in non-bearing grapes or winegrapes due increased risk of injury resulting from inversions. Do not apply more than 6 oz per acre per application to vines less than 3 years old on soils having a sand plus gravel content greater than 80%. DO NOT apply sequential applications closer than 30 days apart. Chateau has a 60 day PHI.
	oryzalin, MOA 3 (Oryzalin, Surflan) 4 AS	2 to 4 qt	2 to 4	Apply once soil has settled after transplanting. Multiple applications per year are permitted; see label for details. Apply in combination with Gallery in newly planted vineyards for improved control of broadleaf weeds. Sequential applications may be used so long as total use rate does not exceed 12 qt per acre per year. Allow 2.5 months between applications
	pendimethalin, MOA (Prowl) H_2O 4E	2 to 6.3 qt	2 to 6	Use on nonbearing grapes only. Allow soil to settle around vines before application. Apply only to dormant, newly planted, and 1-year-old vines. Do not apply after buds have started to swell. Do not apply over the top of vines. In bearing vineyards, Prowl may be applied anytime after harvest, through winter, and in the spring. Use rate cannot exceed 6.3 qt/A per year. Prowl H_2O has a 90-day PHI. For newly planted and 1-year-old vines, apply during dormant period prior to bud swell. Bearing vines may receive a directed application anytime after fall harvest, during winter dormancy, and in the spring. Prowl has a 90-day PHI. Tank mix with simazine or rimsulfuron for expanded residual control. Tank mix with paraquat, glyphosate, or Rely for POST control.
	norflurazon, MOA 12 (Solicam) 80 WDG	1.25 to 5 lb	1 to 4	Vines must be established at least 2 years in the field before application. DO NOT use on nursery stock. Loss of pigment in leaf veins will occur in coarse-textured soils when applied within 3 months after budbreak. Rate is soil-texture dependent. 60-day PHI.
PREEMERGENCE Directed Underneath Vines, Annual grasses and broadleaf weeds	oryzalin, MOA 3 (Oryzalin, Surflan) 4 AS + simazine, MOA 5 (Princep) 90 WDG (Princep) 4 L	2 to 4 qt + 2.2 to 4.4 lb 2 to 4 qt	2 to 4 + 2 to 4	Tank mix for use before weed emergence. See comments for oryzalin and simazine.
PREEMERGENCE Directed Underneath Vines, Broadleaf weeds and some annual grasses	rimsulfuron, MOA 2 (Matrix FNV) 25 WG (Pruvin) 25 WG (Solida) 25 WG	4 oz	0.063	Matrix FNV has POST and PRE activity on broadleaf and some grass weeds. For broad spectrum residual control, tank mix Matrix FNV with oryzalin, Prowl H_2O, or diuron. For nonselective POST weed control, tank mix Matrix with glyphosate, paraquat, or Rely. Do not treat vineyard established less than 1 year. Rainfall for herbicide activation is necessary within 2 to 3 weeks of application. Do not apply within 14 days of harvest. The pH of spray solution should be in the range of 4 to 8. Matrix FNV may be applied as a sequential application so long as total use rate does not exceed 4 oz/A per year and application is made in band to less than 50% of vineyard floor.

TABLE 7-13A. CHEMICAL WEED CONTROL IN SMALL FRUIT CROPS

Timing/Targeted Weeds	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
GRAPES (continued)				
PREEMERGENCE Directed Underneath Vines, Contact kill of all green foliage	paraquat, MOA 22 (Firestorm) 3 SL (Paraquat Concentrate) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.7 to 2.7 pt 2.5 to 4 pt	0.66 to 1	Apply in 20 gal per acre spray mix when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark less than 1 year old. Add a nonionic surfactant at a rate of 16 to 32 oz per 100 gal of spray solution. May be used for sucker suppression. See label for details.
PREEMERGENCE Directed Underneath Vines, Most annual broadleaf and grass weeds plus most perennials	glyphosate, MOA 9 various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Apply preplant or as a directed spray to base of established vines. Do not treat within 14 days of harvest. Wiper applications may also be used. Perennial weeds may require higher rates of glyphosate. See label for specific rates. Do not apply in late summer or fall. Some formulations my require the addition of a surfactant.
	glyphosate + carfentrazone, MOA 9 and 14 (Rage)	20 to 40 oz	0.78 to 1.58	Apply with hooded sprayer. PHI 14 days. Rage should be applied using hooded application equipment so that spray will not contact green stems, leaves, fruit, or any other desirable vegetation. Young vines should be shielded with the use of grow tubes. Apply in combination with non-ionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v. The addition of ammonium sulfate at 2 to 4 lb per acre will enhance herbicide activity.
PREEMERGENCE Directed Underneath Vines, Most annual weeds and a few perennials	glufosinate, MOA 10 (Rely 280) 2.34 SL	48 to 82 oz	0.88 to 1.5	Apply as a directed spray to emerged weeds in a minimum of 20 gal water per acre with a minimum of 30 psi spray pressure when weeds are 1 to 6 in. high. For spot application, use 1.7 oz per gal of water and spray to wet but not runoff; however, spot spray solution should not contact vines or injury can occur. Do not allow spray to contact desirable foliage or green bark. Do not apply within 14 days of harvest. See label for specific rates. Rely can also be used for sucker control—see supplemental label for directions. Do not make more than 3 applications per year. The addition of ammonium sulfate will enhance Rely 280 activity on difficult to control weeds. The use of additional surfactants or crop oil is not needed and/or may increase potential for crop injury.
POSTEMERGENCE, Directed Underneath Vines, Annual broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 1.6 oz	0.008 to 0.025	Apply as a directed spray or as a hooded spray. DO NOT allow spray solution to contact green tissue, leaves, flowers, or fruit. Aim may be used alone or tank mixed with other herbicides; see label for tank mixing instructions. Aim controls cocklebur, pigweed, nightshade, velvetleaf, carpetweed, and spreading dayflower. Do not apply within 3 days of harvest. Apply in minimum spray volume of 20 GPA. Apply in combination with crop oil concentrate at 1% v/v (1 gal/100 gal of spray solution) or a nonionic surfactant at 0.25% v/v (1 qt/100 gal of spray solution). Do not use on newly transplanted vines.
POSTEMERGENCE, Directed Underneath Vines, Annual and perennial grasses	clethodim, MOA 1 (Arrow, Select, and others) 2 EC (Select Max and others) 1 EC	6 to 8 oz 9 to 16 oz	0.07 to 0.125	USE ON NONBEARING CROP ONLY. Postemergence grass control. Very effective in controlling bluegrass. Do not apply within 1 year of harvest. See label for all other instructions. Sequential applications necessary for adequate control of perennial grass weeds. Always apply 80% active ingredient nonionic surfactant at a rate of 0.25% volume per volume (1 pt/50 gal of spray).
	fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	USE ON NONBEARING CROP ONLY. Postemergence grass control. Check label for rates and timings for specific weeds. Do not apply within 1 year of the first harvest. Use of a crop oil or surfactant will be necessary. Sequential applications necessary for adequate control of perennial grass weeds.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	Postemergence grass control. Check label for rates and timings for specific grasses. Use a crop oil at a rate of 1 qt per acre. Do not apply within 50 days of the first harvest. Sequential applications necessary for adequate control of perennial grass weeds.
STRAWBERRIES (matted row)				
Most annual and perennials	methyl bromide	various	240	Inject in the soil 4 to 6 in. deep and cover with tarp immediately. Soil moisture should be near field capacity and soil temperature should be at least 50°F at treatment depth. Allow at least 2 weeks after treatment before transplanting. If tarp is removed, disking before planting will facilitate aeration.
Most annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 12 lb 8 to 12 pt	6 to 9	Apply over the top of newly planted transplants or in fall or early spring for preemergence weed control. Do not apply after first bloom through harvest.
	napropamide, MOA 15 (Devrinol) 50 WDG (Devrinol) 10 G (Devrinol) 2 EC	4 to 8 lb 40 lb 8 qt	2 to 4	Apply to established plants before weed emergence anytime, except the interval between bloom and harvest. Irrigation or mechanical incorporation is essential within 1 week after application.
Most annual broadleaf weeds and grass weeds	terbacil, MOA 5 (Sinbar) 80 WP	2 to 6 oz	0.1 to 0.3	For preemergence control of most weeds. For planting year: apply 2 to 3 oz of Sinbar per acre after transplanting but before new runner plants start to root. If strawberry transplants are allowed to develop new foliage prior to Sinbar application, apply 0.5 to 1 in. irrigation or rainfall immediately after application. For control of winter weeds: apply 2 to 6 oz Sinbar per acre in late summer or early fall. If crop is not dormant, the application must be followed immediately by 0.5 to 1 in. irrigation or rainfall. To extend weed control through harvest of the following year, apply 2 to 4 oz Sinbar per acre just prior to mulching in the late fall. For harvest years: after postharvest renovation and before new growth beings in midsummer, apply 4 to 6 oz of Sinbar per acre. To extend weed control through harvest of the following year, apply 4 to 6 oz of Sinbar per acre just prior to mulching in late fall. Do not apply within 110 days of harvest. See label for more information.
Broadleaf weeds including clover, dock, sowthistle, thistle, and vetch	clopyralid, MOA 4 (Stinger) 3 EC	Spring: 0.67 pt Post harvest 0.33 to 0.67 pt	0.125 to 0.25	Apply postemergence in spring or postharvest to control emerged broadleaf weeds in established strawberries. Do not use surfactant or use with other pesticides. Do not apply within 30 days of harvest.

TABLE 7-13A. CHEMICAL WEED CONTROL IN SMALL FRUIT CROPS

Timing/Targeted Weeds	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
STRAWBERRIES (matted row – continued)				
Annual broadleaf weeds	2,4-D amine, 4 (Amine 4 2,4-D Weed Killer) 4 SL	2 to 3 pt	1 to 1.5	Apply to well-established strawberries after harvest and before runners form or when crop is dormant for postemergence control of weeds. Not more than two treatments per year. Do not apply during bud, flower, or fruit stage. Timing is very critical to avoid damage. Do not apply unless possible injury to crop is acceptable.
	acifluorfen, MOA 14 (UltraBlazer) 2 L	0.5 to 1.5 pt	0.125 to 0.375	**Crop row**. Apply after last harvest or following bed renovation. Another application can be made in late fall or early spring when plants are dormant. Do not apply the last application within 120 days before harvest. **Row middle.** May be applied up to 1.5 pints/A.
	flumioxazin, MOA 14 (Chateau) 51 WDG	3 oz	0.09	Apply to dormant strawberries for the preemergence control of weeds. Crop oil concentrate at 1% v/v or nonionic surfactant at 0.25% v/v may be added to help control emerged broadleaf weeds. **Row middle.** Do NOT apply over strawberries. Apply prior to weed emergence. Crop spotting may occur if an adjuvant is used. DO NOT APPLY AFTER FRUIT SET.
Contact kill of all green foliage	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 L	 1.3 pt 2 pt	0.5 to 1	For control of emerged broadleaf and grass weeds, use shields and direct spray between the rows to prevent contact with strawberry foliage. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. Do not apply within 21 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of emerged grasses in strawberries. With Arrow and Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 0.25% nonionic surfactant, 1 qt per 100 gal spray mix. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 4 days of harvest.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	16 to 24 oz	0.25 to 0.38	USE ON NONBEARING CROP ONLY. Postemergence grass control. Check label for rates and timings for specific weeds. Do not apply within 1 year of the first harvest. Use of a crop oil or surfactant will be necessary.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Do not apply on days that are unusually hot and humid. Do not apply within 7 days of harvest.
STRAWBERRIES (plastic culture)				
Most annual and perennial weeds	methyl bromide (various brands)	See label	See label	Inject into the soil 4 to 6 in deep and cover with black plastic immediately. Soil moisture should be near field capacity and soil temperature should be at least 50°F at the treatment depth. Allow 2 weeks after application before transplanting.
Broadleaf weeds	acifluorfen, MOA 14 (Ultra Blazer) 2 L	0.5 to 1.5 pt	0.125 to 0.375	**Crop row.** Make one banded application before laying plastic mulch and after final land preparation, and prior to transplanting the crop. For best results, avoid soil disturbance during laying of plastic and planting of crop. **Row middles between plastic mulch rows.** Apply as a direct-shielded application to strawberry row middles between mulched beds. DO NOT ALLOW ULTRA BLAZER TO CONTACT STRAWBERRY PLANTS. Limited research has been conducted with Ultra Blazer in North Carolina
Annual grasses and broadleaf weeds	napropamide, MOA 15 (Devrinol) 2 EC (Devrinol) 50 DF	 8 qt 8 lb	4	Devrinol applied to bed before laying the plastic has potential to injury strawberry plants. For plantbed treatment, preplant incorporate to weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 in. incorporated within 24 hours of application before laying of plastic mulch. If weed pressure is from small-seeded annuals, apply Devrinol to the suface of the bed immediately in front of the laying of the plasic mulch. If soil is dry, water or sprinkler irrigate with sufficent water to wet to a depth of 2 to 4 in. before covering with plastic mulch. Lay the plastic mulch over the treated soil on the same day as the Devrinol application.
Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose, and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2 XL	Up to 2 pt	Up to 0.5	Apply to the soil surface of pre-formed beds at least 30 days prior to transplanting crop for control of many broadleaf weeds that will emerge from hole near crop. While incorporation is not necessary, it may result in less crop injury. Soil disturbance after application will reduce weed control. Plastic mulch can be applied any time after applying Goal, but best results are likely if it is applied soon after Goal.
Annual broadleaf weeds including cutleaf evening primrose and some annual grasses	flumioxazin, MOA 14 (Chateau) 51 WDG	3 oz	0.096	**Crop row.** Apply a minimum of 30 days prior to transplanting and prior to plastic mulch being laid. Apply as part of a tank mix to control emerged weeds. Limited research has been conducted in North Carolina. **Row middles between plastic mulch rows.** Apply only to row middles. DO NOT APPLY over strawberries. Apply prior to weed emergence and prior to fruit set. Crop spotting may occur if an adjuvant is added. Application after fruit set may result in spotting of fruit and should be avoided. Do not allow spray drift to come in contact with fruit or foliage.
Annual grasses and small-seeded broadleaf weeds	napropamide, MOA 15 (Devrinol) 50 DF (Devrinol) 2EC	 8 lb 8 qt	4	Apply as a banded preemergence treatment to the middles between plastic before weed emergence. Tank mixture with paraquat will provide pre- and postemergence weed control. Rainfall or irrigation within 24 hr after Devrinol application is needed for optimum control. Effective on volunteer small grains (wheat, etc.) if applied before emergence.
Annual broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides. Preharvest interval is 0 days.

TABLE 7-13A. CHEMICAL WEED CONTROL IN SMALL FRUIT CROPS

Timing/Targeted Weeds	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
STRAWBERRIES (plastic culture – continued)				
Contact kill of green foliage	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 pt 2 pt	0.5	Apply as a banded treatment using shields to the middles between plastic to kill emerged weeds. To avoid injury, do not allow spray to contact strawberry plants. Add a nonionic surfactant at a rate of 16 to 32 oz per 100 gal or 1 gal approved crop oil concentrate per 100 gal spray solution. Do not apply within 21 days of harvest.
Most emerged weeds	glyphosate, MOA 9 (Roundup WeatherMax) 5.5L	11 to 22 oz	0.5 to 0.94	Apply as a hooded spray in row middles or shielded spray in row middles or wiper applications in row middles or post harvest. To prevent severe injury to crop, do not let herbicide contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 2.5 pt	0.2 to 0.5	Apply as a postemergence application to kill emerged grasses. Most effective on actively growing grasses. See label for specific rates and best times to treat. Add 1 qt per acre of crop oil concentrate to spray solution. Very effective control of ryegrass but will not control sedges. Also, effective on volunteer small grains (wheat, etc.). Do not apply within 7 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply as a postemergence application to kill emerged grasses. With Arrow, Clethodim, Intensity, and Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Intensity One and Select Max, add 0.25% nonionic surfactant, 1 qt per 100 gal spray mix. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 4 days of harvest.
Broadleaf weeds including clover, dock, sowthistle, thistle, and vetch	clopyralid, MOA 4 (Stinger) 3 EC	0.33 to 0.5 pt 0.33 to 0.67 pt	0.125 to 0.187 0.125 to 0.25	**Crop row.** Apply postemergence over crop for postemergence control. Do not use with other pesticides or surfactants. Do not apply within 30 days of harvest. **Row middles between plastic mulch rows.** Apply postemergence to row middles for postemergence control. Do not apply within 30 days of harvest.

* Mode of action (MOA) code developed by the Weed Science Society of America. See section with TABLE 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Tree Fruit Crops

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NOTE: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See TABLE 7-11, Herbicide Resistance Management, for details.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
APPLES, Preemergence Directed Underneath Tree				
Annual and perennial grass and broadleaf weeds	dichlobenil, MOA 20 (Casoron) 4 G (Casoron) 1.4 CS	100 to 150 lb 1.4 to 2.8 gal	4 to 6 2 to 3.92	For best results apply in January or February. Casoron CS may be tank mixed with glyphosate or other herbicides registered for use in apples. Casoron 4G can be used in newly planted orchards once trees have been planted for 4 weeks. Casoron CS should only be used in established orchards 1 year after transplanting.
Annual grasses and broadleaf weeds	diuron, MOA 7 (Diuron, Karmex DF or XP) 80 WDG (Direx, Diuron) 4L	2 to 4 lb 1.6 to 3.2 qt	1.6 to 3.2	Apply in spring (March thru May) to trees established in the orchard for at least 1 year. Best results occur if rainfall occurs within 2 weeks of application. DO NOT treat varieties grafted on full-dwarf rootstocks. When using sequential applications allow at least 90 days between applications and total use rate cannot exceed 4 lb/A per year.
Annual grasses and broadleaf weeds	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.38	Chateau is for newly planted and established orchards. Shield trees established less than 1 year from contact with spray solution. Tank mix with glyphosate, Rely, or paraquat for POST weed control. After budbreak, only tank mix with Rely or paraquat. Do not apply more than 6 oz per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective. Do not apply within 60 days of harvest. Chateau may only be applied after final harvest and no later than pink flower bud in bearing orchards. Do not used more than 24 oz of Chateau in a 12-month period.
	indaziflam, MOA 29 (Alion) 1.67 SC	5 to 6.5 oz	0.065 to 0.085	Use in orchards established 3years or more. Allow at least 30 days between applications. Do not use in orchards with open channels or cracks in soil. Do not apply more than 10.3 oz/A per year. Alion has a 14-day PHI. Tank mix glyphosate, Rely, or paraquat for nonselective POST weed control.
Annual grasses and some broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Can be tank mixed with Karmex, Goal, paraquat, Prowl, glyphosate, Princep, and Surflan. Do not apply to newly transplanted trees until ground has settled. Rate is soil texture dependent. See label for details. PHI is 60 days. Multiple applications can be made per season so long as cumulative rate does not exceed maximum use rate for soil texture and crop.
	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS	2 to 6 qt	2 to 6	Allow soil to settle around newly transplanted trees before application. Orzalin may be tank mixed with Goal, paraquat, glyphosate, Solicam, and simazine. May be applied sequentially. See label for details. Sequential applications may be used so long as total use rate does not exceed 12 qt per acre per year.
	pendimethalin, MOA 3 (Prowl H_2O) 4 AS	2 to 4.2 qt	2 to 4	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled. Tank mix with paraquat for POST weed control. 60-day preharvest interval (PHI). May be applied as a sequential application as long as rate does not exceed 4.2 qt/A per year. Allow 30 days between applications.
Broadleaf weeds and some annual grasses	rimsulfuron, MOA 2 (Matrix) 25 WG (Solida) 25 WG (Pruvin) 25 WG	4 oz	0.063	For broad spectrum residual control, tank mix with diuron, Sinbar, oryzalin or Prowl H_2O. For nonselective POST control, apply in combination with glyphosate or paraquat. Do NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH of less than 4.0 or greater than 8.0 will result in herbicide degradation. Rimsulfuron has a 7-day PHI for apples. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 oz/A per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
Annual broadleaf and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt 2.2 to 4.4 lb	2 to 4	Apply preemergence to trees that have been established 1 year or more. Apply with glyphosate, paraquat, or Rely for postemergence weed control. PHI for Princep is 150 days. Tank mixing simazine with oryzalin, Solicam, or Prowl H_2O will expand residual control of annual grasses and certain broadleaf weeds.
Most annual broadleaf and grass weeds plus many perennial grasses	terbacil, MOA 5 (Sinbar) 80 WP or 80 WDG	2 to 4 lb	1.6 to 3.2	Use only on trees that have been established 3 years or more. Rate varies with soil organic matter. See label for details. Apply no more than 3 lb unless soil organic matter is greater than 2%. Do not use on sand or loamy sand soils. Do not use on soils having less than 1% organic matter. Sinbar has a 60-day PHI.
Most annual broadleaf weeds and grass weeds in NEWLY PLANTED ORCHARDS	terbacil, MOA 5 (Sinbar) 80 WP or 80 WDG	0.5 to 1.0 lb	0.4 to 0.8	Apply once soil has settled after transplanting. Apply no more than 1 lb per acre per year. For best results, apply 0.5 lb in spring followed by another 0.5 lb when control from initial application fails. Do not use on soils coarser than sandy loams of soils with less than 1% organic matter.
APPLES, Preemergence Tank Mixes				
Many annuals and perennial grass and broadleaf weeds	diuron, MOA 7 (Diuron or Karmex DF or XP) 80 WDG (Direx) 4 L + terbacil, MOA 5 (Sinbar) 80 WP	 1 to 2 lb 1.6 to 3.2 qt + 1 to 2 lb	 0.8 to 1.6 0.5 to 1 + 0.8 to 1.6	DO NOT treat varieties grafted on full-dwarf rootstocks. Use only on trees established in orchard for 2 years. See labels for details.
Annual grasses and broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details. Apply in combination with paraquat, glyphosate, or Rely for postemergence control.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
APPLES, Preemergence Tank Mixes (continued)				
Annual grasses and broadleaf weeds (continued)	oryzalin, MOA 3 (Oryzalin, Surflan) 4 AS + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details. Apply in combination with paraquat, glyphosate, or Rely for postemergence control.
	rimsulfuron, MOA 2 (Matrix FNV) 25 WG (Solida) 25 WG (Pruvin) 25 WG + terbacil, MOA 5 (Sinbar) 80 WP	2 oz + 1 to 2 lb	0.063 + 0.8 to 1.6	See each product label for use precautions.
Annual grasses and some broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG + diuron, MOA 7 (Diuron or Karmex DF or XP) 80 WDG	2.5 to 5 lb + 2 to 4 lb	2 to 4 + 1.6 to 3.2	Use only on trees established 1 year or more. Do not treat varieties grafted on full-dwarf rootstocks. See label for details. Apply in combination with glyphosate, paraquat, or Rely for postemergence weed control.
APPLES, Postemergence, Directed Underneath Tree				
Broadleaf weeds including morningglory, pigweed, dayflower, lambsquarters, and prickly lettuce	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 1.6 oz	0.008 to 0.025	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. Do not apply within 3days of harvest. Best results are obtained when applied to weeds in the 2- to 3-leaf stage. Apply in combination with a nonioinic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution).
Broadleaf weeds including perennials like blackberry and horsenettle	fluroxypyr, MOA 4 (Starane Ultra) 2.8 (Comet) 1.5	0.7 to 1.4 pt 0.66 to 2.66 pt	0.35 to 0.70	DO NOT apply during bloom or to trees less than 4 years old. Make only one application per year. Starane or Comet may be tank mixed with other herbicides registered for use on apples. Fluroxypyr has a 14-day PHI.
Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Rely 280) 2.34 L	48 to 82 oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK OR FOLIAGE. Rely should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gal of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Rely can be tank mixed with diuron, Sinbar, Solicam, Surflan, Devrinol, Goal, rimsulfuron, and simazine. Rely has a 14 day PHI. DO NOT allow spot spray applications to directly contact tree or suckers. The addition of ammonium sulfate will enhance Rely activity on difficult to control species, however the addition of surfactants and crop oil will increase risk of crop injury.
	glyphosate, MOA 9 (various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Trees are more susceptible to injury from midsummer until dormant. Repeat applications may be necessary for control of perennial weeds. Can be tank mixed with Goal, Karmex, simazine, Solicam, and Surflan. Check label for specifics. Generic glyphosate formulations may require the addition of a surfactant at 0.5% by volume (2 qt per 100 gal of spray solution). See label for spray additive information and for detailed restriction information.
	halosulfuron, MOA 2 (Sandea) 75 WDG	.75 to 2 oz	0.035 to 0.094	Apply halosulfuron t actively growing weeds. Do not apply to apple trees established 1 year. Do not apply more than 1 oz/A per 12-month period. Avoid herbicide contact with tree foliage. The addition of a nonionic surfactant is necessary for optimum herbicide performance. Sequential applications may be more effective on yellow nutsedge than one application. Halosulfuron may be tank mixed with glyphosate for broad spectrum POST weed control
Broadleaf and some small annual grass weeds	paraquat, MOA 22 (Gramoxone Inteon) 2 SL (Firestorm) 3 SL (Paraquat Concentrate) 3 SL (Parazone) 3 SL	2.5 to 4 pt 1.7 to 2.7 pt	0.6 to 1	Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark less than 1 year old. Young trees must be shielded to prevent spray contact with bark. Add surfactant at 0.25% by volume (2 pt per 100 gal). Paraquat may be tank mixed with Goal, Karmex, simazine, Sinbar, Solicam, and Surflan. Paraquat is a restricted use pesticide.
	salflufenacil, MOA 14 (TreeVix) 70 WG	1 oz	0.044	**The addition of methylated seed oil at 1% v/v (1 gal per 100 gal of spray solution) plus ammonium sulfate at 8.5 to 17 lbs/100 gal of spray solution.** Do not apply more than 3 oz/acre per year. Allow at least 21 days between applications. TreeVix has a 0 day PHI. TreeVix may be tank mixed with glyphosate, Rely 280, Poast, and oxyfluorfen. TrerVix provides excellent control of horseweed, purslane, morningglory species, ragweed, and smartweed.
Broadleaf weeds	2,4-D amine, MOA 4 (various generic formulations) 3.8 SL	2 to 3 pt	0.95 to 1.4	Apply any time during the growing season to actively growing broadleaf weeds except during apple bloom. Trees must be at least 1 year old. Do not apply more than two applications per year (75-day interval between applications) or within 14 days of harvest. Some formulations limit rate to 2 pt per acre. See label for details.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
APPLES, Postemergence, Directed Underneath Tree (continued)				
Grasses	clethodim, MOA 1 (Arrow, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	 6 to 8 oz 12 to 16 oz	0.094 to 0.125	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Use in NONBEARING TREES ONLY. When using the 2 EC formulations, add crop oil concentrate at 1% by volume (1 gal per 100 gal of spray solution). When using the 1 EC formulations, add nonionic surfactant at 0.25% by volume (1 qt per 100 gal).
	fluazifop, MOA 1 (Fusilade DX) 2 EC	12 to 24 oz	0.125 to 0.38	NONBEARING TREES ONLY. Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gal per 100 gal).
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add Dash adjuvant at 1 pt per acre or crop oil concentrate at 1 qt per acre. Do not apply within 14 days of harvest. Do not apply more than 7.5 pt per acre per year.
APPLES, Ground Cover Suppression				
Suppression of fescue, orchardgrass, and bluegrass	glyphosate, MOA 9 (various brands and formulations)	Rates and application time varies for each grass species. See label for details.		Mow one time in spring. Apply 3 to 4 days after mowing. **Caution**: This treatment will normally discolor the grass. **DO NOT** apply after seedhead emergence. See label for details.
PEACHES, Preemergence Directed UnderneathTree				
Annual grasses and some broadleaf weeds	diuron, MOA 7 (Direx , Diuron) 4 L (Diuron, Karmex DF, Karmex XP) 80 DF	1.6 to 2.2 qt 2 to 2.75 lb	1.6 to 2.2	Apply in spring to trees at least 3 years old. Rate is soil texture dependent. May be tank mixed with Sinbar, Solicam, glyphosate, or paraquat. Karmex DF, Karmex XP, and Direx 4L have a 20-day PHI. Other formulations of diuron have a 90-day PHI.
	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.38	Chateau is for newly planted and established orchards. Shield trees established less than 1 year from contact with spray solution. Tank mix with Gramoxone Inteon for POST weed control. Do not apply more than 6 oz per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective. Due to the potential for crop injury, Chateau should not be applied in bearing orchards after budbreak until after final harvest. Do not apply within 60 days of harvest. Do not tank mix with glyphosate or 2,4-D amine after trees break dormancy. Do not use more than 24 oz per acre per year.
	indaziflam, MOA 29 (Alion) 1.67 SC	5 to 6.5 oz	0.065 to 0.085	Use in orchards established 3 years or longer. Use low rate on medium and coarse-textured soils. Allow at least 30 days between applications. Do not treat soil around trees with cracks or channels, or with depressions. Do not apply more than 10.3 oz/A per year. Tank mix Alion with glyphosate, Rely, or paraquat for nonselective POST weed control. Alion has a 14-day PHI.
	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Can be tank mixed with Karmex, Goal, glyphosate, paraquat, Prowl, simazine, Sinbar, and Surflan. Rate is soil texture dependent. See label for details. Do not apply within 6 months of transplanting. PHI is 60 days. Multiple applications can be made per season so long as total use rate does not exceed maximum use rate for soil texture and crop.
	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS	2 to 6 qt	2 to 6	Allow soil to settle around newly transplanted trees before application. Surflan may be tank mixed with Goal, glyphosate, paraquat, simazine, and Solicam. Sequential applications permitted. See label for details. In newly planted orchards may be tank mixed with Gallery for broad spectrum preemergence control. Sequential applications may be used if total use rate does not exceed 12 qt per acre per year.
Annual broadleaf and some grass weeds	oxyfluorfen, MOA 14 (Goal 2 XL or OxiFlo) 2 EC (Galigan) 2 E (GoalTender) 4 E (Galigan H_2O) 4E	 5 to 8 pt 5 to 8 pt 2.5 to 4 pt 2.5 to 3 pt	 1.25 to 2 1.25 to 2 1.25 to 2 1.25 to 1.5	Apply to dormant trees until just before buds start to swell. Do not apply when foliage or fruit are present. Do not apply more than 8 pt per acre in one season. May be tank mixed with Devrinol, Kerb, glyphosate, paraquat, simazine, Solicam, or Surflan.
Annual grass and some broadleaf weeds	pendimethalin, MOA 3 (Prowl) H_2O 4 AS	2 to 4 qt	2 to 4	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled around roots. Apply with paraquat to control emerged weeds. Prowl has a 60-day preharvest interval (PHI). May be applied as sequential applications so long as total amount used does not exceed 4.2 qt/A per year. Allow at least 30 days between applications.
Broadleaf and some grass weeds	rimsulfuron, MOA 2 (Matrix) 25 WG (Solida) 25 WG (Pruvin) 25 WG	4 oz	0.063	For broad spectrum PRE control, tank mix with diuron, Sinbar, oryzalin or Prowl H_2O. For nonselective POST control, apply with glyphosate or paraquat. Do NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH lower than 4.0 or higher than 8.0 will result in herbicide degradation. Rimsulfuron has a 14-day PHI for stone fruit, and sequential applications can be made so long as total use rate does not exceed 4 oz/A per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
Broadleaf and grass weed control for NEWLY PLANTED ORCHARDS	terbacil, MOA 5 (Sinbar) 80 WP	0.5 to 1.0 lb	0.4 to 0.8	Apply once soil has settled after transplanting. Apply no more than 1 lb per acre per year. For best results, apply 0.5 lb in the spring followed by another 0.5 lb when control from initial application fails. Do not apply on soils coarser than sandy loam having less than 2% organic matter.
Annual broadleaf and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	 1.6 to 4 qt 1.8 to 4.4 lb	1.6 to 4	Apply in early spring before weed emergence. Use only on trees established 1 year or more. Do not use on sand or loamy sand soils. Tank mixing simazine with oryzalin, Prowl H_2O, or Solicam will improve residual control of annual grasses and certain broadleaf weeds.
Annual broadleaf and grass weeds plus many perennial grasses	terbacil, MOA 5 (Sinbar) 80 WP	2 to 4 lb	1.6 to 3.2	Use on trees established 3 years or longer and soils with at least 1% organic matter. Unless soil organic matter is greater than 2% do not exceed 3 lb/A. Do not use on sand or loamy sand soils. Sinbar is an excellent choice for tank mixing with diuron or rimsulfuron for extended broad spectrum residual control of those products. Sinbar has a 60-day PHI.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PEACHES, Preemergence Tank Mixes				
Many annual and perennial grasses and broadleaf weeds	diuron, MOA 7 (Diuron or Karmex DF or XP) 80 WDG + terbacil, MOA 5 (Sinbar) 80 WP	1 to 2 lb + 1 to 2 lb	0.8 to 1.6 + 0.8 to 1.6	Use only under trees established in the orchard for at least 2 years. Apply to soils having at least 1% organic matter. See label for details.
	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt + 1.6 to 4 qt 1.75 to 4.4 lb	2 to 4 + 1.6 to 4	Tank mix for use before weed emergence. Tree must be established at least 1 year.
	norflurazon, MOA 12 (Solicam) 80 WDG + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See labels for details.
	rimsulfuron, MOA 2 (Matrix FNV) 25 WG (Solida) 25 WG (Pruvin) 25 WG + terbacil, MOA 5 (Sinbar) 80 WP	2 oz + 1 to 2 lb	0.063 + 0.8 to 1.6	See labels for use precautions and details.
	norflurazon, MOA 12 (Solicam) 80 WDG + diuron, MOA 7 (Diuron or Karmex DF) 80 WDG	2.5 to 5 lb + 2 to 4 lb	2 to 4 + 1.6 to 3.2	See labels for details. Trees must be established at least 3 years.
PEACHES, Postemergence, Directed Underneath Tree				
Broadleaf weeds including morningglory, pigweed, lambsquarters, cocklebur, smartweed, and dayflower	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 1.6 oz	0.008 to 0.025	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. Do not apply within 3 days of harvest. Best results are obtained when applied to weeds in the 2- to 3-leaf stage. Apply in combination with a nonioinic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution).
Kill all green foliage on contact	paraquat, MOA 22 (Firestorm) 3 SL (Paraquat Concentrate) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.7 to 2.7 pt 2.5 to 4 pt	0.66 to 1	Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark. Add surfactant at 0.25% by volume (2 pt per 100 gal) for best results. Paraquat may be tank mixed with Goal, Karmex, simazine, Sinbar, Solicam, and Surflan. Paraquat is a restricted use pesticide. Newly planted trees can be severely injured by paraquat, so use a shield or wrap to protect the tree from spray. Do not make more than three applications per year. Paraquat has a 14-day PHI. Paraquat has a 14-day PHI for peach and 28-day PHI for nectarine.
Non-selective weed control	glyphosate, MOA 9 (various brands and formulations)	See label	1	Do not apply in orchards established less than 2 years. Applications must be made with shielded sprayer. Low hanging limbs and suckers must be removed at least 10 days prior to application. DO NOT use glyphosate 90 days past bloom. DO NOT allow glyphoste to contact foliage or bark; EXTREME care must be taken to prevent injury. See label for details. Some glyphosate formulations may require the addition of a surfactant.
Grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	 6 to 8 oz 12 to 16 oz	0.094 to 0.125	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. When using 2 EC formulation chemicals, add crop oil concentrate at 1% by volume (1 gal per 100 gal). When using 1 EC formulations, use a nonionic surfactant at 0.25% by volume rather than crop oil. Select Max has a 14-day PHI for peach. Unless otherwise stated on label, all other clethodim products are for non-bearing orchards.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	8 to 24 oz	0.125 to 0.38	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gal per 100 gal). Do not apply within 14 days or harvest. Do not apply more than 72 fl oz per acre per year.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to annual grasses up to 12 in. tall. For perennial grasses apply early in the growth cycle at the high use rate. Multiple applications may be necessary for perennial grass weeds. Add Dash adjuvant at 1 pt per acre or crop oil concentrate at 1 qt per acre. Do not apply within 25 days of harvest. Do not apply more than 5 pt per acre per year.
Broadleaf weeds	2,4-D amine, MOA 4 (various generic formulations) 3.8 SL	2 to 3 pt	0.95 to 1.4	Do not apply within 40 days of harvest. Do not apply more than twice a year and allow 75 days between applications. Trees must be at least 1 year old. Use when trees are dormant. Some formulations limit rate to 2 pt per acre. See label for details.
	clopyralid, MOA 4 (Garrison or Stinger) 3 EC	0.33 to 0.66 pt	0.125 to 0.25	Multiple applications may be used as long as total amount does not exceed maximum rate. Use at least 10 GPA of spray solution. Stinger may be tank mixed with preemergence herbicides. Do not apply within 30 days of harvest. Do not apply more than twice.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PECANS, Preemergence Directed UnderneathTree				
Broadleaf weeds and annual grasses	diuron, MOA 7 (Diruon or Karmex DF or XP) 80 WDG (Direx) 4 L	2 to 4 lb 1.6 to 3.2 qt	1.6 to 3.2	Do not apply to trees not less than 3 years old. Rate is soil texture dependent. Do not use on soils with less than 0.5% organic matter.
Annual grass and some broadleaf weeds	norflurazon, MOA 12 (Solicam) 80 WDG	2.5 to 5 lb	2 to 4	Do not apply when nuts are on the ground. Rate is soil texture dependent. See label for details. Do not apply within 6 months of planting. PHI is 60 days. Multiple applications can be made per season so long as total use rate does not exceed maximum use rate for soil texture and crop
	oryzalin, MOA 3 (Oryzalin or Surflan) 4 AS	2 to 6 qt	2 to 4	Allow soil to settle around newly transplanted trees before application. Oryzalin may be tank mixed with Goal, glyphosate, paraquat, simazine, and Solicam. Sequential application permitted. See label for details. Sequential applications may be used so long as total use rate does not exceed 12 qt per acre per year.
	pendimethalin, MOA 3 (Prowl H_2O) 4 AS	2 to 6.3 qt	2 to 6	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled around roots. Apply with paraquat to control emerged weeds. Do not apply within 60 days of harvest. Prowl may be applied in sequential applications so long as total use rate does not exceed 6.3 qt/A per year and there is at least 30 days between applications.
PECANS, Preemergence Tank Mixes				
Annual broadleaf weeds and grass weeds	simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt 2.2 to 4.4 lb	2 to 4	Apply preemergence to weeds under trees that have been established 2 years or more. Do not apply when nuts are on the ground. Do not use on sand or loamy sand soils. Tank mixing simazine with oryzalin, Solicam, or Prowl H2O will improve residual control of annual grasses and certain broadleaf weeds.
Most annual broadleaf and grass weeds plus many perennials	flumioxazin, MOA 14 (Chateau) 51 WDG	6 to 12 oz	0.19 to 0.38	Chateau may be applied in newly planted and established orchards. Trees established less than 1 year must be shielded from contact with spray solution to prevent injury. Do not apply more than 6 oz per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective; however, allow 60 days between applications. Do not apply after bud break through final harvest unless using shielded application equipment. When applying Chateau after bud break DO NOT tank mix with glyphosate or 2,4-D amine. When tank mixed with glyphosate and/or 2,4-D amine the potential for drift increases. Chateau has a 60-day PHI. Use rate cannot exceed 24 oz per acre in a 12-month period.
	indaziflam, MOA 29 (Alion) 1.67 SC	5 to 6.5 oz	0.065 to 0.085	Use in orchards established 3 years or longer. Use low rate on medium and coarse-textured soils. Allow at least 30 days between applications. Do not treat soil around trees with cracks or channels, or with depressions. Do not apply more than 10.3 oz/A per year. Tank mix Alion with glyphosate, Rely, or paraquat for nonselective POST weed control. Alion has a 14-day PHI.
	rimsulfuron, MOA 2 (Matrix) 25 WG (Solida) 25 WG (Pruvin) 25 WG	4 oz	0.063	For broad spectrum PRE control, tank mix with, diuron, oryzalin or Prowl H_2O. For nonselective POST control, apply in combination with glyphosate or paraquat. Do NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH lower than 4.0 or higher than 8.0 will result in herbicide degradation. Rimsulfuron has a 14-day PHI for Pecan. Rimsulfuron may be applied as a sequential application so long as total use rate does not exceed 4 oz/A per year and application is made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
	diuron, MOA 7 (Diuron or Karmex DF or XP) 80 WDG + norflurazon, MOA 12 (Solicam) 80 WDG	2 to 4 lb + 2.5 to 5 lb	1.6 to 3.2 + 2 to 4	Trees must be established in the orchard for 3 years.
	norflurazon, MOA 12 (Solicam) 80 F + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2.5 to 5 lb + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	Trees must be established for at least 2 years. See labels for details.
	oryzalin, MOA 3 (Oryzalin, Surflan) 4 AS + simazine, MOA 5 (Princep, Simazine) 4 L 90 WDG	2 to 4 qt + 2 to 4 qt 2.2 to 4.4 lb	2 to 4 + 2 to 4	See label for details.
PECANS, Postemergence, Directed Underneath Tree				
Broadleaf weeds including morningglory, pigweed, lambsquarters, cocklebur, smartweed, and dayflower	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.5 to 2 oz	0.008 to 0.031	Apply alone or tank mixed with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, desirable foliage, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. Do not apply within 3 days of harvest. Best results are obtained when applied to weeds in the 2- to 3-leaf stage. Apply in combination with a nonioinic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution).
Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Rely 280) 2.34 SL	48 to 82 oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK OR FOLIAGE. Rely should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gal water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Rely can be tank mixed with diuron, Solicam, Surflan, Devrinol, Goal, rimsulfuron, and simazine. Do not apply within 14 days of harvest. The addition of ammonium sulfate will enhance Rely activity on difficult to control species, however the addition of non-ionic surfactants or crop oil will increase the risk of crop injury.

TABLE 7-13B. CHEMICAL WEED CONTROL IN FRUIT CROPS—TREE FRUITS

Weed	Herbicide, Mode of Action* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PECANS, Postemergence, Directed Underneath Tree (continued)				
Most annual broadleaf and grass weeds plus many perennials (continued)	glyphosate, MOA 9 (various brands and formulations)	See label	1 to 2	DO NOT SPRAY GREEN BARK OR FOLIAGE. Repeat applications may be necessary for control of perennial weeds. Tank mix with Goal, Karmex, simazine, Solicam, and Surflan. Check label for details. Generic glyphosate formulations may require the addition of surfactant at 0.5% by volume (2 qt per 100 gal). See label to determine if surfactant is needed for the formulation you use.
Yellow and purple nutsedge plus some broadleaf weeds	halosulfuron, MOA 2 (Sandea) 75 WDG	0.66 to 1.33 oz	0.032 to 0.063	Use on trees established in orchard at least 12 months. Avoid contacting bark or foliage or severe injury or death may occur. The addition of 0.25% surfactant (1 qt per 100 gal of spray solution) will be necessary for adequate control. Do not make more than two applications per year. Use no more than 1 oz per acre on soils classified as sand, loamy sand, or sandy loam. Sandea has a 1-day PHI. User assumes risk when treating trees recovering from certain stress conditions. Sandea may be tank mixed with glyphosate to control weeds other than nutsedge.
Annual broadleaf and grass weeds	paraquat, MOA 22 (Firestorm) 3 SL (Paraquat Concentrate) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.75 to 2.7 pt 2.5 to 4.0 pt	0.66 to 1	Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark less than 1 year old. Add surfactant at 0.25% by volume (2 pt per 100 gal) or 1% crop oil concentrate (1 gal per 100 gal) for best results. Paraquat may be tank mixed with Goal, Karmex, simazine, Solicam, and Surflan. Paraquat is a restricted use pesticide.
Broadleaf weeds	2,4-D amine, MOA 4 (various brands) 3.8 SL	2 to 3 pt	0.95 to 1.4	Apply anytime during the growing season to actively growing broadleaf weeds except during bloom. Do not apply more than two applications per year. Do not use within 60 days of harvest. Do not apply to trees less than 1 year old. Some formulations may limit use rate to 2 pt per acre. Refer to product label for details.
Grasses	clethodim, MOA 1 (Arrow, Intensity, or Select) 2 EC (Select Max or Intensity One) 1 EC	 6 to 8 oz 12 to 16 oz	0.094 to 0.125	NONBEARING TREES ONLY. Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. For 2 EC formulation chemicals, add crop oil concentrate at 1% by volume (1 gal per 100 gal). For 1 EC formulation chemicals, a nonionic surfactant at 0.25% by volume may be used rather than crop oil.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	8 to 24 oz	0.125 to 0.38	Postemergence grass control. Annuals up to 12 in. tall and 6 to 10 in. new growth on perennials. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gal per 100 gal). Limited to 72 oz per year. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to annual grasses up to 12 in. tall. For perennial grasses, apply early in the growth cycle at the high use rate. Multiple applications may be necessary to control perennial grass weeds. Add Dash adjuvant at 1 pt per acre or crop oil at 1 qt per acre. Do not apply within 15 days of harvest. Do not apply more than 10 pt per year.
PECANS, Ground Cover Suppression				
Groundcover suppression in row middles	glyphosate, MOA 9 (various brands) 4 SL (various brands) 5 SL	Rate and application times different for grass species. See label.		See label directions specific for each grass species. **DO NOT** apply after seedhead emergence. See label for details.
	(Roundup WeatherMax) 5.5 SL	See label	See label	

* Mode of action (MOA) code developed by the Weed Science Society of America. See section with TABLE 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Hay Crops and Pastures

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Note: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See TABLE 7-11, Herbicide Resistance Management, for details.

TABLE 7-14. CHEMICAL WEED CONTROL IN HAY CROPS AND PASTURES

Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
ALFALFA, BIRDSFOOT TREFOIL, CLOVERS, LESPEDEZA Preplant				
Certain annual grass weeds, broadleaf weeds, and nutsedge species	EPTC, MOA 8 (Eptam 7-E) 7 EC (Eptam 20-G) 20 G	 3.5 pt 15 lb	3	Use on clay and clay loam soils of piedmont. Incorporate into soil immediately after application. See label for directions. Temporary crop stunting may occur if conditions for germination and growth are not optimum. Do not use if grain or grass crop is to be planted with the legume.
ALFALFA, BIRDSFOOT TREFOIL, LADINO CLOVER, RED CLOVER Preplant				
Certain annual grass and broadleaf weeds	benefin, MOA 3 (Balan DF) 60 DF	 2 to 2.5 lb	1.2 to 1.5	Incorporate before seeding. Use 2 lb on light and medium soils and 2.5 lb on heavy soils. Check label. Do not use if grain or grass crop is to be planted with the legume.
ALFALFA, Established Preemergence				
Crabgrass, foxtails, and other annual grasses	trifluralin, MOA 3 (Treflan TR-10) 10 G (Treflan HFP) 4 EC	 20 lb 2 qt	2	A single rainfall of 0.5 in. or more after application is required to activate Treflan. Apply 2 qt Treflan HFP if chemigation or water incorporated.
ALFALFA, Seedling				
Seedling broadleaf weeds, such as burcucumber, cocklebur, jimsonweed, lambsquarters, velvetleaf, Virginia pepperweed, shepherd's-purse, wild radish, and species of morningglory, mustard, nightshade, pigweed, ragweed, and smartweed	bromoxynil, MOA 6 (Buctril) 2 EC	 1 to 1.5 pt	0.25 to 0.375	Apply in fall or spring to seedling alfalfa with a minimum of 4 trifoliate leaves, and to weeds not greater than 4 leaf stage, 2 inches in height, or 1 inch in diameter, whichever comes first. Unacceptable crop injury can occur 3 days after application if temperatures exceed 70°F. For chemigation only, apply to alfalfa with 2 trifoliate leaves at 2 pt/A to most susceptible weeds not greater than 8 leaf stage, 4 inches in height, or 2 inches in diameter, whichever comes first. Unacceptable crop injury can occur 3 days after application if temperatures exceed 85°F. Buctril can be tank mixed with 2,4-DB 250 or Pursuit DG. Do not apply in warm humid conditions or to alfalfa under any kind of stress. Do not add surfactant unless specified. Do not cut for feed or graze spring- treated alfalfa until 30 days after treatment. Wait until spring, or 60 days after treatment, for winter-treated alfalfa.
ALFALFA, BIRDSFOOT TREFOIL, CLOVERS, Seedling				
Certain broadleaf weeds such as cocklebur, lambsquarters, morningglory, pigweed, ragweed, smartweed, curly dock, shepherdspurse, and wild mustard	2,4-DB, MOA 4 (2,4-DB 200) 2 EC	 2 to 6 pt	0.5 to 1.5	Apply postemergence when weeds are less than 3 in. tall and legume has at least two to four trifoliate leaves. Do not graze or feed seedling legume crops to livestock within 60 days after application.
ALFALFA, CLOVER, BIRDSFOOT TREFOIL, CROWN VETCH, Established and Seedling				
Ryegrass, annual bluegrass, perennial bluegrass, orchardgrass, chickweed, and volunteer grain	pronamide, MOA 3 (Kerb 50-W) 50 WP	 2 lb	1	Use preemergence or postemergence to the weeds only on established legume plantings or on new plantings after the legume has reached the trifoliate leaf stage or beyond. Controls henbit, shepherdspurse, and wild mustard with preemergence applications. Apply from October 15 to January 15. Optimum herbicidal activity occurs when applications are made under cool temperatures (55° F or less) and followed by rainfall. Do not graze or harvest for forage or dehydration within 120 days of treatment.
ALFALFA, Established and Seedling				
Lambsquarters, pigweed, ragweed, morningglory, and smartweed	2,4-DB, MOA 4 (2,4-DB 200) 2 EC	 2 to 6 pt	0.5 to 1.5	Apply postemergence when weeds are less than 3 in. tall. Do not graze established alfalfa or cut for hay within 30 days after application.
Crabgrass, foxtails, seedling johnsongrass and certain broadleaf weeds such as chickweed, cocklebur, henbit, jimsonweed, morningglory, wild mustard, nightshade, pepperweed, pigweed, ragweed, smartweed, spurge, and Russian thistle	imazethapyr, MOA 2 (Pursuit DG) 70 DG	 1.08 to 2.16 oz	0.048 to 0.095	Apply postemergence when seedling alfalfa is in the second trifoliate stage or larger. Can also be applied postemergence to established alfalfa in the fall, in the spring to dormant or semi-dormant alfalfa, or between cuttings. Application should be made before significant alfalfa growth or regrowth to allow herbicide to reach target weeds. Use 80% active nonionic surfactant at 1 qt per 100 gal of water or a crop oil concentrate at 1 qt per acre. Weeds should be 1 to 3 in. in height. Pursuit will reduce growth of perennial grasses (fescue, etc.) that are present in the stand. See label for weeds controlled and other precautions.
Annual bluegrass, barnyardgrass, crabgrass, crowfootgrass, foxtail species, goosegrass, Italian ryegrass, seedling johnsongrass, fall panicum, Texas panicum, sandbur, signalgrass, and certain broadleaf weeds such as palmer amaranth, common chickweed, henbit, lambsquarters, pigweed species, and smartweed	pendimethalin, MOA 3 (Prowl H2O) 3.8 CS	1.1 to 8.4 pt	0.52 to 4	Use on alfalfa grown for forage, hay, or seed. Apply 1.1 to 4.2 qt/A prior to weed emergence in fall after last cut, during winter dormancy, in the spring, or between cuttings before alfalfa reaches 6 inches when grown for forage or hay. Apply same rates for alfalfa grown for seed production when dormant or before alfalfa exceeds 10 inches after first or second cut. Use drop nozzles to minimize foliar contact. Apply 1.1 to 2.1 pt/A to seedling alfalfa in second trifoliate stage before 6 inches of growth. Do not harvest alfalfa forage or hay less than 28 days after applying 2.1 qt/A or less than 50 days after applying more than 2.1 qt/A. Do not harvest alfalfa seed less than 90 days after application. Some stunting and chlorosis of alfalfa may occur after postemergence applications.

TABLE 7-14. CHEMICAL WEED CONTROL IN HAY CROPS AND PASTURES

Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
ALFALFA, Established and Seedling (continued)				
Annual and perennial grasses	clethodim, MOA 1 (Select 2 EC) 2 EC	8 to 16 fl oz	0.125 to 0.250	Apply postemergence for annual grasses in seedling alfalfa at 6 to 8 fl oz per acre or in established alfalfa at 8 oz per acre. Apply postemergence for bermudagrass and rhizome johnsongrass at 8 to 16 fl oz per acre. Add a crop oil concentrate at 1 qt per acre. Can be applied at any stage of alfalfa growth. Apply to actively growing grasses not under drought stress. Be sure grasses have leaves present for contact by the spray solution. Do not apply within 15 days of grazing, feeding, or harvesting (cutting) alfalfa for forage or hay. Select may be tank mixed with 2,4-DB or Pursuit. When tank mixing, see respective labels for application rates, weeds controlled, maximum weed size to treat, specific application directions, and precautions.
	sethoxydim, MOA 1 (Poast) 1.5 EC (Poast Plus) 1 EC	1 to 2.5 pt 1.5 to 3.5 pt	0.19 to 0.47	Apply postemergence for annual grasses at 0.19 lb a.i. (the lower rate) per acre and for bermudagrass and johnsongrass at 0.47 lb a.i. (the higher rate) per acre. Add 2 pt crop oil concentrate per acre. Use 10 to 20 gal of spray solution per acre. Can be applied at any stage of alfalfa growth. Do not apply to weedy grasses or alfalfa under stress. Be sure grasses have leaves present for contact by the spray solution. Do not apply within 7 days of grazing, feeding, or cutting for (undried) forage, or within 14 days of cutting alfalfa for (dry) hay.
ALFALFA, Established dormant				
Winter annual weeds, such as chickweed, henbit, bittercress, pepperweed, shepherdspurse, yellow rocket, and ryegrass	metribuzin, MOA 5 (Sencor 4) 4 F (Sencor DF) 75 DF	1 pt 0.67 lb	0.5	Good results have been obtained in N.C. when the herbicide was applied from Nov. 20 to Dec. 20. Do not graze or harvest within 28 days after application. In alfalfa-grass mixtures, it will provide partial reduction of forage grass stands. Common chickweed may be controlled with only 0.25 to 0.375 lb active ingredient per acre of Sencor.
	terbacil, MOA 5 (Sinbar) 80 WP	0.5 to 1.5 lb	0.4 to 1.2	Apply to established alfalfa stands at least 1 year old before or shortly after weed growth begins. Weeds have been controlled with an application from mid-November through February. Do not use Sinbar on alfalfa-grass mixtures on sand or loamy sand soils or on soils containing less than 1% organic matter.
LESPEDEZA, Preplant				
Certain annual grass and broadleaf weeds	EPTC, MOA 8 (Eptam 7-E) 7 EC	3.5 pt	3	See remarks under alfalfa.
No-Till ALFALFA or No-Till Pasture Reseeding				
Complete kill of existing sod	glyphosate, MOA 9 (Roundup Ultra) 4 SL	1 to 5 qt	1 to 5	Broadcast spray 10 to 14 days before planting. Provides better control of perennial weeds. Check label for rate according to weeds present.
	paraquat, MOA 22 (Boa) 2.5 SL (Gramoxone Max) 3 SL	2 to 3 pt 1.5 to 2.7 pt	0.6 to 0.9 0.56 to 1	Broadcast spray in 20 to 30 gal of water per acre. Apply 2.5 pt per acre to sod 3 weeks before planting. Follow at planting with 1.5 to 2.5 pt broadcast per acre. If spraying following hay harvest, allow enough regrowth to provide leaf area to absorb the herbicide. Add 1 pt of a nonionic surfactant per 100 gal of water.
No-Till Pasture Reseeding with Clover				
Suppression of existing sod and undesirable emerged broadleaf and grass weeds to permit pasture reseeding	paraquat, MOA 22 (Boa) 2.5 SL (Gramoxone Max) 3 SL	13 to 24 fl oz 0.75 to 1.3 pt	0.25 to 0.5 0.28 to 0.49	Rates are per sprayed acre. Usually band sprayed for planting clover into existing grass sod. Apply before or at time of seeding. Pasture should not exceed 3 in. in height at time of treatment. Add 1 qt of a nonionic surfactant per 100 gal of water. Check label for grazing restrictions.
Pastures, LADINO CLOVER, ORCHARDGRASS, FESCUE, and other grasses				
Curly dock, ragweed, bitterweed, pigweed, dandelion, and other broadleaf weeds	2,4-D amine, MOA 4 (various brands) 4 SL	1 to 2 pt	0.5 to 1	Spray when weeds are 4 to 8 in. tall and before heading. Clover may be stunted and growth retarded 3 to 6 weeks. Use lower rate in warm, wet weather. For wild garlic, apply late February or early March. Repeat for 3 year. *Do not graze dairy animals on treated areas within 7 days after application*. Remove meat animals from treated areas for 3 days before slaughter. Withdrawal is not necessary if more than 2 weeks have elapsed since treatment. Do not cut treated grass for hay within 30 days after application.
Wild garlic	2,4-D amine, MOA 4 (various brands) 4 SL	1 qt	1	
Perennial Grasses, RANGELAND, PERMANENT GRASS PASTURES				
Many annual and perennial grass and broadleaf weeds and nutsedge species (goosegrass not controlled)	imazapic, MOA 2 (Panoramic 2 SL) 2 SL	4 to 12 fl oz	0.0625 to 0.1875	Apply to common and coastal bermudagrass varieties. Jiggs bermudagrass is more sensitive than other types. Expect 30 to 45 days of bermudagrass suppression. Do not apply 1) to drought stressed bermudagrass, 2) during spring transition, 3) to newly aerated fields for 30 days, 4) to newly sprigged or seeded bermudagrass, or 5) to World Feeder bermudagrass varieties. To speed bermudagrass recovery, apply with nitrogen fertilizer, and do not add a spray adjuvant. If spray carrier is water, add a nonionic surfactant at 0.25% by volume or a methylated seed oil at 1.5 to 2 pt per acre. Panoramic 2 SL also controls winter weeds when applied to dormant bermudagrass, and can be mixed with glyphosate at this time. There is a 7-day hay restriction.
Johnsongrass, kyllinga species, purple and yellow nutsedge	sulfosulfuron, MOA 2 (Outrider) 75 WG	1.33 oz	0.0625	Apply to established bermudagrass and bahiagrass pastures. A second application can be made 40 days after initial application if needed, but do not exceed 2.66 oz per acre per year. Apply a nonionic surfactant at 0.25% v/v. There are no grazing restrictions. Do not harvest for hay within 14 days of application. Johnsongrass is best controlled if Outrider is applied at 18- to 24-in. and up to heading stage.
Emerged annual, biennial, and perennial broadleaf weeds and certain woody species	picloram + 2,4-D, MOA 4 + 4 (Grazon P+D) 0.54 + 2 lb/gal SL	1 to 8 pt	0.3175 to 2.54	Due to crop sensitivity, Grazon P+D should not be used in cotton- or tobacco-growing regions of the state. Do not graze lactating dairy animals for 7 days after application. Do not harvest grass for hay for 30 days after application. Meat animals must be withdrawn from treated forage at least 3 days before slaughter. There are no other grazing restrictions for non-lactating dairy animals or other livestock. Newly seeded grasses may be injured. Check label for livestock transfer restrictions due to possible urine and manure contamination with picloram. Check label for all other restrictions.
	picloram + fluroxypyr, MOA 4 + 4 (Surmount) 1.19 + 0.96 lb/gal EC	1.5 to 6 pt	0.40 to 1.60	Due to crop sensitivity, Surmount should not be used in cotton- or tobacco-growing regions of the state. Do not allow lactating dairy animals to graze or consume harvested forage within 14 days after application. There are no grazing restrictions for nonlactating dairy animals or other livestock. Do not harvest hay within 7 days after application. Withdraw meat animals from treated forage at least 3 days before slaughter. Newly seeded or sprigged grasses may be injured. Check label for livestock transfer restrictions due to possible urine and manure contamination with picloram. Check label for all other restrictions.

TABLE 7-14. CHEMICAL WEED CONTROL IN HAY CROPS AND PASTURES

Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, RANGELAND, PERMANENT GRASS PASTURES (continued)				
Mustard, radish, cocklebur, vetch, and other susceptible broadleaf weeds	2,4-D amine, MOA 4 (various brands) 4 SL	1 to 2 pt	0.5 to 1	Do not spray in seedling stages or just before heading. Apply after the perennial grass seedlings have reached the two- to four-leaf stage. For wild garlic apply February or March. Repeat for 2 years. *Do not graze dairy animals on treated areas within 7 days after application*. Remove meat animals from treated areas for 3 days before slaughter. Withdrawal is not necessary if more than 2 weeks have elapsed since treatment. Do not cut treated grass for hay within 30 days after application.
Wild garlic	2,4-D amine, MOA 4 (various brands) 4 SL	3 qt	3	
Many broadleaf weeds including certain ones resistant to 2,4-D	dicamba, MOA 4 (Banvel) 4 SL	0.5 to 2 pt	0.25 to 1	Rate dependent on weed species and size. See label for specific rates and precautions concerning grazing.
Many broadleaf weeds including dogfennel, thistles, and horsenettle	dicamba (Banvel) 4 SL + 2,4-D amine (various brands) 4 SL (a tank mix) MOA 4 + 4	0.5 pt + 1.5 pt	0.25 + 0.75	The tank-mix combination will control a greater number of broadleaf weeds than either herbicide alone. Observe each label for restrictions on grazing and cutting for hay. For 1 pt of Banvel or 2 pt of Weedmaster, do not graze lactating dairy animals for 7 days or harvest hay for 37 days. No grazing restrictions for other livestock; however, meat animals must be removed 30 days before slaughter.
	dicamba + 2,4-D amine, MOA 4 + 4 (Weedmaster) (a premix) 1 + 2.87 lb/gal SL	1 to 2 pt	0.13 to 0.25 + 0.36 to 0.72	
	2,4-D +triclopyr, MOA 4 + 4 (Crossbow) 2 + 1 lb/gal EC	1 to 6 qt	0.5 to 3 + 0.25 to 1.5	Rate depends upon weeds to be controlled. Woody plant control requires 6 qt or more. Consult label for specific rates. Withdraw livestock from treated forage at least 3 days before slaughter during the year of treatment. Do not graze lactating dairy animals on treated areas for 14 days following treatment. Do not harvest grass for hay from treated areas for 1 year following treatment for lactating dairy animals. Wait 7 days for other livestock.
	metsulfuron methyl, MOA 2 (Cimarron) 60 WDG	0.1 to 1 oz	0.0038 to 0.038	Bermudagrass, bluegrass, orchardgrass, bromegrass, and timothy are tolerant. Cimarron may cause stunting and seedhead suppression of tall fescue. Therefore, do not exceed 0.4 oz product per acre. Pensacola bahiagrass controlled at 0.3 oz product per acre in established bermudagrass. Also controls wild garlic. Alfalfa, clover, and ryegrass are highly sensitive. Use a nonionic surfactant of at least 60% active ingredient with a hydrophilic/lipophilic balance greater than 12 at 1 to 2 pt per 100 gal of spray solution. Use a COC of 80% quality or MSO with 15% surfactant emulsifiers at 1 gal per 100 gal spray solution. Cimarron has no grazing restrictions.
	metsulfuron methyl + chlorsulfuron, MOA 2 + 2 (Cimmaron Plus) 48% + 15% WDG	0.125 to 1.25 oz	0.005 to 0.05	Tolerant to native grasses, such as bluestems, blue grama, and buffalograss, as well as bermudagrass, bluegrass, orchardgrass, bromegrass (but not Matua), and fescue. To minimize fescue injury, do not exceed 0.5 oz per acre and use a nonionic surfactant unless liquid nitrogen is the carrier. Apply to bermudagrass 2 months after establishment and fescue 24 months after establishment. Generally, treat actively growing weeds less than 4 in. tall or 4 in. in diameter. However, this product also provides preemergence control. Unless otherwise recommended, use a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1% v/v. There are no grazing or hay harvest restrictions.
Many annual and perennial broadleaf weeds and woody brush	metsulfuron methyl + dicamba + 2,4-D amine, MOA 2 + 4 + 4 (Cimarron Max) (a 2-part product) 60%+(1+2.87) lb/gal	0.25 to 1 oz + 1 to 4 pt	0.009375 to 0.038 + 0.48 to 1.94	Observe same precautions as Cimarron except for the following changes or additions: Tall fescue: do not exceed 0.25 oz per acre Part A + 1 pt per acre Part B. Nonlactating meat animals: remove 30 days prior to slaughter. Lactating dairy animals: 7-day grazing and 37-day hay restriction.
Henbit, common chickweed, mustards, buttercup, Carolina geranium, pigweed species, common lambsquarters, and other susceptible broadleaf weeds	chlorsulfuron, MOA 2 (Telar XP) 75 DF	0.25 to 1 oz	0.0117 to 0.047	Treat perennial weeds in bud to bloom stage or fall rosette stage. There are no grazing or hay restrictions with rates up to 1.33 oz per acre. For bermudagrass and orchardgrass, apply a maximum of 1 oz per acre. Apply up to 0.5 oz per acre on tall fescue. Spot treat with 1.33 oz per acre if grass injury can be tolerated. Use a high quality spray adjuvant for improved postemergence control, but do not use LI-700 or other acidifying spray adjuvants.
Buttercup species, cocklebur, henbit, horsenettle, horseweed, ragweed, thistles, and other susceptible broadleaf weeds	aminopyralid, MOA 4 (Milestone) 2 SL	3 to 7 fl oz	0.04688 to 0.10938	Due to crop sensitivity, use extreme caution around sensitive crops, including, but not limited to alfalfa, cotton, potatoes, soybeans, tobacco, and other broadleaf or vegetable crops, fruit trees, or ornamental plants. Do not use aminopyralid-treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed treated areas in compost or mulch that will be in contact with susceptible broadleaf plants. There are no restrictions on grazing or hay harvest following aminopyralid applications. Check product label for complete list of precautions.
	aminopyralid + 2,4-D amine, MOA 4 + 4 (ForeFront) 0.33 + 2.67 lb/gal L	1.5 to 2.6 pt	0.56 to 0.975	Do not use on areas where loss of desirable broadleaf forage plants (legumes) cannot be tolerated. Do not use hay, straw, or manure from farm animals that have grazed forage or eaten hay harvested from treated areas within previous 3 days in compost or mulch that will be in contact with susceptible broadleaf plants. Wait 7 days after application to harvest hay. Wait 30 days to make second application. Do not transfer grazing animals from treated areas to sensitive broadleaf crop areas without allowing for 3 days grazing on nontreated areas.
	aminopyralid + metsulfuron, MOA 4 + 2 (Chaparral) 71.58 WG	1 to 3.3 oz	0.0447 to 0.1476	Chaparral is effective on Pensacola bahiagrass. At higher rates, Chaparral may stunt tall fescue, cause yellowing, or cause seedhead suppression. Follow label precautions to minimize these symptoms. Include 1% crop oil concentrate, 0.25% non-ionic surfactant, 0.5% methylated seed oil, or 2 qt/A urea ammonium nitrate. Can spot spray less than 50% of an acre with up to 6.6 oz/A. There are no grazing or hay harvest restrictions. Do not use on grasses grown for seed. Do not overseed 4 months after treatment. Aminopyralid Precautions: Do not transfer grazing animals from treated areas to sensitive broadleaf crop areas without allowing for 3 days grazing on nontreated areas. Do not use hay, straw, or manure from animals that have grazed forage or eaten hay from treated areas within previous 3 days in compost or mulch that will contact susceptible broadleaf plants. Do not spread manure on land used for growing susceptible broadleaf crops if animals have consumed treated hay within 3 previous days. Conduct a field bioassay before planting a broadleaf crop.

TABLE 7-14. CHEMICAL WEED CONTROL IN HAY CROPS AND PASTURES

Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, RANGELAND, PERMANENT GRASS PASTURES (continued)				
Catchweed bedstraw, common lambsquarters, mustard spp., nightshade spp., amaranthus spp., velvetleaf, bittercress, shepherds-purse, annual sowthistle, corn spurry, Russian thistle, redstem filaree	carfentrazone, MOA 14 (Aim) 2 EC	0.5 to 2 fl oz	0.0078125 to 0.03125	Use in grasses grown for forage, fodder, hay, seed, and sod. There are no grazing or hay restrictions. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate or methlated seed oil at 1% v/v with or without a high quality sprayable liquid N fertilizer at 2 to 4% v/v or ammonium sulfate at 2 to 4 lb per acre. Apply to weeds up to 4 in. tall. In overseeded pastures, Aim can be applied to barley, millet, oats, rye, teosinte, triticale, and wheet from prior to planting up to joint stage. Tank mix 2,4-d amine or ester for extended broadleaf weed control but don't harvest for forage within 7 days of application.
Catchweed bedstraw, common lambsquarters, mustard spp., nightshade spp., amaranthus spp., velvetleaf, bittercress, shepherds-purse, annual sowthistle, corn spurry, Russian thistle, redstem filaree, and many other weeds susceptible to 2,4-D	carfentrazone + 2,4-D ester, MOA 14 + 4 (Rage D-Tech) 0.13 + 5.92 lb/gal EC	0.5 to 2 pt	0.378125 to 1.5125	Use in grasses grown for forage, fodder, hay, seed, and sod. Restrictions after application include: 3-day slaughter; 7-day dairy grazing; and 30-day hay harvest. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate or methlated seed oil at 1.5 to 2% v/v with or without a high quality sprayable liquid N fertilizer at 2 to 4% v/v or ammonium sulfate at 2 to 4 lb per acre. Apply to weeds up to 6 in. tall. In overseeded pastures, 8 to 16 oz of Rage D-Tech can be applied to barley, oats, rye, and wheat from 3 tiller stage up to joint stage. Use only a nonionic surfactant with or without a fertilizer solution as described above in small grains. Do not graze dairy or meat animals being finished for slaughter for 14 days following application. Do not feed treated straw to livestock.
Buttercup species, cocklebur, dogfennel, henbit, horsenettle, horseweed, and select amaranth and pigweed species, other susceptible broadleaf weeds.	diflufenzopyr + dicamba, MOA 19 + 4 (Overdrive) 20% + 50% DF	4 to 8 oz	0.05 + 0.125 to 0.1 + 0.25	Use caution around sensitive broadleaf crops, including but not limited to alfalfa, clover, and lespedeza. There are no hay harvesting or grazing restrictions for pasture and rangelands treated with Overdrive, however, there is a 30-day crop rotation or planting restriction. Overdrive is for use on established grasses; do not apply to newly seeded grasses or to small grains grown for pasture.
Many broadleaf weeds including most legumes (clover, vetch, lespedeza), buttercups, bull and musk thistle, common chickweed, curly dock, henbit, ragweed, and plantains	triclopyr + clopyralid, MOA 4 + 4 (Redeem R&P) 2.25 + 0.75 lb/gal EC	1 to 4 pt	0.28 to 1.13 + 0.09 to 0.38	Apply to established grass pastures. Rate depends on weeds to be controlled. See label for rates for specific weeds. A nonionic surfactant is recommended for use with Redeem R&P. This product should not be used where desirable legumes such as clover are used in the forage mixture. For lactating dairy animals, do not graze or harvest green forage from treated area for 14 days after treatment but treated areas cannot be used for hay until the next growing season. For other livestock, no grazing restrictions exist. However, do not harvest hay for 7 days after treatment. Withdraw livestock from grazing treated grass or consumption of treated hay for at least 3 days before slaughter. The addition of 1 pt per acre of 2,4-D enhances the weed spectrum of Redeem R&P.
Many broadleaf weeds including most legumes, cocklebur, curly dock, horseweed, jimsonweed, lambsquarters, prickly lettuce, mustards, nightshades, redroot pigweed, plantains, wild radish, sicklepod, sowthistles, and thistles	2,4-D amine + clopyralid, MOA 4 + 4 (Curtail) 2 +0.38 lb/gal	2 to 4 qt	1.19 to 2.38	Apply to established grass pastures. Allow 7 days grazing on nontreated pasture before livestock transfer to sensitive broadleaf crop areas. Do not use plant residues or manure from treated areas for composting or mulching near sensitive plants. Avoid movement of treated soil and minimize spray drift when possible. There is a 14-day grazing restriction for lactating cattle, a 30-day restriction for haying, and a 7-day restriction for slaughter. Addition of surfactant is usually not necessary.
Many woody plants, such as poplar, sumac, sassafras, wax myrtle, oaks, red maple, locust, eastern persimmon, and broadleaf weeds such as poison oak, poison ivy, blackberry, clover, curly dock, multiflora rose, lespedeza, mustard, plantain, and vetch	triclopyr ester, MOA 4 (Remedy) 4 EC	1 to 3 pt	0.5 to 1.5	Apply to established grass pastures. Rate depends on weed species to be controlled. See label for rates for specific weeds and dilution rates for woody plant control. For lactating dairy animals where 2 qt per acre or less are used, do not graze or harvest green forage for 14 days after treatment, or for hay, do not harvest until next growing season. Where more than 2 qt per acre are used, do not graze, harvest green forage, or hay until next growing season. For other livestock where 2 qt per acre or less are used, there are no grazing restrictions, but for hay do not harvest for 7 days after treatment. Where more than 2 qt per acre used, do not graze or harvest green forage for 14 days after treatment. However, if less than 25% of a grazed area is treated, there is no grazing restriction. For hay, where 2 to 4 qt per acre used, do not harvest for 14 days after treatment or where greater than 4 qt per acre used, do not harvest hay until next growing season. Withdraw livestock from grazing treated grass or consumption of treated hay for at least 3 days before slaughter. Addition of 1 pt per acre of 2,4-D enhances weed spectrum of Remedy. A surfactant or oil-based carrier is recommended.
	(Remedy Ultra) 4 EC	1 to 3 pt	0.5 to 1.5	Follow same precautions as for Remedy (above) except for the following restrictions for lactating dairy animals: Do not allow grazing until the following season after application. Wait 14 days to harvest hay. Portions of grazed area may be treated if comprised of no more than 10 percent of the total grazable area.
	triclopyr + fluroxypyr, MOA 4 + 4 (PastureGard) 1.5 to 0.5 lb/gal EC	1.5 to 8 pt	0.38 to 2	Apply to established grass pastures. In general, apply 1.5 to 2 pt per acre for annual broadleaf weeds, 2 to 3 pt per acre for biennial and perennial broadleaf weeds, and 2 to 8 pt per acre for woody plants. Do not graze or harvest green forage for lactating dairy animals during the same growing season. There are 14-day haying and 3-day slaughter restrictions. A nonionic surfactant at 1 to 2 qt per 100 gal of spray solution may improve control of drought-stressed weeds.
Multiflora rose	dicamba, MOA 4 (Banvel) 4 SL	1 to 2 gal	4 to 8	Mix 1 gal of Banvel herbicide with 99 gal of water. Add a nonionic surfactant at the rate of 2 qt per 100 gal of spray solution to improve wetting. Apply 100 to 200 gal of spray solution per acre. Completely wet foliage and stems, allowing spray solution to run down the stem. Apply at full vegetative stage before bloom. For spot treatment, mix 3 tbsp of Banvel per 1 gal of water, or directly apply concentrate to root area with a spotgun applicator. Use 1 fl oz of Banvel per 10 ft of canopy diameter and apply before bud-break in spring. Do not graze dairy animals for 60 days after treatment. There is no waiting period between treatment and grazing for animals other than dairy animals.
	glyphosate, MOA 9 (Roundup Ultra Max) 5 SL	1% solution		Apply 1% solution of Roundup in water with a handgun. Spray foliage completely. Apply after full bloom until August 1. Do not graze livestock for 10 days following treatment.
	metsulfuron methyl, MOA 2 (Cimarron) 60 WDG	0.5 oz	0.019	Broadcast application: treat in spring when multiflora rose is fully leafed but less than 3 ft tall. Spot application: treat spring through summer at 1 oz per 100 gal of spray solution. Add surfactant. Cimarron has no grazing restrictions.

TABLE 7-14. CHEMICAL WEED CONTROL IN HAY CROPS AND PASTURES

Weed	Herbicide, Mode of Action, and Formulation	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Perennial Grasses, RANGELAND, PERMANENT GRASS PASTURES (continued)				
Multiflora rose (continued)	tebuthiuron, MOA 7 (Spike 20 P) 20 P	20 lb	4	Apply in the spring just before growth begins or during periods of vigorous growth, late spring or early summer (March 15 to June 1). Best to apply to individual clumps on basis of area (sq ft) covered. Spread uniformly over the plant roots. Check label carefully for restrictions and precautions on use. Do not contaminate water used for irrigation.
	2,4-D + triclopyr, MOA 4+4 (Crossbow) 2 + 1 lb/gal EC	1.5 gal	4.5	Mix 1 to 1.5 gal of Crossbow with water to make 100 gal of total spray solution. Spray to give thorough coverage of foliage, wetting leaves and stems to the drip point. The best time for treatment is during early to mid-flowering stage. See restrictions for Crossbow on grazing and hay harvest listed previously.
Annual and perennial grass and broadleaf weeds and vine species	imazapic + glyphosate, MOA 2 + 9 (Journey) 0.75 + 1.5 lb/gal AS	11 to 32 fl oz	0.19 to 0.56	Journey will injure, delay green-up, suppress growth, and possibly kill desirable forage grasses. Spot treat or locally broadcast in weedy areas only. Apply to undesirable, non-native, invasive, or noxious weeds to aid in establishment of desirable rangeland plant species. Do not apply to newly seeded or sprigged grass stands. Add a methylated seed oil at 1.5 to 2 pt per acre or a nonionic surfactant at 0.25% v/v. Journey has no grazing restrictions. Wait 7 days after treatment to cut grass for hay.
BERMUDAGRASS, Newly Sprigged				
Annual and perennial grass and broadleaf weeds	diuron, MOA 7 (Direx 4 L) 4 L	0.8 to 2.4 qt	0.8 to 2.4	Apply after planting, before emergence of bermudagrass or weeds. Apply 0.4 to 0.8 qt per acre if annual weeds are up to 4 in. tall with a NIS at 2 qt per 100 gal of water. If bermudagrass has emerged at time of treatment, expect temporary burn. Plant sprigs 2 in. deep to reduce crop injury potential. Do not graze or feed livestock within 70 days of application.
BERMUDAGRASS, Dormant				
Emerged winter annual broadleaf and grass weeds	metsulfuron methyl, MOA 2 (Cimarron) 60 WDG	0.1 to 0.3 oz	0.0038 to 0.011	Controls many winter annual broadleaf weeds.
	paraquat, MOA 22 (Boa) 2.5 SL	12.8 fl oz	0.25	Apply in February or March in *dormant* bermudagrass pasture. Add 1 pt of a nonionic surfactant per 100 gal of water. Do not mow for hay until 40 days after treatment.
Barnyardgrass, crabgrass, crowfootgrass, foxtail species, goosegrass, seedling johnsongrass, fall panicum, Texas panicum, sandbur, signalgrass, and certain broadlead weeds such as palmer amaranth, lambsquarters, pigweed species, and smartweed	pendimethalin, MOA 3 (Prowl H2O) 3.8 CS	1.1 to 4.2 qt	1.045 to 4	Apply to established bermudagrass pasture and hay fields in winter dormancy. Apply as a single full rate or in two split applications with a half rate at the onset of winter dormancy and another half rate prior to spring greenup. Do not harvest for forage or graze until 45 days after treatment. Do not harvest for hay until 60 days after harvest. Observe a plant back interval of 270 days after treatment. Use of Prowl H2O on rangeland is prohibited.
BERMUDAGRASS, Coastal				
Various annual grass and broadleaf weeds	glyphosate MOA 9 (Roundup Ultra) 4 SL	1 pt	0.125	May be applied to coastal bermudagrass prior to spring growth or immediately after first cutting. Cannot be applied prior to spring growth and immediately after first cutting in the same year. Remove domestic livestock from area before making applications. When applying prior to spring growth, apply in late winter or early spring but before new coastal bermudagrass growth begins in spring. Applications to new growth can damage bermudagrass. Wait 60 days after making this application before grazing or harvesting the treated area. When applied after first cutting, apply after the first bermudagrass cutting when the bermudagrass has not yet begun to grow. Applications made after regrowth can damage the bermudagrass. Wait 28 days after making this application before grazing or harvesting the treated area.
Suppresses large crabgrass, goosegrass. Controls barnyardgrass, broadleaf signalgrass, foxtail species, johnsongrass up to 18 in., panicum species, Italian ryegrass, sandbur, volunteer cereals, Pensacola bahiagrass, wild garlic, many broadleaf weeds such as bitter sneezeweed, buttercup, geranium, chickweed, curly dock,dandelion, dog fennel, henbit, horseweed, jimsonweed, lambsquarters, morningglory, pigweed, plantain, smartweed, wild mustard.	nicosulfuron + metsulfuron, MOA 2 + 2 (Pastora) 56.2% + 15% WG	1 to 1.5 oz	0.0445 to 0.0668	There are no grazing or hay restrictions. Pastora provides pre and post broadleaf weed control and only post grass weed control. Apply to established bermudagrass. Temporary crop injury may occur if treated on new growth more than 2 inches or after 7 days following harvest. Do not exceed 2.5 oz/A per year if sequential applications are needed; 0.25% non-ionic surfactant is preferred but can apply with 1% crop oil concentrate or 2 qt/A urea ammonium nitrate. Check label for acceptable tank mix partners. Until Dec. 31, 2013, FIFRA Section 2 (ee) allows glyphosate to be tankmixed with Pastora for improved control or suppression of crabgrass, sandbur, foxtail, rescuegrass, Japanese brome, little barley, and ryegrass. Apply 2.5 to 4.1 oz a.i. per acre glyphosate. Expect temporary yellowing or stunting of bermudagrass. Add nonionic surfactant at 0.25% v/v.
HYBRID BERMUDAGRASS, (Coastal, Tifton 44)				
Young annual broadleaf weeds	2,4-D amine, MOA 4 (various brands) 4 SL	1 qt	1	Apply after sprigging. Gives little preemergence weed control. Later applications may be needed to control broadleaf weeds.
SORGHUM-SUDAN HYBRIDS, Preemergence				
Annual broadleaf and grass weeds	atrazine, MOA 5 (AAtrex 4 L) 4 L (AAtrex Nine-0) 90 WDG	3.2 to 4 pt 1.8 to 2.2 lb	1.6 to 2	Use only on silt-loam, clay loam, and clay soils with more than 1% organic matter. Use lower rates on soils 1% to 1.5% organic matter and higher rates on soils having more than 1.5% organic matter. On highly erodible soils (as defined by SCS), if conservation tillage is practiced, leaving at least 30% of soil covered with plant residues at planting, apply a maximum of 2 lb active per acre as broadcast spray. If soil coverage with plant residue is less than 30% at planting, a maximum of 1.6 lb active per acre may be applied. On soils not highly erodible, apply 2 lb active per acre as a broadcast spray.

Chemical Weed Control in Lawns and Turf

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Notes: A mode of action code has been added to the Herbicide and Formulation column of this table. Use MOA codes for herbicide resistance management. See TABLE 7-11, Herbicide Resistance Management, for details.

Several of the preemergence herbicides are available on fertilizer carriers for homeowner application.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, SMOOTH and LARGE CRABGRASS, FOXTAILS, other annual grasses				
benefin, MOA 3 (Balan 2.5 G) 2.5 G	2.75 lb	120 lb	3	Safe to apply to all established turfgrass except bentgrass. Do not apply in the spring to lawns seeded the previous fall or to golf course greens. Do not use on newly sprigged turfgrasses.
benefin + trifluralin, MOA 3 + 3 (Team 2 G) 2 G (Team Pro 0.86%) 0.86 G	3.5 lb 8 lb	150 lb 349 lb	3	Use on lawns and golf course fairways of bahiagrass, bentgrass, bermudagrass, centipedegrass, fescue, perennial ryegrass, St. Augustinegrass, and zoysiagrass.
bensulide, MOA 8 (Bensumec 4 LF or Betasan 4.8-E) 4 EC (PreSan) 12.5 G (PreSan) 7 G		varies because several concentrations available	10	May be applied to all established turfgrass and dichondra, residential lawns, and also golf course greens and tees. Limit 2 applications per year to greens and tees. Do not use on newly sprigged turfgrasses.
bensulide + oxadiazon, MOA 8 + 14 (Goosegrass/Crabgrass Control) 6.56 G	2.6 lb	116 lb	6 + 1.5	Controls crabgrass and goosegrass. Use on established bermudagrass, zoysiagrass, tall fescue, bentgrass, perennial bluegrass, or perennial ryegrass fairways and tees. Use also on bermudagrass and bentgrass greens.
dithiopyr, MOA 4 (Dimension 2 EW) 2 EW (Dimension Ultra WSP, Dynamo 40 WSP or Dithiopyr 40 WSP) 40 WP	0.75 fl oz 0.46 oz	1 qt 20 oz	0.5	May be applied to all cool-season and warm-season turfgrasses except colonial bentgrass. See label for injury precautions regarding certain varieties. Also controls pre-tillered crabgrass. Split applications recommended in southern and coastal regions of the state (0.25 lb a.i. at 8 week intervals). Timely irrigation or rainfall is critical for activation.
indaziflam, MOA 21 (Specticle 20 WSP) 20 WSP	0.057 to 0.115 oz	2.5 to 5 oz	0.03125 to 0.0625	Use only on established turf (1 year after seeding) such as bermudagrass, zoysiagrass, centipedegrass, St. Augustinegrass, seashore paspalum, and bahiagrass. Labeled for commercial and residential lawns, golf courses excluding putting greens, sod farms, athletic fields, parks and cemeteries. Use a minimum of 2.5 oz per acre for crabgrass, annual bluegrass and broadleaf weed control and a minimum of 3.75 oz per acre for goosegrass, annual sedge and kyllinga species control. Apply up to 2.5 oz per acre on centipedegrass and St. Augustinegrass due to tolerance concerns. For all other tolerant turfgrasses, do not exceed 5 oz per acre in a single application or 7.1 oz per acre within a calendar year. There is an 8 month overseeding restriction following a 2.5 oz per acre application. Can sprig 2 months following application, or if sprigged first wait 4 months before spraying. Can sod 4 months following application, or if sodded first wait 2 months after rooting before spraying.
metolachlor, MOA 15 (Pennant Liquid) 8 EC (Pennant) 5 G	1.5 fl oz 1.8 lb	4 pt 80 lb	4	Apply to established bermudagrass, centipedegrass, St. Augustinegrass, bahiagrass, and zoysiagrass.
napropamide, MOA 15 (Devrinol) 50 WDG (Devrinol) 2 G	1.5 to 2.2 oz 2.3 to 3.4 lb	4 to 6 lb 100 to 150 lb	2 to 3	Use in established bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, and tall fescue.
oryzalin, MOA 3 (Oryzalin 4 Pro or Surflan A.S.) 4 AS	1.5 fl oz	2 qt	2	Use on established bahiagrass, centipedegrass, tall fescue, St. Augustinegrass, zoysiagrass, and bermudagrass except greens and tees. A total of 3 qt per acre may be used if application is split by applying 1.5 qt per acre followed by 1.5 qt per acre 8 to 10 weeks later. Follow label directions. Do not apply in the spring or summer to tall fescue reseeded the previous fall.
(Harrier WDG) 85 WDG	0.64 to 0.88 oz	1.75 to 2.4 lb	1.4875 to 2.04	Observe same turf tolerances and tall fescue precautions as above. Successful preemergence activity should occur if activated by 0.5 inch of water within 21 days of application. Apply 2.4 lb per acre as a single application or 1.75 lb per acre in sequential applications spaced 12 weeks apart.
oxadiazon, MOA 14 (Oxadiazon 2G) 2 G (Ronstar G or Regal Ronstar A.C.) 2 G	2.3 to 4.6 lb 2.3 to 3.4 lb	100 to 200 lb 100 to 150 lb	2 to 4 2 to 3	Use in established perennial bluegrass, perennial ryegrass, bentgrass, bermudagrass, tall fescue, zoysiagrass, and St. Augustinegrass. Red fescue is not tolerant. Do not apply to dichondra, centipedegrass, putting greens or tees, or to newly seeded areas. Do not apply to bentgrass mowed at less than 3/8 in. Do not apply to wet turf. Rainfall or irrigation after application will improve weed control activity. May be applied when sprigging bermudagrass and zoysiagrass. Do not apply to home lawns.
(Oxadiazon 50 WSB or Ronstar 50 WSB) 50 WP	1.5 to 2.2 oz	4 to 6 lb	2 to 3	Use in dormant, established bermudagrass, St. Augustinegrass, and zoysiagrass in fairways and parks. Should be applied at least 2 to 3 weeks before greenup of turf. May be applied when sprigging bermudagrass and zoysiagrass. Do not use on home lawns.
(Ronstar Flo, Oxadiazon SC or Starfighter L) 3.17 SC	1.85 to 2.8 fl oz	2.52 to 3.81 qt	2 to 3	Use in dormant, established bermudagrass, St. Augustinegrass, and zoysiagrass in fairways and parks. May apply 2 lb a.i. per acre when sprigging bermudagrass. Make application at least 2 to 3 weeks before greenup of turf. Do not use on home lawns.
oxadiazon + benefin, MOA 14 + 3 (Regalstar) 1.5 G	4.5 lb	200 lb	2 + 1	Use on turf and golf courses of bermudagrass, centipede-grass, St. Augustinegrass, zoysiagrass, bentgrass (fairways only), bluegrass, ryegrass, and tall fescue. Do not use on home lawns. Product contains 38% N. Apply to dry foliage.
oxadiazon + prodiamine, MOA 14 + 3 (Regalstar II) 1.2 G	4.5 lb	200 lb	2 + 0.4	Use on turf and golf courses (excluding putting greens) of established bermudagrass, zoysiagrass, St. Augustinegrass, ryegrass, centipedegrass, bentgrass, bluegrass, and tall fescue. Product contains 38% N. Apply to dry foliage.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, SMOOTH and LARGE CRABGRASS, FOXTAILS, other annual grasses (continued)				
pendimethalin, MOA 3 (Pendulum 2 G) (Pre-M 0.86 G) (Signature 0.86 G) (Signature 0.75 G)	 1.72 to 3.44 lb 4 to 5.3 lb 2.67 to 5.34 lb 3.1 to 6.15 lb	 75 to 150 lb 175 to 230 lb 116 to 232 lb 135 to 268 lb	 1,5 to 3 1.5 to 2 1 to 2 1 to 2	Use on established bahiagrass, bermudagrass, centipedegrass, fine fescue, Kentucky bluegrass, perennial ryegrass, St. Augustinegrass, tall fescue, and zoysiagrass. Do not use on winter-overseeded grasses.
pendimethalin, MOA 3 (Pendulum AquaCap) 3.8 CS	1.15 to 2.3 fl oz	3.1 to 6.3 pt	1.5 to 3	Use on noncropland as well as established nonresidential and residential turf areas mowed at least 4 times consisting of bahiagrass, bermudagrass, buffalograss, centipedegrass, St. Augustinegrass, zoysiagrass, Kentucky bluegrass, perennial ryegrass, bentgrass, established *Poa annua* (0.5 inch height or taller), fine fescue, and tall fescue. Do not use on bentgrass or *Poa annua* greens and tees. If lower rate is applied initially, repeat in 6-8 weeks for extended control. Do not reseed or overseed into treated turfgrass for 3 months, or sprig turfgrass for 5 months following application. Do not exceed 4.2 pt per acre on residential and sod farm turfgrass.
prodiamine, MOA 3 (Barricade 65 WG) 65 WG (Barricade 4 FL) 4 FL (Prodiamine 65 WDG, ProClipse 65 WDG or RegalKade 65 WDG) 65 WG	 0.28 to 0.4 oz 0.23 to 1.1 fl oz 0.185 to 0.83 oz	 0.75 to 1.5 lb 0.625 to 3 pt 0.5 to 2.3 lb	 0.5 to 1 0.3125 to 1.5 0.325 to 1.5	May be used on established bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, zoysia, tall fescue, creeping red fescue, perennial bluegrass and ryegrass, and creeping bentgrass. Do not apply to greens. May apply when sprigging or plugging bermudagrass, up to 0.8 lb product per acre.
(RegalKade) 0.5 G	1.5 to 6.9 lb	64 to 300 lb	0.32 to 1.5	See precautions for Barricade except may be used on established turf only. Do not apply more than 150 lb per acre per application. Do not make more than two applications per calendar year. Wait at least 60 days after initial application before making a second application. Prodiamine is coated on a 32-3-12 dry fertilizer carrier.
siduron, MOA 7 (Tupersan) 50 WP	7.3 oz	20 lb	10	Use only on bluegrass, fescue, perennial ryegrass, and certain bentgrasses (check label). Can be used at the rate of 8 lb of formulation when seeding bentgrass, bluegrass, fescue, and ryegrass. Can also be used in newly sprigged or established zoysia. Do not use on bermudagrass, carpetgrass, or centipedegrass.
Preemergence Control, GOOSEGRASS				
dimethenamid, MOA 15 (Tower) 6 L	0.73 fl oz	32 fl oz	1.5	Use on golf course turf, excluding greens, consisting of bentgrass, bluegrass species, fescue species, perennial ryegrass, bahiagrass, bermudagrass species, centipedegrass, St. Augustinegrass, seashore paspalum and zoysiagrass. For extended control, make sequential applications within 5 to 8 weeks at 32 fl oz per acre rate. Irrigate within 24 hours of application for optimum control. Following application, wait 6 weeks to overseed or reseed, wait 2 months to sprig, wait until 2 mowings for new sod, and wait until 4 mowings for newly seeded turf.
Preemergence Control, ANNUAL BLUEGRASS *(Poa annua*)				
benefin + trifluralin, MOA 3 + 3 (Team 2 G) 2 G	2.27 lb	100 lb	2	Apply during late summer before *Poa annua* germinates. Do not apply to turf areas that are to be overseeded. See section on preemergence control of crabgrass or product labels for turfgrass tolerance.
bensulide, MOA 8 (Betasan 4.8-E or Bensumec 4 LF) 4 EC (PreSan) 12.5 G (PreSan) 7 G		several concentrations available	12.5	
dithiopyr, MOA 4 (Dimension 2 EW) 2 EW (Dimension Ultra WSP, Dynamo 40 WSP or Dithiopyr 40 WSP) 40 WP	 0.75 fl oz 0.46 oz	 1 qt 20 oz	0.5	Timely irrigation or rainfall is critical for activation.
indaziflam, MOA 21 (Specticle 20 WSP) 20 WSP	0.057 to 0.115 oz	2.5 to 5 oz	0.03125 to 0.0625	
metolachlor, MOA 15 (Pennant Liquid) 8 EC (Pennant) 5 G	 0.7 to 1.5 fl oz 0.9 to 1.8 lb	 2 to 4 pt 40 to 80 lb	2 to 4	
napropamide, MOA 15 (Devrinol) 50 WDG (Devrinol) 2 G	 1.5 to 2.25 oz 2.3 to 3.4 lb	 4 to 6 lb 100 to 150 lb	2 to 3	
oryzalin, MOA 3 (Oryzalin 4 Pro or Surflan A.S.) 4 AS (Harrier WDG) 85 WDG	1.1 fl oz 0.64 to 0.88 oz	1.5 qt 1.75 to 2.4 lb	1.5 1.4875 to 2.04	Apply full rate unless potentially thin turfgrass cover is a problem caused by dense poa infestation.
oxadiazon, MOA 14 (Ronstar G or Regal Ronstar A.C.) 2 G	2.3 lb	100 lb	2	
(Oxadiazon 2G) 2 G	2.3 to 4.6 lb	100 to 200 lb	2 to 4	
pendimethalin, MOA 3 (Pendulum 2 G) (Pre-M 0.86 G) (Signature 0.86 G) (Signature 0.75 G) (Pendulum AquaCap) 3.8 CS	 1.72 to 3.44 lb 4 to 5.3 lb 2.67 to 5.34 lb 3.1 to 6.15 lb 1.15 to 1.55 fl oz	 75 to 150 lb 175 to 230 lb 116 to 232 lb 135 to 268 lb 3.1 to 4.2 pt	 1.5 to 3 1.5 to 2 1 to 2 1 to 2 1.5 to 2	

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Preemergence Control, ANNUAL BLUEGRASS *(Poa annua*) (continued)				
prodiamine, MOA 3 (Barricade 65 WG) 65 WG (Barricade 4 FL) 4 FL (Prodiamine 65 WDG, ProClipse 65 WDG or RegalKade 65 WDG) 65 WG	0.28 to 0.4 oz 0.23 to 1.1 fl oz 0.185 to 0.83 oz	0.75 to 1.5 lb 0.625 to 3 pt 0.5 to 2.3 lb	0.5 to 1 0.3125 to 1.5 0.325 to 1.5	
pronamide, MOA 3 (Kerb WSP) 50 WP	0.75 to 1 oz	2 to 3 lb	1 to 1.5	Gives preemergence and postemergence control. Apply September 15 to February 1. Can also be used for removal of overseeded grasses; therefore, do not overseed grass if it is desired to maintain a stand. Do not overseed treated area within 90 days of treatment. Injury symptoms from postemergence applications are slow to develop. Use on bermudagrass, zoysiagrass, St. Augustinegrass, and centipedegrass.
Preemergence Control, ANNUAL BLUEGRASS in OVERSEEDED BERMUDAGRASS				
benefin, MOA 3 (Balan) 2.5 G	2.75 lb	120 lb	3	Apply in late summer before *Poa annua* germinates. Perennial ryegrass can be overseeded 6 weeks after Balan 2.5 G is applied.
dithiopyr, MOA 4 (Dimension 2 EW) 2 EW (Dimension Ultra WSP, Dynamo 40 WSP or Dithiopyr 40 WSP) 40 WP	0.75 fl oz 0.46 oz	1 qt 20 oz	0.5	Apply in late summer before *Poa annua* germinates. Perennial ryegrass can be overseeded 6 to 8 weeks after application. Apply only on well-established bermudagrass. Do not reapply in fall or winter after overseeding unless injury can be tolerated.
prodiamine, MOA 3 (Barricade 65 WG) 65 WG	0.213 to 0.367 oz	0.58 to 1 lb	0.37 to 0.65	Use on golf courses (excluding putting greens) when overseeding with perennial ryegrass at a minimum seeding rate of 350 lb per acre. Apply 8 to 10 weeks before overseeding and expect 70 percent or greater control. For best potential control, use higher rate and shorter time interval before overseeding. However, this could increase ryegrass seedling mortality or temporarily reduce root growth.
Preemergence Control, ANNUAL BLUEGRASS in OVERSEEDED BERMUDAGRASS GREENS AND TEES				
fenarimol (Rubigan) 50 WSP (Rubigan A.S.) 1 AS	1 to 1.5 oz 4 to 6 fl oz	44 to 65 oz 1.375 to 2.11 gal	1.4 to 2	Use as a preemergence program in bermudagrass greens and tees to be overseeded. Use two or three applications to reach a total of 3 oz per 1000 sq ft for the 50 WSP or 12 oz per 1000 sq ft for the 1 AS. Rubigan should be applied before the germination of *Poa annua* and the last application 14 days before overseeding with perennial ryegrass or 30 days prior to overseeding with *Poa trivialis* or bentgrass. In North Carolina *Poa annua* germination can occur from late August to mid-September under irrigated conditions. See label for timing of applications and other precautions.
Preemergence and Postemergence Control, ANNUAL BLUEGRASS				
ethofumesate, MOA 8 (Prograss) 1.5 EC	2 fl oz	2.67 qt	1	For control of annual bluegrass in dormant bermudagrass overseeded with perennial ryegrass or in established perennial ryegrass turf. Rates are per application. The first application should be 30 to 45 days after overseeding with perennial ryegrass. The second application should be 21 to 28 days later. Do not apply Prograss to overseeded bermudagrass after January 1 in North Carolina.
(PoaConstrictor) 4 SC	0.55 to 1.47 fl oz	1.5 to 4 pt	0.75 to 2	Must be professionally applied to residential and nonresidential turf including golf courses and sod farms. May be applied to established perennial ryegrass, Kentucky bluegrass, creeping bentgrass, tall fescue, St. Augustinegrass, and dormant bermudagrass. Do not apply to putting greens. Delay application at least 8 weeks after a pgr application. Fall annual bluegrass control best during period of maximum germination. Spring appliclations most effective following fall applications. For overseeded bermudagrass, apply 1 to 2 weeks after perennial ryegrass emergence and repeat at 21- to 28-day intervals. Do not apply to bermudagrass 4 weeks prior to breaking winter dormancy.
Postemergence Control and Seedhead Suppression, ANNUAL BLUEGRASS in OVERSEEDED BERMUDAGRASS FAIRWAYS, TEES				
bispyribac-sodium, MOA 2 (Velocity) 17.6 SG	0.046 to 0.138 oz	2 to 6 oz	0.021875 to 0.065625	Do not apply to putting greens, ryegrass mowed to less than 0.375 in., or non-overseeded bermudagrass. Apply between Feb. 1 and March 15. Make first application when annual bluegrass begins flowering. If actively flowering, use the low rate and re-treat in 28 to 35 days. If not actively flowering, use the low rate and re-treat in 14 to 21 days with the low rate. Do not apply if air temperature is less than 50°F within 3 days after application. Check label for further special instructions.
Postemergence Control, ANNUAL BLUEGRASS, OVERSEEDED PERENNIAL RYEGRASS, TALL FESCUE, *Poa trivialis*				
flazasulfuron, MOA 2 (Katana) 25 DG	0.011 to 0.069 oz	0.5 to 3 oz	0.0078 to 0.0469	For use on well established bermudagrass, zoysiagrass and centipedegrass grown on nonresidential turf including industrial parks, tank-sod- and seed farms, cemeteries, athletic field and commercial lawns. Apply a maximum of 1.5 oz per acre on fully green centipedegrass. 3 oz per acre needed for annual bluegrass control and best if applied in spring. 0.5 to 1.5 oz per acre will control perennial and Italian ryegrass. 1.5 oz per acre needed for tall fescue control. 2.25 to 3 oz per acre needed for *poa trivialis* control. Include a nonionic surfactant at 0.25% by volume.
foramsulfuron, MOA 2 (Revolver) 0.19 SC	0.2 to 0.6 fl oz	8.8 to 26.2 fl oz	0.013 to 0.039	For use on bermudagrass and zoysiagrass grown on home lawns, golf courses and sod farms. Do not use on warm season turfgrass collars surrounding bentgrass greens. May be applied up to 1 week prior to overseeding. Do not apply within 2 weeks of bermudagrass sprigging. Apply in 25 to 60 gal water per acre. Rainfast after 2 hours. Surfactant not required.
rimsulfuron, MOA 2 (TranXit GTA) 25 DF	0.046 to 0.092 oz	2 to 4 oz	0.03125 to 0.0625	May be applied to bermudagrass on professionally managed sports facilities at professional and collegiate levels, golf courses, sod farms, industrial and commercial lawns. For annual bluegrass control, apply November through December and again February through March at 2 oz per acre. May be applied 10 to 14 days prior to overseeding. For overseeded removal, apply 2 oz per acre 3 to 4 weeks before desired removal date, and repeat 3 weeks later. For all grass control, apply 4 oz per acre if single application only. A nonionic surfactant at 0.25% by volume is required. Do not apply to cool-season turfgrasses, residential lawns, bermudagrass putting greens, or newly sprigged/sodded bermudagrass.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, ANNUAL BLUEGRASS, OVERSEEDED PERENNIAL RYEGRASS, TALL FESCUE, *Poa trivialis* (continued)				
sulfosulfuron, MOA 2 (Certainty) 75 DG	0.017 to 0.046 oz	0.75 to 2 oz	0.035 to 0.09375	May be applied to certain ornamental native grasses and also bermudagrass species, zoysiagrass, centipedegrass, St. Augustinegrass, and kikuyugrass grown on sod farms, golf courses (excluding greens), commercial and residential turf that is highly managed, and other noncrop areas. Use 1.5 to 2 oz per acre for fall annual bluegrass control 7 to 10 days before overseeding. Use 0.75 to 1.25 oz per acre for fall or winter control in nonoverseeded bermudagrass, and reapply if needed but not before 21 days after initial application. For tall fescue control, two applications may be required at 4- to 10-wk intervals. Perennial ryegrass control not as complete as with Revolver, TranXit GTA, or Monument 75 WG. Use a nonionic surfactant at 0.25% by volume. Do not exceed 2.66 oz per acre per year.
trifloxysulfuron, MOA 2 (Monument 75 WG) 75 WG	0.0023 to 0.0129 oz	0.1 to 0.56 oz	0.0047 to 0.0263	May be applied to residential bermudagrass and zoysiagrass and also on golf courses, sod farms, and other nonresidential turf areas. A nonionic surfactant at 0.25 to 0.5% by volume is recommended. Temporary discoloration may occur if used with MSO or COC. May be applied 3 weeks prior to overseeding. Use rates of 0.1 to 0.3 oz per acre to remove overseeded perennial ryegrass and *Poa trivialis* to aid bermudagrass spring transition. Labeled turf species can be seeded or sprigged into treated areas 4 weeks after application.
Preemergence and Postemergence Control, ANNUAL BLUEGRASS and certain winter annual broadleaf weeds				
atrazine, MOA 5 (AAtrex or Atrazine) 4 L (AAtrex Nine-O or Atrazine 90) DF, WSP, WG	0.75 to 1.5 fl oz 0.025 to 0.05 lb	1 to 2 qt 1.1 to 2.2 lb	1 to 2	Use on centipedegrass, St. Augustinegrass, and dormant bermudagrass. Apply November 15 to December 31. Follow label directions.
simazine, MOA 5 (Sim-Trol DF, Simazine WG, DF or Regal Wynstar DF) 90 WDG or DF (Princep Liquid, Simazine or Sim-Trol) 4 L	0.4 to 0.8 oz 0.75 to 1.5 fl oz	1.1 to 2.2 lb 1 to 2 qt	1 to 2	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. See label for instructions on newly sprigged turfgrass or on hybrid bermudagrass. Apply November 15 to December 15. Follow label directions.
Preemergence Control, Certain Broadleaf Weeds				
isoxaben, MOA 21 (Gallery 75 Dry Flowable) 75 DF	0.25 to 0.5 oz	0.66 to 1.33 lb	0.5 to 1	All established turfgrasses are tolerant. Check label for specific weeds controlled.
pendimethalin, MOA 3 (Pendulum AquaCap) 3.8 CS	1.15 to 1.55 fl oz	3.1 to 4.2 pt	1.5 to 2	See section on preemergence control of crabgrass or product label for turfgrass tolerance. Provides preemergence control of summer broadleaf weeds, such as prostrate spurge, prostrate knotweed, and purslane species, as well as winter broadleaf weeds, such as yellow woodsorrel, hop clover, cudweed species, common chickweed, lawn burweed, henbit, and corn speedwell when applied before expected germination.
Preemergence and Postemergence Control CRABGRASS, GOOSEGRASS, OTHER ANNUAL GRASSES, BROADLEAF WEEDS, SEDGES				
mesotrione, MOA 27 (Tenacity) 4 SC	0.092 to 0.183 fl oz	4 to 8 fl oz	0.125 to 0.25	Use on residential turf, golf courses (not greens) and sod farms for pre- and postemergence weed control. Tolerant turfgrasses include St. Augustinegrass, centipedegrass, tall fescue, fine fescue, Kentucky bluegrass, and perennial ryegrass. Add a nonionic surfactant and repeat application after 2 to 3 weeks for improved postemergence control. Tank mix with Barricade 65 WG for extended preemergence grassy weed control. Can be applied at seeding to all tolerant grasses except fine fescue. After turf germination, wait 4 weeks or until turf has been mowed twice before making a postemergence application. Also controls henbit, chickweed, dandelion, white clover, Florida betony, Florida pusley, ground ivy, oxalis, wild violet, creeping bentgrass, and yellow nutsedge.
sulfentrazone + prodiamine, MOA 14 + 3 (Echelon 4 SC) 4 SC	0.184 to 0.826 fl oz	0.5 to 2.25 pt	0.25 to 1.125	For use in residential and institutional lawns, athletic fields, sod farms, golf course fairways and roughs, roadsides, utility right-of-ways, railways, and industrial areas. Apply to turf following a second mowing, if a good root system has been established. Apply up to 12 fl oz per acre to bentgrass at 0.5 inches or higher, fine fescue, and perennial ryegrass. Apply 18 to 24 fl oz per acre to perennial bluegrass, tall fescue, and all warm season grasses except St. Augustinegrass (do not apply) and bermudagrass (apply 18 to 36 fl oz per acre). For sod production, apply 6 months after establishment, and do not harvest within 3 months. Do not apply with adjuvants or surfactants. Echelon should not be applied to cool-season turf with N-containing fertilizers unless some short-term discoloration is tolerable.
Postemergence Control, CRABGRASS, GOOSEGRASS				
fenoxaprop, MOA 1 (Acclaim Extra) 0.57 EC	0.3 to 0.9 fl oz	0.8 to 2.4 pt	0.057 to 0.174	Use only on perennial ryegrass, fine fescue, tall fescue, Kentucky bluegrass, and zoysiagrass. Reduced vigor or discoloration can occur. Rate depends upon leaf number or tillers of grass weeds and turf tolerance. Check label. A second application may be applied after 14 days.
	0.08 fl oz	3.5 fl oz	0.016	Apply only to established Penncross bentgrass maintained at a minimum cutting height of at least 0.25 in. Bentgrass should be established for one growing season. Do not apply to greens. Applications should be made at a minimum of 21-day intervals, beginning in the spring when grassy weeds first emerge and are not larger than two- leaf. Repeat applications throughout the summer as new infestations of one- to two-leaf grassy weeds occur. See label for other restrictions.
metribuzin, MOA 5 (Sencor 75 Turf) 75 WDF	0.12 to 0.24 oz	0.33 to 0.67 lb	0.25 to 0.5	Recommended for application by commercial applicators only on established bermudagrass turf (such as parks, athletic fields, golf course fairways, cemeteries, and sod farms) that has a mowing height of 0.5 in. or greater. Apply when turf is vigorously growing and not under stress. Repeat if necessary in 7 to 10 days. Do not make more than two applications per season. Do not apply to greens, tees, or aprons.
sethoxydim, MOA 1 (Segment, Sethoxydim SPC) 1 EC	0.8 to 1.38 fl oz	2.25 to 3.75 pt	0.28 to 0.47	Use in seedling and established centipedegrass and fine fescues. Apply 2.25 pt to grasses up to 6 inches and 3.75 pt to grasses up to 12 inches if turf is tolerant. Does not control yellow and purple nutsedge, annual bluegrass or broadleaf weeds. Apply no sooner than 3 weeks after spring greenup of centipedegrass. Apply before crabgrass becomes extensively tillered. Delay all treatments until newly planted centipedegrass has 3 in. of new stolon growth. Do not mow within 7 days before or after application. Two applications 3 weeks apart will suppress bahiagrass. Additives or adjuvants not required.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, SMOOTH and LARGE CRABGRASS, BARNYARDGRASS, WHITE AND HOP CLOVER, COMMON DANDELION, DOLLARWEED, FOXTAILS				
quinclorac, MOA (27 + 4) (Drive 75 DF, Quinclorac 75 DF or Quinclorac SPC 75 DF) 75 DF (Drive XLR8) 1.5 SL	0.367 oz 1.45 fl oz	1 lb 2 qt	0.75 0.75	For use in residential and nonresidential turf that is established, or newly seeded, overseeded, or sprigged. Refer to label for specific varieties. Apply to common and hybrid bermudagrass, Kentucky bluegrass, annual bluegrass, buffalograss, tall fescue, annual and perennial ryegrass, creeping bentgrass, and zoysiagrass. Can also be applied to fine fescue but must be in a blend. Some discoloration of hybrid bermudagrass, creeping bentgrass or fine fescue may occur. Do not apply to bahiagrass, centipedegrass, St. Augustinegrass, or dichondra. Do not use on golf course greens or collars. The addition of methylated seed oil (1.5 pt per acre or 0.55 oz per 1,000 sq ft) or a crop oil concentrate (2 pt per acre or 0.73 oz per 1,000 sq ft) is required for control. Application to weeds under stress will result in poor control. Irrigation 24 hours prior to application is recommended if drought conditions exist. Some ornamental plants are sensitive to Drive. See label for further precautions.
Postemergence Control, SMOOTH and LARGE CRABGRASS, BARNYARDGRASS, FOXTAILS, and many broadleaf weeds				
quinclorac + sulfentrazone + 2,4-D amine + dicamba, MOA (27 + 4) + 14 + 4 + 4 (Q4) 1.54 L	2.57 to 2.94 fl oz	7 to 8 pt	1.35 to 1.54	For use in fully dormant bermudagrass and zoysiagrass as well as cool-season turf including annual bluegrass and ryegrass, perennial bluegrass and ryegrass, and fescue species. Do not apply to bahiagrass, bentgrass (creeping, 'Seaside,' 'Colonial'), centipedegrass, St. Augustinegrass, carpetgrass, and golf course greens, tees, and collars. May be applied to home lawns. Apply to seedling grasses after second or third mowing, or 28 days after emergence. Wait 3 to 4 weeks after sodding, sprigging, or plugging operations to apply. Wait 4 weeks after application to seed.
(Q4 Plus) 1.79 L	1.8 to 3 fl oz	5 to 8 pt	1.12 to 1.79	Contains 0.25 lb ai per gal more quinclorac than Q4. Same statements as above except can be applied to actively growing bermudagrass after spring greenup but use only 5 to 7 pt per acre.
quinclorac + 2,4-D amine + dicamba, MOA (27 + 4) + 4 + 4 (Quincept) 1.875 SL	2.57 to 2.94 fl oz	7 to 8 pt	1.64 to 1.875	For use in residential and nonresidential cool season turf, including athletic fields, golf courses, and sod farms. Do not use on centipedegrass, St. Augustinegrass, bahiagrass, zoysiagrass, bermudagrass, bentgrass, or dichondra. Can apply to tolerant turfgrass seedlings after third mowing, and to newly sodded, sprigged, or plugged grasses 3 to 4 weeks after operations.
quinclorac + mecoprop + dicamba, MOA (27 + 4) + 4 + 4 (Onetime) 2.45 SL	0.5 to 1.45 fl oz	0.68 to 2 qt	0.4165 to 1.225	For use in warm- and cool-season residential and non-residential turf, including but not limited to commercial property, parks, roadsides, schools, athletic fields, cemeteries, and golf courses. May be applied to species of bermudagrass, bluegrass, fescue, and ryegrass as well as creeping bentgrass, seashore paspalum, and zoysiagrass. Use with methylated seed oil at 1.5 pt per acre. Allow 28 days of seedling or sprig growth before application. If treating first, allow 28 days before seeding or sprigging. Do not apply to golf course collars or greens or to turf grown for sod. Use low rate in 2 split applications when treating creeping bentgrass.
carfentrazone + quinclorac, MOA 14 + (27 + 4) (SquareOne) 75 WG	0.184 to 0.413 oz	8 to 18 oz	0.35 to 0.79	Can use up to 12 oz per acre 7 days after emergence from seed or sod installment on bluegrass and fescue species and perennial ryegrass. 18 oz per acre can be used 7 days after seed, sod or sprig operations on bermudagrass species, centipedegrass and seashore paspalum. Wait 14 days after emergence for zoysiagrass. May apply to residential, commercial, and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. Adjuvants not required but may help on mature weeds.
sulfentrazone + quinclorac, MOA 14 + (27 + 4) (Solitare) 75 WG	0.367 to 0.735 oz	1 to 2 lb	0.75 to 1.5	Use up to 21 oz per acre on well-established tall fescue, Kentucky bluegrass and perennial ryegrass. Use up to 32 oz per acre on well-established bermudagrass, centipedegrass, zoysiagrass and seashore paspalum. May be applied to residential, commercial, and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. After treatment, wait at least 1 month before reseeding, overseeding (use slit seeder for best results), or sprigging. Wait at least 3 months for sod establishment and do not spray within 3 months of harvest. Solitare will control goosegrass in the 1 to 4 leaf stage. Yellow nutsedge and kyllinga species are also controlled. Do not apply with a spray adjuvant.
Postemergence Control, LARGE CRABGRASS, CARPETGRASS, BULL PASPALUM, BAHIAGRASS, FOXTAILS, and many broadleaf weeds, including CHAMBERBITTER, CORN SPEEDWELL, DICHONDRA, DOLLARWEED, DOVEWEED, FLORIDA BETONY, FLORIDA PUSLEY, LESPEDEZA, OXALIS, SPURGE, VIRGINIA BUTTONWEED, KYLLINGA				
thiencarbazone-methyl + iodosulfuron + dicamba, MOA 14 + 2 + 4 (Celsius WG) 68 WG	0.057 to 0.113 oz	2.5 to 4.9 oz	0.106 to 0.208	For use by licensed applicators in residential and commercial lawns, golf courses (excluding greens), sports fields, parks, recreational areas, roadsides, school grounds, and sod farms. Provides up to 60 days residual control. Use on bermudagrass, zoysiagrass, centipedegrass, and St Augustinegrass. Apply maximum 7.4 oz per acre per season. Safe to use at high temperatures. Ryegrass can be overseeded 2 weeks after application. Apply 30 days prior to seeding bermudagrass or zoysiagrass. Wait 2 weeks after bermudagrass seedlling emergence or sprigging operation before applying. For zoysiagrass, wait 3 weeks after seedling emergence before applying. A nonionic surfactant or methylated seed oil at 0.25% v/v is required for optimum control.
Postemergence Control, GOOSEGRASS				
diclofop-methyl, MOA 1 (Illoxan) 3 EC	0.75 to 1 fl oz	32 to 43 fl oz	0.75 to 1	Apply in established bermudagrass. Rate depends upon number of goosegrass leaves from one to four leaves. Check label for specific rates.
foramsulfuron, MOA 2 (Revolver) 0.19 SC	0.39 fl oz	17 fl oz	0.025	For use on bermudagrass and zoysiagrass grown on home lawns, golf courses and sod farms. See precautions listed under annual bluegrass section. For goosegrass control, apply 17 fl oz per acre on plants up to 2 tillers followed by 17 fl oz per acre 2 weeks later.
sulfentrazone, MOA 14 (Dismiss) 4 SC	0.275 fl oz	0.75 pt	0.375	May be applied to home lawns. For use on creeping bentgrass, tall and fine fescue, perennial ryegrass, Kentucky bluegrass, and all warm-season turf species except St. Augustinegrass. See precautions listed under purple and yellow nutsedge section. For goosegrass control, apply 0.75 pt per acre on plants up to 2 tillers.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, BAHIAGRASS, CRABGRASS, DALLISGRASS, GOOSEGRASS, NUTSEDGE, ANNUAL SEDGES, SANDBUR				
MSMA, MOA 17 (various brands)		several concentrations	2 to 3	Bermudagrass is tolerant. Bluegrass, fescue, and zoysia are slightly sensitive. Do not use on bentgrass, carpetgrass, centipedegrass, or St. Augustinegrass. MSMA restrictions: For existing golf courses, spot treat (100 sq ft per spot) not to exceed 25% of total acreage. For new courses, make 1 broadcast application per year. For sod farms, make 1 to 2 broadcast applications per year and maintain 25 feet buffer around permanent water bodies. For highway rights of way, make 2 broadcast applications and maintain 100 feet buffer around permanent water bodies. MSMA use will be cancelled as of Dec. 31, 2012 with use of existing stocks permitted through 2013.
Postemergence Control, CRABGRASS, GOOSEGRASS, SANDBUR, DALLISGRASS				
MSMA, MOA 17 (various brands) + metribuzin, MOA 5 (Sencor 75 Turf) 75 WDF		several concentrations + 0.17 to 0.33 lb	1.5 to 2 + 0.125 to 0.25	See remarks for MSMA and metribuzin. The combination improves goosegrass control. Should be applied to bermudagrass only.
Postemergence Control, CRABGRASS, GOOSEGRASS, SANDBUR, DALLISGRASS and many broadleaf weeds				
MSMA + 2,4-D + MCPP + dicamba, MOA 17 + 4 + 4 + 4 (Trimec Plus) 2.88 F	3 to 5 fl oz	1 to 1.67 gal	1.8 + 0.48 + 0.48 + 0.12	Use on bermudagrass, perennial bluegrass, fescues, perennial ryegrass, and zoysiagrass. A second application will enhance control of dallisgrass or goosegrass.
MSMA + 2,4-D + clopyralid + dicamba, MOA 17 + 4 + 4 + 4 (Millennium Ultra Plus) 2.42 L	3 to 5 fl oz	1 to 1.67 gal	2.42 to 4.04	Do not use on residential turf. Apply to bermudagrass, zoysiagrass, tall fescue, perennial bluegrass, and perennial ryegrass. Apply to seeded grasses after third mowing. Wait 3 to 4 weeks after application to seed. Do not exceed 1 gallon per acre on cool-season grasses and 1.67 gallons per acre on warm-season grasses.
Postemergence Control, CRABGRASS, GOOSEGRASS, SANDBUR				
asulam, MOA 18 (Asulox) 3.34 SL	1.8 fl oz	5 pt	2	Use only on St. Augustinegrass and Tifway 419 turf. On golf courses, use only on fairways and roughs.
Postemergence Control, YELLOW NUTSEDGE, ANNUAL SEDGE				
bentazon, MOA 6 (Basagran T/O or Lescogran) 4 SL	0.75 to 1.5 fl oz	1 to 2 qt	1 to 2	For control of yellow nutsedge in established bluegrass, fescues, bentgrass, ryegrass, bermudagrass, bahiagrass, St. Augustinegrass, centipedegrass, and zoysiagrass. Apply to yellow nutsedge when actively growing under good soil moisture conditions. Additional applications may be made at intervals of 10 to 14 days until nutsedge is controlled.
Postemergence Control, PURPLE and YELLOW NUTSEDGE, KYLLINGA SPECIES				
flazasulfuron, MOA 2 (Katana) 25 DG	0.034 to 0.069 oz	1.5 to 3 oz	0.023 to 0.0469	For use on well established bermudagrass, zoysiagrass and centipedegrass grown on nonresidential turf including golf course fairways, roughs and tees, and industrial parks, tank-sod- and seed farms, cemeteries, athletic field and commercial lawns. Apply a maximum of 1.5 oz per acre on fully green centipedegrass. 3 oz per acre needed for perennial nutsedge and some annual sedge species control. Repeat applications in 2 to 6 weeks when nutsedge or sedge growth is evident. 1.5 to 2.25 oz per acre will control kyllinga species. Maintain a 25 feet nontreated border beside susceptible turf species. Can overseed in 2 weeks if applied up to 1. 5 oz per acre. Wait 4 weeks if applied more than 1.5 oz per acre. Include a nonionic surfactant at 0.25% by volume.
imazaquin, MOA 2 (Image 70 DG) 70 DG	0.128 to 0.256 oz	0.357 to 0.714 lb	0.25 to 0.5	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Do not apply during spring greenup. Temporary yellowing may occur. Add a nonionic surfactant at 2 pt per 100 gal of spray solution. Addition of MSMA at 1.5 lb active per acre will improve sedge control in MSMA tolerant turfgrasses.
halosulfuron, MOA 2 (Sedgehammer or Prosedge) 75 WDG	0.9 g	0.67 to 1.33 oz	0.031 to 0.062	May be applied to established residential and commercial bermudagrass, bahiagrass, zoysiagrass, centipedegrass, St. Augustinegrass, creeping bentgrass, Kentucky bluegrass, perennial ryegrass, tall fescue, and fine fescue. Apply broadcast when sedges have reached the three- to eight-leaf stage. Use lower rate for light infestations and higher rate for heavy infestations. A second treatment will usually be required 6 to 10 weeks after the initial treatment. Use an 80% active nonionic surfactant at 2 qt per 100 gal of spray solution (0.5% by volume). Do not exceed 1 to 2 pt of surfactant per acre. Do not apply to putting greens. Sedgehammer and Prosedge only suppress green kyllinga.
MSMA, MOA 17 (various brands)		several concentrations	2 to 3	See remarks for MSMA above. Will require at least two applications 7 to 10 days apart.
sulfosulfuron, MOA 2 (Certainty) 75 DG	0.017 to 0.029 oz	0.75 to 1.25 oz	0.035 to 0.059	May be applied to certain ornamental native grasses and also bermudagrass species, zoysiagrass, centipedegrass, St. Augustinegrass, and kikuyugrass grown on sod farms, golf courses (excluding greens), commercial and residential turf that is highly managed, and other noncrop areas. Use 0.75 to 1.25 oz per acre, and repeat in 4 to 10 weeks if needed. Use a nonionic surfactant at 0.25% by volume.
trifloxysulfuron, MOA 2 (Monument 75 WG) 75 WG	0.0023 to 0.0129 oz	0.1 to 0.56 oz	0.0047 to 0.0263	May be applied to residential bermudagrass and zoysiagrass and also on golf courses, sod farms, and other nonresidential turf areas. A nonionic surfactant at 0.25 to 0.5% by volume is recommended. Temporary discoloration may occur if used with MSO or COC. Use rates of 0.33 to 0.56 oz per acre for sedge and kyllinga species control. Labeled turf species can be seeded or sprigged into treated areas 4 weeks after application. Repeat application may be needed in 4 to 6 weeks.
Postemergence Control, PURPLE and YELLOW NUTSEDGE, KYLLINGA SPECIES, and various broadleaf weeds				
sulfentrazone, MOA 14 (Dismiss) 4 SC	0.092 to 0.275 fl oz	0.25 to 0.75 pt	0.125 to 0.375	May be applied to home lawns. For use on creeping bentgrass, tall and fine fescue, perennial ryegrass, Kentucky bluegrass, and all warm-season turf species except St. Augustinegrass. Wait 3 months to seed, overseed, or sprig unless overseeding bermudagrass with perennial ryegrass, which only requires a 4- to 6-week waiting period after application. Apply to seedling grasses after second mowing and to new sod 6 months after establishment.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, PURPLE and YELLOW NUTSEDGE, KYLLINGA SPECIES, and various broadleaf weeds (continued)				
sulfentrazone + imazethapyr, MOA 14 + 2 (Dismiss South) 4 SC	0.22 to 0.33 fl oz	9.5 to 14.4 fl oz	0.29 to 0.45	May be applied to home lawns, athletic fields, sod farms, golf course fairways and roughs, and various non-crop sites. For use on bahiagrass, bermudagrass, centipedegrass, and zoysiagrass. Do not apply to soils classified as sand with less than 1% organic matter. Do not reseed, overseed, or sprig within 1 month of application. Expect slight perennial ryegrass injury if overseeded 2 to 4 weeks after application. Allow 3 month sod establishment before treatment.
sulfentrazone + metsulfuron, MOA 14 + 2 (Blindside) 66 WG	0.075 to 0.23 oz	3.25 to 10 oz	0.134 to 0.413	May be applied to established residential, commercial and institutional lawns, athletic fields, sod farms, and golf course fairways and roughs. Use up to 6.5 oz per acre on Kentucky bluegrass and tall fescue and 10 oz per acre on bermudagrass, centipedegrass, St Augustinegrass and zoysiagrass. Do not reseed, overseed, or sprig within 1 month of application. Expect slight perennial ryegrass injury if overseeded 6 to 8 weeks after application. Allow 3 months sod establishment before treatment. No adjuvant needed.
Postemergence Control, BAHIAGRASS, CRABGRASS, YELLOW and PURPLE NUTSEDGE, ANNUAL SEDGE, KYLLINGA SPECIES				
imazapic, MOA 2 (Plateau DG) 70 DG	0.032 to 0.066 oz	1.43 to 2.86 oz (1 to 2 water soluble packs)	0.063 to 0.125	For use on centipedegrass only when grown as fine turf in nonresidential areas such as commercial and industrial turf, golf courses, and other recreational areas. Not for use in home lawns. Do not use on other turfgrass species. See label for mixing instructions of water soluble packs. A repeat application may be needed on tough to control perennial weeds such as bahiagrass. The highest labeled rate may discolor centipedegrass by causing a red color.
Postemergence Control, DANDELION, CARPETWEED, CAROLINA CRANESBILL, CURLY DOCK, PLANTAIN, DICHONDRA, SHEPHERDS-PURSE, YELLOW ROCKET				
2,4-D amine, MOA 4 (various brands) 4 SL	3 to 4 tsp	1.5 to 2 pt	0.75 to 1	Cut rate one-half for bentgrass, carpetgrass, centipedegrass, and St. Augustinegrass. Spray when weeds are young and actively growing. To reduce danger of injury to flowers and ornamentals by spray drift, use low pressure and do not spray on windy days.
Postemergence Control, COMMON CHICKWEED, MOUSEEAR CHICKWEED, CREEPING CHARLIE or GROUND IVY, DANDELION, LESPEDEZA, BLACK MEDIC, SPOTTED SPURGE, HOP or WHITE CLOVER				
mecoprop, MOA 4 (MCPP-p 4 Amine) 1.9 L (Mecomec 2.5) 1.16 L (Mecomec 4) 1.74 L	 1 to 1.5 fl oz 1.5 to 2.25 fl oz 0.75 to 1.5 fl oz	 2.7 to 4 pt 4 to 6 pt 2 to 4 pt	 0.64 to 0.95 0.58 to 0.87 0.43 to 0.87	Observe same precaution as for 2,4-D. May be used on bentgrass, carpetgrass, centipedegrass, St. Augustinegrass, and other turf grasses.
Postemergence Control, CHICKWEED, WHITE CLOVER, DANDELION, CURLY DOCK, HAWKWEED, HENBIT, KNOTWEED, RED SORREL, KNAWEL, SPURWEED, SPOTTED SPURGE, WILD STRAWBERRY, YARROW				
dicamba, MOA 4 (Banvel) 4 SL	1 to 2 tsp	0.5 to 1 pt	0.25 to 0.5	Apply as foliar spray to growing weeds. Prevent injury to ornamentals. Avoid rooting zone of shallow-rooted trees and shrubs.
diglycolamine, MOA 4 (Vanquish) 4 SL	1 to 4.5 tsp	0.5 to 2 pt	0.25 to 1	Do not exceed 1 pt per acre on bentgrass, carpetgrass, buffalograss, and St. Augustinegrass. Apply to newly seeded grasses after the second mowing. Do not exceed 0.25 pt per acre on extended sensitve plant roots on sandy soils and 0.5 pt per acre on clay soils.
Postemergence Control, ALL WEEDS LISTED UNDER 2,4-D AMINE, MCPP, DICAMBA, and DIGLYCOLAMINE SECTIONS				
2,4-D amine + MCPP + dicamba, MOA 4 + 4 + 4 (Trimec) various formulations (Triplet SF) 3.23 L or (Three-Way Selective Herbicide) 3.23 L	See label 0.75 to 1.5 fl oz	See label 2 to 4 pt	See label 0.8075 to 1.615	Check individual labels for specific instructions and precautions. Generally, 1) apply to grass seedlings after second mowing; 2) apply to sodded, sprigged, or plugged turf 3 to 4 weeks after operations; and 3) wait 3 to 4 weeks after application to seed. Many products labeled for tall fescue, perennial ryegrass, perennial bluegrass, bermudagrass, and St. Augustinegrass. Some products labeled for bentgrass putting greens, bahiagrass, zoysiagrass, and centipedegrass. Some products labled for home use when applied by a commercial applicator.
2,4-D amine + MCPP + dichlorprop, MOA 4+ 4 + 4 (Spoiler) 4.11 L (Triamine) 2.48 L	0.62 to 1.47 fl oz 0.64 to 1.47 fl oz	1.7 to 4 pt 1.75 to 4 pt	0.873 to 2.055 0.543 to 1.24	
MCPA + MCPP + dicamba, MOA 4 + 4 + 4 (Tri-Power) 4 L	0.7 to 1.5 fl oz	2.5 to 4.1 pt	1.25 to 2.05	
Postemergence Control, CURLY DOCK, BROADLEAF DOCK, GALINSOGA, NIGHTSHADE, CLOVER (RED, HOP, WHITE, SWEET) GOLDENROD, MUSK THISTLE, SPEEDWELLS, COMMON VETCH, HAIRY BUTTERCUP, BROADLEAF PLANTAIN				
clopyralid, MOA 4 (Lontrel) 3 EC	0.1 to 0.5 fl oz	0.25 to 1.33 pt	0.09 to 0.5	Do not apply to home lawns. May be used on bentgrass, Kentucky bluegrass, creeping, red, chewings, sheep and tall fescue, perennial ryegrass, bermudagrass, bahiagrass, buffalograss, centipedegrass, zoysiagrass, and St. Augustinegrass. Do not apply to putting greens and tees. Should be applied in a minimum of 20 gal of water per acre. Surfactants are not necessary. Do not apply to exposed roots of certain trees and shrubs (legumes such as acacia, locust, mimosa, redbud, or mesquite) or *Tilia* spp. Do not use treated clippings for mulching and compost during the growing season of application.
ALL WEEDS LISTED UNDER 2,4-D AMINE, CLOPYRALID, DICAMBA, and DIGLYCOLAMINE SECTIONS				
2,4-D amine + clopyralid + dicamba, MOA 4 + 4 + 4 (Millennium Ultra) 3.75 L (Millennium Ultra 2) 3.56 L	 0.36 to 1.1 fl oz 0.55 to 1.1 fl oz	 1 to 3 pt 1.5 to 3 pt	 0.47 to 1.41 0.67 to 1.34	Do not apply to home lawns. Use on perennial bluegrass, ryegrass, and fescue species, bentgrass (excluding greens and tees), bermudagrass, zoysiagrass, and bahiagrass. Do not apply to seedling grasses until well established. Wait 3 to 4 weeks after application to seed.
Postemergence Control, VIRGINIA BUTTONWEED, CHICKWEED SPECIES, WHITE CLOVER, DANDELION, HENBIT, GROUND IVY, PROSTRATE KNOTWEED, MATCHWEED, BLACK MEDIC, PLANTAIN SPECIES, COMMON WOODSORREL				
2,4-D amine + fluroxypyr + dicamba, MOA 4 + 4 + 4 (Escalade) 4.4 SL or (Escalade Low Odor) 4.4 SL (Escalade 2) 4 SL	 0.46 to 1.84 fl oz 0.36 to 1.1 fl oz	 1.25 to 5 pt 1 to 3 pt	 0.69 to 2.75 0.5 to 1.5	Use on perennial bluegrass and ryegrass, tall fescue, creeping bentgrass (excluding greens and tees), bermudagrass species, bahiagrass, zoysiagrass, and St. Augustinegrass in residential, industrial, and institutional lawns, parks, cemeteries, athletic fields, golf courses, and sod farms. Use on St. Augustinegrass sod farms only. Apply 1 to 2 pt per acre on creeping bentgrass and 1.5 to 1.8 pt per acre on warm season turf grown for sod. Apply 2 to 3 pt per acre to all other turf areas. For non-turf areas, rate can be increased to 2 to 5 pt per acre. Application can be made to grass seedlings after second mowing and to newly sodded, sprigged, or plugged grasses 3 to 4 weeks after operations.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, Winter and Summer Annual Broadleaf Weeds				
bentazon + atrazine, MOA 6 + 5 Create by tank mixing			0.5 to 0.75 + 0.5 to 0.75	Apply to bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Check individual labels for weeds controlled and weed size for proper application.
Postemergence Control, BLACK MEDIC, WHITE, HOP CLOVER, BUCKHORN PLANTAIN, COMMON CHICKWEED, MOUSEEAR CHICKWEED, HENBIT, SPURWEED (LAWN BURWEED), BROADLEAF PLANTAIN, DANDELION, FALSE DANDELION, LESPEDEZA, PROSTRATE SPURGE*, WILD VIOLET*				
triclopyr + clopyralid, MOA 4 + 4 (Confront) 3 SL	0.37 to 0.74 fl oz	1 to 2 pt	0.28 to 0.56 + 0.09 to 0.19	Do not apply to home lawns. May be used on centipedegrass, bermudagrass, zoysiagrass, tall fescue, creeping red fescue, chewing fescue, Kentucky bluegrass, perennial ryegrass. *Repeat treatment may be necessary.
MCPA ester + triclopyr ester + dicamba, MOA 4 + 4 + 4 (Cool Power) 3.6 EC	0.91 to 1.29 fl oz	2.5 to 3.5 pt	1.125 to 1.575	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial use as sod or seed production. Use on perennial bluegrass, ryegrass, and fescue species, bentgrass (excluding greens and tees), bermudagrass, zoysiagrass, and bahiagrass. Do not apply to seedling grasses until well established. Wait 3 to 4 weeks after application to seed.
MCPA amine + triclopyr amine + dicamba, MOA 4 + 4 + 4 (Horsepower) 4.56 L	0.73 to 1.1 fl oz	2 to 3 pt	1.14 to 1.71	
Postemergence Control, PLANTAIN, CHICKWEED, DANDELION, PURSLANE, and THISTLE SPECIES, GROUND IVY, LAWN BURWEED, HENBIT, CORN SPEEDWELL, SPOTTED SPURGE				
carfentrazone-ethyl, MOA 14 (QuickSilver) 1.9 EW	0.0126 to 0.048 fl oz	0.55 to 2.1 fl oz	0.008 to 0.031	May be applied to bahiagrass, bermudagrass, buffalograss, centipedegrass, St. Augustinegrass, zoysiagrass, Kentucky bluegrass, tall fescue, fine fescue, perennial ryegrass, and bentgrass. To expand the weed spectrum and extend control of the weeds listed here and on the label, carfentrazone-ethyl can be tank mixed with the entire range of phenoxy products—amines, esters, and other salts—and is also compatible with dicamba, atrazine, glyphosate, glufosinate, clopyralid, triclopyr, and MSMA. When applied alone, add 0.12 to 0.25% nonionic surfactant.
Postemergence Control, WHITE CLOVER, DANDELION, GROUND IVY, SPURGES, PLANTAINS, CHICKWEEDS, HENBIT, LAWN BURWEED, WOODSORRELS, DOLLARWEED, POISON IVY, POISON OAK, CORN SPEEDWELL, WILD STRAWBERRY, WILD VIOLET, VIRGINIA PEPPERWEED, SHEPHERD'S PURSE				
carfentrazone + 2,4-D ester + MCPP + dicamba, MOA 14 + 4 + 4 + 4 (Speed Zone) 2.2 EC	0.75 to 1.8 fl oz	2 to 5 pt	0.55 to 1.375	May be used on annual and perennial bluegrass, annual and perennial ryegrass, tall and fine fescue, creeping and colonial bentgrass, common and hybrid bermudagrass, and zoysiagrass. For use in ornamental turf, golf courses, lawns, sod farms, cemeteries, and parks. Optimum results when applied when temperatures are between 45 and 75°F but may be applied up to 90°F. Lower rates may be used in cooler weather. Rainfast within 3 hr and may reseed after 2 wk. May apply 3 to 4 wk after sodding, sprigging, or plugging. Also may be used on bahiagrass, buffalograss, St. Augustinegrass, centipedegrass, seashore paspalum, and kikuyugrass. May reseed after 1 wk.
carfentrazone + 2,4-D ester + MCPP + dicamba, MOA 14 + 4 + 4 + 4 (Speed Zone Southern) 0.81 EC	0.55 to 2.2 fl oz	1.5 to 6 pt	0.1519 to 0.6075	
carfentrazone + MCPA ester + MCPP + dicamba, MOA 14 + 4 + 4 + 4 (Power Zone) 2.91 EC	0.75 to 2.2 fl oz	2 to 6 pt	0.7275 to 2.1825	Same precautions and turf uses as Speed Zone 2.2 EC except cannot be applied to creeping and colonial bentgrass.
sulfentrazone + 2,4-D amine + MCPP + dicamba, MOA 14 + 4 + 4 + 4 + 4 (Surge) 2.18 SL	0.92 to 1.84 fl oz	2.5 to 5 pt	0.68 to 1.36	Apply 2.5 to 3.25 pt per acre on warm season turf including bermudagrass species, zoysiagrass, bahiagrass, and buffalograss. Apply 3.25 to 4 pt per acre on cool season turf including species of bluegrass, ryegrass, fescue, and bentgrass (excluding greens and tees). Four to 5 pt per acre needed to control corn speedwell and wild violet. Turf areas include residential, ornamental, institutional, and sod farms. Apply to grass seedlings after second mowing. Apply to sodded, sprigged, or plugged areas 3 to 4 weeks after operations. Treated areas may be reseeded 3 weeks after application.
triclopyr ester + sulfentrazone + 2,4-D ester + dicamba, MOA 4 + 14 + 4 + 4 (T Zone) 2.51 EC	0.75 to 1.5 fl oz	2 to 4 pt	0.628 to 1.26	Apply 2 to 2.25 pt per acre on fully dormant bermudagrass, zoysiagrass, and bahiagrass. Apply 3.25 to 4 pt per acre on annual and perennial bluegrass and ryegrass, and tall, red, and fine fescue. Rainfast within 3 hours. Approved turf areas include residential, ornamental, institutional, noncropland, and sod farms. Apply to grass seedlings after the second or third mowing. Apply to sodded, sprigged, or plugged areas 3 to 4 weeks after operations. Treated areas may be reseeded 3 weeks after application.
Postemergence Control, CHICKWEED, CLOVER, PLANTAIN and DANDELION SPECIES, FLORIDA BETONY, DOLLARWEED, GROUND IVY, LESPEDEZA, and YELLOW WOODSORREL				
penoxsulam, MOA 2 (various brands) 0.014 G or 0.03 G	3.4 to 10.3 lb or 1.7 to 4.6 lb	150 to 450 lb or 75 to 200 lb	0.02 to 0.06	May be applied to residential and commercial lawns, golf courses (excluding greens and tees), parks, athletic fields, and sod farms. Use on turf that has been mowed at least 3 times or sprigs that have developed secondary root systems. Apply up to 75 lb per acre of 0.03 G or 150 lb per acre of 0.014 G to perennial ryegrass and tall fescue. Apply up to 150 lb per acre of 0.03 G or 300 lb per acre of 0.014 G to bentgrass, Kentucky bluegrass, and fine fescue. Apply up to 200 lb per acre of 0.03 G or 450 lb per acre of 0.014 G to bermudagrass, centipedegreass, zoysiagrass, and St. Augustinegrass. Do not apply to dormant centipedegrass. Reapply at 4 weeks if needed but do not exceed 300 lb per acre of 0.03 G or 650 lb per acre of 0.014 G per season. After treatment, wait 3 to 4 weeks to reseed.
CARPETWEED, CHICKWEED, DANDELION, CURLY DOCK, CUTLEAF EVENINGPRIMROSE, HENBIT, KNOTWEED, COMMON MALLOW, POISON IVY, AND ANNUAL SOWTHISTLE				
pyraflufen ethyl, MOA 14 (Octane 2% SC) 0.177 SC	0.016 to 0.092 fl oz	0.7 to 4 fl oz	0.000938 to 0.0055	Used in established sod farm and ornamental turf by commercial applicators and professional landscapers only. Turf can be newly seeded, sodded, or sprigged as long as it is established and not under stress. Tolerant turfgrasses include bermudagrass, centipedegrass, St. Augustinegrass, zoysiagrass, tall fescue, perennial ryegrass, perennial bluegrass, and creeping bentgrass (not greens or tees). Apply 1 to 4 fl oz alone to 3- to 6-inch tall weeds. For larger weeds and broader spectrum control, apply 0.75 to 1.5 fl oz and tank mix with 2,4-D, mecoprop, dicamba, chloroprop, MCPA, triclopyr, or fluroxypyr.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Postemergence Control, BAHIAGRASS, PERENNIAL RYEGRASS, WILD GARLIC, SPURWEED, HENBIT, Miscellaneous Other Broadleaf Weeds				
metsulfuron, MOA 2 (Blade, Manor, or MSM Turf) 60 WDG	0.003 to 0.02 oz	0.125 to 1 oz	0.005 to 0.038	May be applied to established bermudagrass, zoysiagrass (Meyer or Emerald), St. Augustinegrass, Kentucky bluegrass or fine fescue. Do not apply to turf less than 1 year old. Do not exceed 0.5 oz per acre on centipedegrass, fine fescue, or Kentucky bluegrass. See label for a complete list of weeds controlled. The addition of 0.25% nonionic surfactant will enhance control. May be used for removal of perennial ryegrass from overseeded warm-season turf species. For bahiagrass control, use 0.25 to 0.75 oz per acre after spring greenup but before seedhead development. A repeat treatment may be necessary in 4 to 6 weeks.
(Patriot) 60 WDG	0.007 to 0.046 oz	0.33 to 2 oz	0.012 to 0.075	Apply to unimproved industrial turf only. Use maximum of 0.5 oz per acre for fescue and bluegrass and 2 oz per acre for bermudagrass.
Postemergence Control, TALL FESCUE, WILD GARLIC, HENBIT, and Miscellaneous Other Broadleaf Weeds				
chlorsulfuron, MOA 2 (Corsair) 75 WDG	0.02 to 0.122 oz	1 to 5.33 oz	0.05 to 0.25	May be applied to all established turfgrass species except tall fescue, buffalograss, ryegrass, and dichondra. Some discoloration or delayed greenup may occur on St. Augustinegrass, centipedegrass, zoysiagrass, or bahiagrass if applied while turf is under stress. See label for a complete list of weeds controlled. The addition of 0.25% nonionic surfactant will enhance control.
Postemergence Control, WILD GARLIC, WILD ONION				
imazaquin, MOA 2 (Image 70 DG) 70 DG	0.128 to 0.256 oz	0.357 to 0.714 lb	0.25 to 0.5	Use on bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass. Do not apply during spring greenup. Temporary yellowing may occur. Add a nonionic surfactant at 2 pt per 100 gal of spray solution.
2,4-D amine, MOA 4 (various brands) 4 SL	2.2 fl oz	3 qt	3	Apply in fall when garlic is young and actively growing. Add a wetting agent to keep spray from bouncing off garlic leaves. Repeat treatment for 2 years. Avoid spray drift which can injure susceptible plants. Use on bluegrass, fescue, bermudagrass, or zoysia. For more susceptible grasses, uses spot treatment below.
	Spot treatment			One tbsp of 1% 2,4-D solution per garlic clump or use pressurized applicator. Apply December to April. Use as spot treatment for widely scattered clumps in small areas. Avoid excessive spraying as turfgrass injury may result.
Postemergence Control of Various Grass and Broadleaf Weeds in Unimproved Turf and Other Noncrop Areas				
glyphosate, MOA 9 (Glypro) 5.4 SL (Glyphosate T&O, Razor, or Razor Pro) 4 SL	0.14 to 1.1 fl oz 0.75 to 2.94 fl oz	0.375 to 3 pt 1 to 4 qt	0.25 to 2 0.5 to 4	Apply to dormant or actively growing well established bermudagrass and bahiagrass. Bahiagrass growth will be suppressed if treated after spring greenup and before seedhead formation. Treat winter annual weeds when less than 6 in. tall. Higher rates are needed for more mature plants. Apply in 10 to 25 gal of water per acre and use an NIS at 2 qt per 100 gal of spray solution.
glyphosate + 2,4-D amine, MOA 9 + 4 (Campaign) 1.2 + 1.9 lb/gal SL	0.55 to 1.47 fl oz	1.5 to 4 pt	0.58 to 1.55	Apply in 15 to 30 gal of water per acre. May be applied to highly maintained dormant bermudagrass at 2 to 4 pt per acre. In low maintenance bermudagrass, Oust can be added at 0.25 to 1 oz per acre when dormant or actively growing. Apply 2 to 4 pt per acre on dormant bahiagrass and 1.5 to 2 pt per acre on actively growing bahiagrass. Tank mix with Oust if needed. Check label for Oust rates. Tall fescue applications can be made in the spring or summer at 2 to 3 pt per acre with or without Oust. Spray tall fescue at 4 to 6 in. tall and before seedhead emergence to minimize injury.
sulfosulfuron, MOA 2 (Outrider) 75 WG	0.017 to 0.046 oz	0.75 to 2 oz	0.035 to 0.094	May be used in well established dormant and actively growing bermudagrass and bahiagrass. Wait 30 days to re-treat if needed, and do not exceed 2.66 oz per acre per year. If treating weeds postemergence, use an NIS at 2 qt per 100 gal spray solution unless tank mixed with Roundup Pro. Outrider can also be tank mixed with Campaign, Escort, Oust, and Telar, but check label for proper turf species and timing. Expect temporary injury or discoloration with tank mix partners. For well established tall fescue, do not exceed 1 oz per acre per year, and do not tank mix. Outrider is effective on johnsongrass.
Postemergence Control in Dormant Warm Season Turf ANNUAL BLUEGRASS, Various Other Winter Annual Weeds				
diquat, MOA 22 (Reward LS) 2 SL	0.4 to 0.75 fl oz	1 to 2 pt	0.25 to 0.5	Apply in 20 to 100 gal spray mix as a broadcast application. Add 1 to 2 pt of a nonionic surfactant per 100 gal of solution. Bermudagrass must be dormant. More than one application may be needed.
glyphosate, MOA 9 (Glyphosate T&O, Razor Pro, or Roundup Pro) 4 SL	0.37 fl oz	1 pt	0.5	Apply in 5 to 20 gal water per acre with 0.5% by volume of a nonionic surfactant. Application to actively growing annual bluegrass must be made before initiation of bermudagrass greenup in the spring.
glyphosate, MOA 9 (Touchdown Pro) 3 LC	0.18 to 1.47 fl oz	0.5 to 4 pt	0.1875 to 1.5	Apply to dormant bermudagrass and bahiagrass before spring greenup. Apply in 10 to 40 gal water per acre. Will control winter annual weeds up to 6 in. tall and four- to six-leaf tall fescue. Use a 75% active ingredient nonionic surfactant at 0.25% by volume or dry ammonium sulfate at 0.5% by weight.
glyphosate + diquat, MOA 9 + 22 (QuikPRO) 76 WG (Razor Burn) 4.21 SL	0.11 to 0.37 oz 0.18 to 0.62 fl oz	5 to 16 oz 8 to 27 fl oz	0.24 to 0.76 0.26 to 0.89	Apply to dormant bermudagrass and bahiagrass not grown for research, sale, or other commercial uses, such as sod, seed production. Apply in 10 to 80 gal water per acre. Rates greater than 9 oz per acre QuikPro or 15 fl oz per acre Razor Burn may cause injury or delay greenup in highly maintained areas. Controls tall fescue.
metribuzin, MOA 5 (Sencor 75 Turf) 75 WDF	0.25 oz	0.67 lb	0.5	For application by commercial applicators to *dormant* bermudagrass turf. Broadcast spray before greenup of turf. Do not apply to greens, tees, or aprons. Controls common chickweed, corn speedwell, henbit, parsley-piert, and spurweed.
Suppression/Control, BERMUDAGRASS				
fenoxaprop, MOA 1 (Acclaim Extra) 0.57 EC	0.46 fl oz	1.25 pt	0.089	Use on Kentucky bluegrass, perennial ryegrass, fine and tall fescue, and zoysiagrass. Apply June 1, July 1, August 1, and September 1, and repeat for 2 years. Can be tankmixed with 1 pt per acre Turflon Ester following the same schedule as above. Apply June 1 and Aug 1 for 2 years if tankmixed with 1 qt per acre Turflon Ester. Zoysia may show discoloration but should recover in 10 to 14 days following tankmix applications.

TABLE 7-15. CHEMICAL WEED CONTROL IN LAWNS AND TURF

Herbicide and Formulation	Amount of Formulation Per 1,000 sq ft	Amount of Formulation per Acre	Pounds Active Ingredient per Acre	Precautions and Remarks
Suppression/Control, BERMUDAGRASS (continued)				
fluazifop, MOA 1 (Fusilade II) 2 EC	0.05 to 0.14 fl oz	2 to 6 fl oz	0.03 to 0.09	Use on tall fescue or zoysia. For fescue, apply 5 to 6 oz per acre during warm weather in early spring when bermudagrass is breaking dormancy and repeated in fall when bermudagrass is preparing for dormancy. For zoysia, apply 4 oz per acre on June 1 and August 1 and repeat for 2 years. Can be tank-mixed with 1 qt per acre Turflon Ester following same schedule as above. Zoysia or tall fescue may show slight discoloration but should recover in 10 to 14 days. Add a nonionic surfactant at 0.25% v/v. Apply in a minimum of 30 gal of water per acre.
siduron, MOA 7 (Tupersan) 50 WP	0.5 to 1 lb	21.78 to 43.56 lb	10.88 to 21.78	Apply as an 8- to 12-inch band treatment with a single nozzle sprayer along putting green perimeter to suppress bermudagrass stolon encroachment. Initiate in March or April, and continue subsequent applications at 4- to 5-wk intervals.
triclopyr, MOA 4 (Turflon Ester Ultra) 4 lb/gal	0.73 fl oz	1 qt	1.0	Use on perennial bluegrass, perennial ryegrass, and tall fescue or ornamental turf including sod farms and golf courses. Do not apply to zoysia unless injury can be tolerated. Apply June 1, July 1, August 1, and September 1, and repeat for 2 years. Can be tank-mixed with Acclaim Extra or Fusilade II at rates and timings listed above. New low-odor formulation uses methylated seed oil solvents instead of petroleum distillates.
Postemergence Control BERMUDAGRASS				
clethodim, MOA 1 (Envoy Plus) 0.97 EC	0.4 to 0.8 fl oz	17 to 34 fl oz	0.125 to 0.25	For use on sod farms only. Do not apply to centipedegrass being grown for seed. Do not apply until 3 weeks after full greenup of centipedegrass in spring. Do not mow for 1 week before and after application. The addition of a nonionic surfactant at 0.25 % solution (1 pt per 50 gal water) or a crop oil concentrate at 1% solution (2 qt per 50 gal water) is necessary for control. A repeat application usually 3 to 4 weeks after the first application will be required for bermudagrass control. Use higher rates for more established bermudagrass. Do not apply more than 68 oz of Envoy per acre per year. Some discoloration of centipedegrass will occur at higher rates.
Preplant Control or Lawn Renovation — Emerged Annual and Perennial Grass and Broadleaf Weeds				
glyphosate, MOA 9 (Glyphosate T&O, Razor Pro, or Roundup Pro) 4 SL	0.75 to 3 fl oz	1 to 4 qt	1 to 4	Where existing vegetation is growing in a field or unmowed situation, apply to actively growing weeds at the stages according to label. Where existing vegetation is growing under mowed turfgrass management, apply after omitting at least one regular mowing to allow sufficient growth for good interception of the spray. Tillage or renovation techniques such as vertical mowing, coring, or slicing should be delayed for 7 days after application. Desirable turfgrass may be established following treatment.
glyphosate, MOA 9 (Touchdown Pro) 3 LC	0.18 to 1.47 fl oz	0.5 to 4 pt	0.1875 to 1.5	Same remarks as Roundup Pro, above. In addition, use a 75% active ingredient nonionic surfactant at 0.25% by volume or dry ammonium sulfate at 0.5% by weight.
glyphosate + diquat, MOA 9 + 22 (QuikPRO) 76 WG (Razor Burn) 4.21 SL	1.65 to 4.5 oz 2.75 to 5.5 fl oz	4.5 to 12.25 lb 3.75 to 7.5 qt	3.4 to 9.3 3.95 to 7.89	Generally use QuikPro at 4.5 lb per acre on annuals, 9 lb per acre on perennials, and 12.25 lb per acre on dusty or stressed plants, dense stands, or difficult-to-control perennials. Generally use Razor Burn at 3.75 qt per acre on annuals and 7.5 qt per acre on perennials. Do not use on turf grown for research, for sale, or for commercial uses, such as sod or seed production. Do not use if renovating bermudagrass or kikuyugrass sods. Delay tillage for 7 days after application.
Trimming and Edging and Control of Emerged Weeds				
diquat, MOA 22 (Reward LS) 2 SL	0.4 to 0.75 fl oz	1 to 2 pt	0.25 to 0.5	Add nonionic surfactant at 0.25 oz per gallon of water. Water volumes above 15 gal per acre should be used. For spot sprays, use 0.3 to 0.75 fl oz per gallon.
glufosinate, MOA 10 (Finale) 1 SL	2.2 to 4.4 fl oz	3 to 6 qt	0.75 to 1.5	Rate depends upon the weed to be controlled and stage of growth. Consult label. For spot or directed spray use 1.5 to 4 fl oz per gallon of water.
glyphosate + diquat, MOA 9 + 22 (QuikPRO) 76 WG (Razor Burn) 4.21 SL	1.65 to 4.5 oz 2.75 to 5.5 fl oz	4.5 to 12.25 lb 3.75 to 7.5 qt	3.4 to 9.3 3.95 to 7.89	May be used in general noncrop areas. Do not use on plants grown for sale or other commercial uses, such as seed production. See rate comments in lawn renovation section. For spray to wet treatments, apply QuikPro at 1.2 oz per gal of water for annuals and 1.5 oz per gal of water for perennials. Apply Razor Burn at 2 fl oz per gal of water for annuals and 2.5 fl oz per gal water for perennials. For directed spot treatment of perennials using hand-held low volume equipment, apply 4 to 8 oz per gal of water.

Chemical Weed Control in Ornamentals

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TABLE 7-16. CHEMICAL WEED CONTROL IN ORNAMENTALS

Weed	Herbicide and Formulation	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Preplant to all ornamentals				
Most annuals and perennials	dazomet (Basamid granular)	350 lb	347	Preplant in beds. Incorporate to 8 in. deep. Drench with water or cover with plastic for best results.
	diquat dibromide (Reward) 2 L	1 to 2 qt	0.5 to 1	A nonionic surfactant should be added to the spray solution. Apply for full coverage and thorough weed contact. Best control occurs if weeds are young. Re-treatment will be necessary for established weeds.
	glufosinate (Finale) 1 L	3 to 6 qt	0.75 to 1.5	Thorough coverage is essential. Apply in a minimum of 20 gal of water per acre. No residual control. Repeat applications may be necessary for control of perennial weeds.
	glyphosate (Glyfos, Roundup Pro, Touchdown Pro, and others)	1 to 5 qt	1 to 5	Apply to emerged weeds prior to planting ornamentals.
	paraquat (Gramoxone Extra) 2.5 L	2 to 3 pt	0.6 to 0.9	Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark of crop less than 1 year old. Add wetting agent to make 0.25% (2 pt per 100 gal of water) by volume of spray for best results. Not for use in landscapes.
Post-plant Preemergence Weed Control				
Annual grasses and broadleaf weeds (preemergence) See label for susceptible species	benefin + oryzalin (XL) 1 + 1 G	200 to 300 lb	2 to 3 + 2 to 3	Apply preemergence to weeds. May be applied in spring and fall to ornamental plants.
	bensulide (Betasan) 12.5 G	80 to 100 lb	10 to 12.5	Apply preemergence to weeds. Plants should be well established.
	dichlobenil (Casoron) 4 G (Barrier) 4 G	100 to 150 lb	4 to 6	Do not use on fir, hemlock, *Ilex crenata, I. rotunda,* or *I. vomitoria*. Do not use more than 6 lb per acre on azalea, rhododendron, boxwood, holly, euonymus, forsythia, leucothoe, ivy, lilac, heather, or any plantings less than 1 year old. Do not use in seedbeds, cutting, or transplant beds. Do not apply until 4 weeks after transplanting any plants. Winter applications are best. The granular material is superior to the equal rate of wettable powder without incorporation.
	dimethenamid-p (Tower) 6 EC	21 to 36 oz	1 to 1.5	Preemergence control of yellow nutsedge, annual grasses and many annual broadleaf weeds in woody landscape plantings, field nurseries. Avoid foliar treatments over the top of early spring growth flushes as injury to ornamental plants can occur.
	dimethenamid-p + pendimethalin (Freehand) 1.75 (0.75 + 1) G	100 to 200 lb	1.75 to 3.5	Preemergence control of annual grasses and many broadleaf weeds from seed as well as suppression of yellow nutsedge in container and field nurseries, and woody landscape plantings.
	EPTC (Eptam) 5 G	100 to 120 lb	5 to 6	Apply postplant but preemergence to weeds. Use granular form only. Incorporate mechanically or by irrigation for best results.
	flumioxazin (Broadstar) G	150	0.375	Preemergence control of most annual broadleaf and annual grasses in container and field-grown woody nursery crops. Not for use in landscape plantings. See label for species and precautions. Do not apply to wet foliage or newly potted liners.
	flumioxazin (Sureguard) DG	0.75 lb	0.375	Preemergence control of most annual broadleaf and annual grasses, and early postemergence control of seedling broadleaf weeds in field and container-grown woody nursery crops and certain landscape plantings. See label for species and precautions.
	imazaquin (Image) 1.5 LC	1 to 1.3 qt	0.4 to 0.5	Apply as a directed spray away from rooting zone. Labeled for over the top sprays on a few species.
	isoxaben (Gallery) 75 DF	0.66 to 1.33 lb	0.5 to 1	Use as preemergence control of broadleaf weeds in many field and container grown ornamentals, turf, and landscape plantings.
	isoxaben + trifluralin (Snapshot TG) 2.5 G	100 to 200 lb	2.5 to 5	Preemergence to weeds on field- and container-grown ornamentals and landscape plantings. See label for specific species.
	isoxaben + oxyfluorfen + trifluralin (Showcase) 2.5 G	100 to 200 lb	2.5 to 5	Preemergence weed control in container-grown woody ornamentals.
	S-metolachlor (Pennant Magnum) 7.62 EC	1.3 to 2.6 pt	1.2 to 2.5	Preemergence control of annual grasses, annual sedges, and some annual broadleaf weeds including doveweed, as well as suppression of yellow nutsedge. Apply to soil surface immediately after planting. Avoid foliar treatments over the top of early spring growth flushes as injury to ornamental plants can occur.
	napropamide (Devrinol) 50 DF (Devrinol) 2 G	8 to 12 lb 200 to 300 lb	4 to 6	Apply preemergence to weeds and as a directed spray in ornamentals. Can be used in field or container nurseries or landscape plantings. If broadcast over top of ornamentals, irrigate soon after application to reduce risk of foliar injury.
	norflurazon (Predict) 80 WP	3 lb	2.4	Apply preemergence to weeds in field grown nursery stock. **Caution:** Some conifers are sensitive. See label.
	oryzalin (Surflan) 4 AS	2 to 4 qt	2 to 4	Preemergence to weeds in field or container nurseries or landscape plantings. Apply only to established plantings. Do not use in seedbeds or transplant beds. Not recommended for use on soils containing more than 3% organic matter. Use higher rate for longer term control. Do not apply on hemlock.

TABLE 7-16. CHEMICAL WEED CONTROL IN ORNAMENTALS

Weed	Herbicide and Formulation	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-plant Preemergence Weed Control (continued)				
Annual grasses and broadleaf weeds (preemergence) See label for susceptible species (continued)	oxadiazon (Chipco Ronstar) 2 G	100 to 200 lb	2 to 4	Apply preemergence to weeds. Can be used on container- and field-grown ornamentals. Repeat applications are labeled for some species. Injury has been observed on ajuga, liriope, mondo, and fig (*Carica spp.*) Granules may burn tender foliage of several species if irrigation is not used to wash them off. Caution: Plants that trap granules in leaf axil can be injured.
	oxadiazon + pendimethalin (Jewel) 3.25 (2 + 1.25) G	100 lb	3.25	Apply preemergence to weeds. Can be used on container and field-grown ornamentals. Repeat applications are labeled. Check label for genera of plants on which it can be used. Do not apply to wet foliage.
	oxyfluorfen (Goal) 2 XL	5 to 10 pt	1 to 2	Preemergence and postemergence control of many broadleaf and grass weeds in conifers and dormant deciduous trees. Do not apply when conifers have young tender growth. Lower rates are used in conifer seedbeds and for postemergence treatments.
	(HGH 63) 2 G	12.5 to 100 lb	0.25 to 2	Preemergence weed control in field- and container-grown woody ornamentals. Use lower rates on conifer seedbeds, transplant beds, and newly potted liners. Up to 100 lb/acre may be used on larger and/or older plants. See label for specific species and guidelines.
	oxyfluorfen + oryzalin (Rout) 3 (2+1) G	100 lb	3 (2 + 1)	Apply preemergence to weeds. Can be used on container and field-grown ornamentals. Repeat applications are labeled. Check label for genera of plants on which it can be used.
	oxyfluorfen + oxadiazon (Regal OO) 3 (2 + 1) G	100 lb	3 (2 + 1)	Apply preemergence to weeds. May be used on container- or field-grown woody ornamentals, including liner production. Injury is to be expected to herbaceous plants or to plants with leaf orientation that might trap granules. Check label for genera of plants on which it can be used.
	oxyfluorfen + pendimethalin (Ornamental Herbicide 2) 3 (2+1) G	100 lb	3 (2 + 1)	Apply preemergence to weeds. Can be used on container- and field-grown ornamentals. Repeat applications are labeled. Check label for genera of plants on which it can be used.
	oxyfluorfen + trifluralin (HGH 75) 5 (2 + 3) G	100 lb	5 (2 + 3)	Preemergence control of annual grasses and broadleaf weeds in container- and field-grown woody ornamentals and landscape beds. Injury is to be expected to herbaceous ornamentals or plants with leaf orientation that might trap granules.
	pendimethalin (Corral, Pendulum) several formulations	See label	2 to 4	Preemergence control of annual grasses and some broadleaf weeds in turf, landscape plantings, container and field-grown nursery crops, and Christmas trees. Pendulum Aqua Cap is labeled only for turf and landscape uses. See labels for details.
	prodiamine (Barricade) 65 WG, 4 FL (Regalkade) 0.5 G	1 to 1.15 lb 21 to 48 oz 150 lb	0.65 to 0.75	Apply preemergence to weeds. Labeled for use in turf, landscape plantings, and nurseries. See label for tolerant species and restrictions.
	pronamide (Kerb) 50 WP	2 to 4 lb	1 to 2	Pre and postemergence control of cool-season grasses and some annual broadleaf weeds from seed. Apply in late winter just before rain or snowfall. Not recommended for soils that are high in muck or peat. Check label for use restrictions.
	simazine (Princep) 4 L	2 to 3 qt	2 to 3	Apply preemergence to weeds in field nurseries and Christmas trees. Injury has occurred on azaleas, Japanese holly, euonymus, lilac, privet, pittosporum, mock orange, hemlock, boxwood, and several other broadleaf species. High rates will injure Fraser fir.
	trifluralin (Preen) 1.47G (Treflan) 5 G	136 to 272 lb 80 lb	2 to 4 4	Preemergence to weeds. Irrigate after application. May injure some azalea cultivars.
Post-Plant, Postemergence Selective Grass Control				
Annual and perennial grasses (postemergence) See label for tolerant species	clethodim (Envoy)	8 to 34 fl oz	0.06 to 0.25	Postemergent grass control. Annuals 2 to 6 in. tall, perennials at 4 to 12 in. new growth. Add nonionic surfactant at 0.25% v/v (2 pt per 100 gal) to final spray.
	fenoxaprop-P (Acclaim Extra) .57EC	13 to 39 oz	0.06 to 0.17	Apply to emerged grass using at least 40 gpa. Can be used overtop of many flowers and woody ornamentals. Check label. Injury has been observed on Bar Harbor juniper, philodendron, Salvia, Podocarpus, and Pittosporum when sprayed with this product.
	fluazifop-P (Fusilade II) 2 EC	2 to 3 pt	0.25 to 0.4	Postemergence grass control. Annuals not over 2 to 8 in. tall, perennials at 4 to 12 in. new growth. Consult label for tolerant species. Use nonionic surfactant and no oil.
	sethoxydim (Segment) 1 EC	36 to 60 oz	0.3 to 0.5	Postemergence grass control. Annuals up to 12 in. tall and 6 to 10 in. new growth on perennials.
Post-Plant, Postemergence Weed Control				
Annual grasses and broadleaf weeds (postemergence)	asulam (Asulox) 3.34 L	77 to 128 oz	2 to 7	Apply postemergence to weeds in many conifers.
	bentazon (Basagran TO) 4 L	1.5 to 2 pt	0.75 to 1	Postemergent directed to many established ornamentals for yellow nutsedge and seedling broadleaf weed control.
	clopyralid (Lontrel) 3 L	4 to 11 oz	0.09 to 0.25	Postemergence control of legume and many aster weeds. Can be used as a directed spray around on several field-grown woody ornamentals. Can be applied overtop of actively growing conifers transplanted 1 year or more. Apply when weeds are young and actively growing.

TABLE 7-16. CHEMICAL WEED CONTROL IN ORNAMENTALS

Weed	Herbicide and Formulation	Amount Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Post-Plant, Postemergence Weed Control (continued)				
Annual grasses and broadleaf weeds (postemergence) (continued)	dichlobenil (Barrier) 4 G (Casoron) 4 G	100 to 150 lb	4 to 6	Pre and Postemergence control of many annual and perennial weeds. Do not use on fir, hemlock, Ilex crenata, I. rotunda, or I. vomitoria. Do not use more than 6 lb per acre on azalea, rhododendron, boxwood, holly, euonymus, forsythia, leucothoe, ivy, lilac, heather, or any plantings less than 1 year old. Do not use in seedbeds, cutting, or transplant beds. Do not apply until 4 weeks after transplanting any plants. Winter applications are best.
	EPTC (Eptam) 5 G	100 to 120 lb	5 to 6	Apply postplant but preemergence to weeds. Use granular form only. Incorporate mechanically or by irrigation for best results. Thorough coverage is essential. Apply in a minimum of 20 gal of water per acre. No residual control. Repeat applications may be necessary for control of perennial weeds.
	glufosinate (Finale) 1 L	3 to 6 qt	0.75 to 1.5	Non-selective postemergence control of weeds. Thorough coverage is essential. Apply in a minimum of 20 gal of water per acre. No residual control. Repeat applications may be necessary for control of perennial weeds.
	glyphosate (Glyfos) 4L (Roundup-Pro) 4 L (Touchdown Pro) 3L and others	1 to 5 qt	1 to 5	Non-selective postemergence control of weeds. DO NOT SPRAY GREEN BARK OR FOLIAGE of crop. Exercise extreme caution in applications near small plants. Use of a shielded sprayer can increase crop safety. Apply in 20 to 30 gal of water per acre as a directed spray under shrubs or trees. No residual control. Repeat applications may be necessary for control of perennial weeds.
	imazaquin (Image) 1.5 LC	1 to 1.3 qt	0.4 to 0.5	Apply as a directed spray away from rooting zone.
	oxyfluorfen (Goal) 2 EC	1 to 2 pt	0.25 to 0.5	Pre- and postemergence control. Apply 1 to 2 pt of Goal 2 EC per acre as a postemergence application on some conifers. Add 0.25% (v/v) nonionic surfactant.
	paraquat (Gramoxone Extra) 2.8 L	2 to 3 pt	0.6 to 0.9	Non-selective postemergence control of weeds. Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with foliage or bark of crop less than 1 year old. Add wetting agent to make 0.25% (2 pt per 100 gal) by volume of spray for best results. Not for use in landscapes.
Sedges (postemergence)	bentazon (Basagran T/O) 4 L	1.5 to 2 pt	0.75 to 1	Postemergent directed spray. For best results add 1 qt per acre crop oil concentrate. For yellow nutsedge and annual sedges only.
	halosulfuron (Sledgehammer) 75 DF	0.67 to 1.33 oz	0.031 to 0.062	Early postemergence control of yellow and purple nutsedge. Use only as a directed spray around established woody plants. Add 0.25% nonionic surfactant.
	imazaquin (Image) 1.5 LC	1 to 1.3 pt	0.4 to 0.5	Pre- or early postemergence control of purple nutsedge. Use as a directed spray. Labeled as an over the top spray on a few species. Add a nonionic surfactant.

Chemical Weed Control in Vegetable Crops

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NOTE: A mode of action code (MOA) has been added to the Herbicide and Formulation column in this table. Use MOA codes for herbicide resistance.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
ASPARAGUS (seeded and new crown plantings), Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.7 to 2.7 pt 2.5 to 4 pt	0.6 to 1	Apply to emerged weeds in a minimum of 20 gal spray mix per acre before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds in a minimum of 20 gal spray mix per acre before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Perennial weeds may require higher rates. The need for an adjuvant Depends on brand used.
Annual grasses and small-seeded broadleaf weeds	linuron, MOA 7 (Lorox DF) 50 WDG	1 to 2 lb	0.5 to 1	Preemergence application. Plant seed 0.5 in. deep in coarse soils. Apply to soil surface. See label for further instruction. Postemergence application. Apply when ferns are 6 to 18 in. tall. Make one or two applications, but do not exceed 2 lb active ingredient total per acre. Do not use surfactant or crop oil, as injury will occur. Use the lower rate on coarse soils. Not recommended on sand or loamy sand soils.
Annual and perennial grasses	clethodim, MOA 1 (Intensity One, Select Max) 1 EC (Arrow) 2 EC	 9 to 16 oz 6 to 8 oz	 0.07 to 0.125 0.094 to 0.125	Apply to emerged grasses. Consult the manufacturer's label for best times to treat specific grasses. For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. With sethoxydim, add 1 qt crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. With fluazifop, add 1 qt of nonionic surfactant or 1 gal crop oil concentrate per 100 gal of spray mix.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	
ASPARAGUS, (established- at least 2 yr old) Preemergence				
Annual grasses and small-seeded broadleaf weeds	linuron, MOA 7 (Lorox DF) 50 WDG	1 to 2 lb	0.5 to 1	Apply before spear emergence or immediately after a cutting. Do not use a surfactant or fertilizer solution in spray mixture. Use the lower rates on coarse soils. Not recommended for sand or loamy sand soils. Repeat applications may be made but do not exceed 4 lb per acre per year. Lorox can also be applied as a directed spray to the base of the ferns. Make one application of 2 lb active ingredient per acre. Lorox will also control emerged annual broadleaf weeds up to 3 in. in height or spread. Do not apply within 1 day of harvest.
	napropamide, MOA 15 (Devrinol) 50 DF	8 lb	4	Apply to the soil surface in spring before weed and spear emergence. Do not exceed 8 lb per acre per year.
	trifluralin, MOA 3 (Treflan, Trilin, Treflan HFP, Treflan) 4 EC)	1 to 4 pt	0.5 to 2	In winter or early spring, apply to dormant asparagus after ferns are removed but before spear emergence, or apply after harvest in late spring or early summer. In a calendar year, the maximum rate is 2 pints per acre for coarse soils, 3 pints on medium soils and 4 pints on fine soils. See label for further restrictions on rates for soil types.
Annual broadleafand grass weeds	diuron, MOA 7 (Karmex) 80 DF (Karmex) 80 XP (Direx) 4 L	 1 to 4 lb 1 to 4 lb 0.8 to 3.2 qt	0.8 to 3.2	Apply in spring before spear emergence but no *earlier* than 4 weeks before spear emergence. A second application may be made immediately after last harvest. **For the majority of N.C. plantings, a 1 to 2 lb per acre dosage of 80 DF or 0.8 to 1.6 qt rate of Direx should be used.** Diuron also controls small emerged weeds but less effectively.
	flumioxazin, MOA 14 (Chateau) 51 WDG	6 oz	0.188	Apply only to dormant asparagus no sooner than 14 days before spears emerge or after the last harvest. Do not apply more than 6 oz per acre during a single growing season. Provides residual weed control. Can be tank mixed with paraquat for control of emerged weeds. Apply in a minimum of 15-gal spray mix per acre. Add a nonionic surfactant at 1 qt per 100 gal of spray mix. A spray-grade nitrogen source (either ammonium sulfate at 2 to 2.5 lb per acre or 28 to 32 percent nitrogen solutions at 1 to 2 qt per acre) may be added to increase herbicidal activity.
	metribuzin, MOA 5 (Metribuzin) 75 WDG (TriCor DF) 75 WDG (Metri) 4 F	1.3 to 2.67 lb 2 to 4 pt	1 to 2	Make a single application to small emerged weeds and the soil surface in early spring before spear emergence. Do not apply within 14 days of harvest or after spear emergence. For the majority of N.C. plantings, the low rate should be used. Do not make postharvest applications until after the last harvest of spears. A split application can be used. See label for rates.
	terbacil, MOA 5 (Sinbar) 80 WP	0.25 to 0.5 lb	0.2 to 0.4	Apply in spring before weed emergence and spear emergence or immediately after last clean-cut harvest. Use the lower rate on sandy soils and the higher rate on silty or clay soils. Do not use on soils containing less than 1% organic matter nor on gravelly soils or eroded areas where subsoil or roots are exposed. Do not harvest within 5 days after application. See label about rotation restrictions.
ASPARAGUS (established at least 2 yr old), Postemergence				
Broadleaf weeds including trumpetcreeper	2,4-D, MOA 4 (Amine 4 and various other brands) 4 SL	1.5 to 2 qt	1.5 to 2	Apply in spring before spear emergence or immediately following a clean cutting. Make no more than two applications during the harvest season and these should be spaced at least 1 month apart. Postharvest sprays should be directed under ferns, avoiding contact with ferns, stems, or emerging spears. Add a nonionic surfactant at a rate of 1 qt per 100 gal spray mix. **Do not apply if sensitive crops are planted nearby or if conditions favor drift.**
	dicamba, diglycolamine salt, MOA 4 (Clarity) 4 L	8 to 16 oz	0.25 to 0.5	Apply to emerged and actively growing weeds in 40 to 60 gallons of diluted spray per treated acre immediately after cutting in the field but at least 24 hours before the next cutting. If spray contacts emerged spears, twisting of spears may occur. Discard twisted spears. See label for more information. **Follow precautions on label concerning drift to sensitive crops.**

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
ASPARAGUS (established at least 2 yr old), Postemergence (continued)				
Contact kill of emerged annual weeds, suppression of emerged perennial weeds, and contact kill of volunteer ferns	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.7 to 2.7 pt 2.5 to 4 pt	0.6 to 1	Apply to control emerged weeds (including volunteer ferns). Apply in a minimum of 20 gal spray mix per acre to control weeds before spears emerge or after last harvest. Do not apply within 6 days of harvest. Use a nonionic surfactant at a rate of 1 qt per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Volunteer ferns (seedling) and certain broadleaf weeds	linuron, MOA 7 (Lorox DF) 50 WDG	2 lb	1	Apply before cutting season or immediately after cutting. Do not apply within 1 day of harvest. Lorox will also control emerged annual broadleaf weeds that are less than 3 in. in height or spread.
Annual and perennial grass and broadleaf weeds Established volunteer ferns	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds up to 1 week before spear emergence or immediately after last cutting has removed all above-ground parts or as a directed spray under mature fern. Avoid contact with the stem to reduce risk of injury. Perennial weeds may require higher rates of glyphosate. For spot treatment, apply immediately after cutting but prior to emergence of new spears. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Yellow and purple nutsedge, wild radish, non-ALS resistant pigweed, cocklebur, ragweed and other broadleaf weeds	halosulfuron, MOA 2 (Profine 75) 75 DF (Sandea) 75 DF	0.5 to 1.5 oz	0.024 to 0.072	**Postemergence and Post-transplant.** Apply before or during the harvesting season. **Do not use a nonionic surfactant or crop oil or unacceptable crop injury may occur.** Without the addition of a nonionic surfactant, postemergence weed control may be reduced. Do not exceed 1 oz per acre per year. Do not harvest within 24 hours of application. **Postharvest.** Apply after final harvest with drop nozzles to limit contact with crop. Contact with the fern may result in temporary yellowing. Add a nonionic surfactant at 1 qt per 100 gal of spray mixture. Under heavy nutsedge pressure, split applications will be more effective; see label for details. Do not exceed 1 oz per acre per year.
Annual and perennial grasses	clethodim, MOA 1 (Intenstiy One, Select Max) 1 EC (Arrow) 2 EC	 9 to 16 oz 6 to 8 oz	 0.07 to 0.125 0.094 to 0.125	For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. DO NOT USE CLETHODIM WITHIN 1 DAY OF HARVEST.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to emerged grasses. Consult the manufacturer's label for best times to treat specific grasses. With sethoxydim, add 1 qt crop oil concentrate per acre. With fluazifop, add 1 qt nonionic surfactant or 1 gal crop oil concentrate per 100 gal of spray mix. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperature. DO NOT USE FLUAZIFOP OR SETHOXYDIM WITHIN 1 DAY OF HARVEST.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1.5 to 2.5 pt	0.3 to 0.5	
BEANS, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.5 to 2.7 pt 2 to 4 pt	0.6 to 1	**Lima or snap beans only.** Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to planting or emergence of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Various beans are covered.** Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Sonalan HFP) 3 EC	1.5 to 3 pt	0.6 to 1.1	**Dry beans only.** Apply preplant and incorporate into the soil 2 to 3 in. deep using a rototiller or tandem disk. If groundcherry or nightshade is a problem, the rate range can be increased to 3 to 4.5 pt per acre. For broader spectrum control, Sonalan may be tankmixed with Eptam or Dual. Read the combination product label for directions, cautions, and limitations before use.
	dimethenamid, MOA 15 (Outlook) 6.0 EC	12 to 18 oz	0.55 to 0.85	**Dry beans only.** Apply preplant incorporated, preemergence to the soil surface after planting, or early postemergence (first to third trifoliate stage). Dry beans may be harvested 70 or more days after Outlook application. See label for further instructions including those for tank mixtures.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF, other brands) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Dry, lima, or snap beans only.** Apply preplant and incorporate into the soil 2 to 3 in. deep within 8 hr. Incorporate with a power-driven rototiller or by cross disking.
	pendimethalin, MOA 3 (Prowl H_20) 3.8 AS	1.5 to 3 pt	0.75 to 1.5	**Dry, lima, or snap beans only.** Apply preplant and incorporate into the soil 2 to 3 in. using a power-driven rototiller or by cross disking. DO NOT APPLY AFTER SEEDING.
	S-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	**Dry, lima, or snap beans only.** Apply preplant incorporated or preemergence to the soil surface after planting.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.4 to 0.67 pt	0.15 to 0.25	**Succulent beans only.** Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instructions. Limited research has been done on this product in this crop in North Carolina.
Yellow and purple nutsedge, grasses and some small-seeded broadleaf weeds	EPTC, MOA 8 (Eptam) 7 EC	2.25 to 3.5 pt	2 to 3	**Dry or snap beans only.** Apply preplant and incorporate immediately to a depth of 3 in. or may be applied at lay-by as a directed application before bean pods start to form to control late season weeds. See label for instructions on incorporation. May be tank mixed with Prowl.
Many broadleaf weeds	fomesafen, MOA 14 (Reflex 2 EC)	1 to 1.5 pt	0.25 to 0.375	**Dry bean and snap beans only.** Apply preplant surface and preemergence. Total use per year cannot exceed 1.5 pt per acre. See label for further instructions and precautions.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BEANS, Preplant and Preemergence (continued)				
Yellow and purple nutsedge, common cocklebur, and other broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	**Dry beans and succulent snap beans, including lima beans, only.** Apply after seeding but prior to cracking. Do not apply more than 0.67 oz product per acre to dry bean. Data are lacking on runner-type snap beans. See label for other instructions.
Broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	1.5 oz	0.018	**Dry beans and lima beans only.** Apply preemergence or preplant incorporated. Pursuit should be applied with a registered preemergence grass herbicide. **Snap beans only.** Apply preemergence or preplant incorporated. For preplant incorporated application, apply within 1 week of planting. May be used with a registered grass herbicide. Reduced crop growth, quality, yield, and/or delayed crop maturation may result.
BEANS, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	**Dry, lima, or snap beans only.** Apply overtop of beans and weeds when beans have one to two expanded trifoliate leaves. Two applications spaced 7 to 10 days apart may be made for nutsedge control. Do not apply more than 2 qt per season or within 30 days of harvest. Use of crop oil as an adjuvant will improve weed control but will likely increase crop injury. See label regarding crop oil concentrate use in other crops.
Many broadleaf weeds	fomesafen, MOA 14 (Reflex 2 EC)	0.75 to 1 pt	0.188 to 0.25	**Dry or snap beans only.** Apply postemergence to dry beans or snap beans that have at least one expanded trifoliate leaf. Include a nonionic surfactant at 1 qt per 100 gal spray mixture. Total use per year cannot exceed 1.5 pt per acre. Do not apply within 45 days of dry bean harvest or 30 days of snap bean harvest. **Postemergence application of fomesafen can cause significant injury to the crop.** See label for further information.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Yellow and purple nutsedge	EPTC, MOA 8 (Eptam) 7 EC	3.5 pt	3	**Green or dry beans only.** Do not use on lima bean or pea. Apply and incorporate at last cultivation as a directed spray to soil at the base of crop plants before pods start to form.
Yellow and purple nutsedge, common cocklebur, and other broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.66 oz	0.024 to 0.031	**Succulent snap beans, including lima beans.** Apply after crop has reached 2-to 4-trifoliate leaf stage but prior to flowering. Postemergence application may cause significant but temporary stunting and may delay crop maturation. Do not apply within 30 days of harvest. See label for further precautions. Data lacking on runner-type snap beans.
Annual broadleaf weeds, including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2.EC	1.5 to 3 oz	0.023 to 0.047	**Dry beans and snap beans only.** Use only 1.5 oz EC formulation on snap bean and up to 3 oz on dry beans. Apply postemergence to 1- to 3-in. weeds (one to four leaves) when dry beans have at least one fully expanded trifoliate leaf. Add nonionic surfactant at 2 pt per 100 gal of spray mixture with all postemergence applications. For dry bean, do not apply within 60 days of harvest. See label for instructions on use.
Most emerged weeds	glyphosate, MOA 9 (Roundup PowerMax) 5.5 L (Roundup WeatherMax) 5.5 L	11 to 22 oz	0.5 to 0.94	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	**Dry or snap beans only.** Sethoxydim is also labeled for limabean; quizalofop is not. Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. With sethoxydim, add 1 qt of crop oil concentrate per acre. With quizalofop, add 1 qal oil concentrate or 1 qt nonionic surfactant per 100 gal spray. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply on days that are unusually hot and humid. Do not apply within 15 days and 30 days of harvest for succulent and dry beans, respectively.
	quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC (Targa) 0.88 EC	6 to 12 oz	0.04 to 0.08	
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 16 oz 9 to 16 oz	0.094 to 0.25 0.07 to 0.125	**Dry beans, lupins, snap beans, waxbeans, mung beans, broadbeans, lima beans, and green beens only.** Select is registered for dry beans only. Apply postemergence for control of emerged grasses. See label for specific rate for crop. For Arrow, Clethodim, or Select, add a crop oil concentrate at 1 qt per acre. For Select Max or Intensity One, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. See label for minimum time from application to harvest.
BEETS (Garden or Table), Preplant				
Annual and perennial grasses and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations) SL 6 SL	See labels	See labels	**Garden beets only.** Apply to emerged weeds before seeding or after seeding but before crop emergence. Perennial weeds may require higher rates. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
BEETS (Garden or Table), Preemergence				
Broadleaf weeds only including common ragweed, smartweed, and wild mustard	pyrazon, MOA 6 (Pyramin) 65 DF	4.6 to 5.4 lb	3.1 to 3.7	Do not use on light sandy soils as severe injury may occur. Apply to the soil surface immediately after planting. If rain does not occur within 5 to 10 days after application, beets should be irrigated.
BEETS (Garden or Table) Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Solix 3, Stinger) 3EC	0.25 to 0.5 pt	0.093 to 0.187	Apply to beets having 2 to 8 leaves when weeds are small and actively growing. Will control most legumes. Do not apply within 30 days of harvest. Do not apply more than 0.5 pt per acre per year. See label for information regarding rotational restrictions.
Broadleaf weeds including mustard, purslane suppression	phenmedipham, MOA 6 (Spin-aid) 1.3 EC	3 to 6 pt	0.5 to 1	Apply postemergence when beets are past the six true leaf stage and when weeds are in cotyledon to four-leaf stage. Do not apply within 60 days of harvest.
Broadleaf weeds only	pyrazon, MOA 6 (Pyramin) 65 DF	5.4 lb	3.7	Do not use on light sandy soils as severe injury can occur. Apply after beets have 2 expanded true leaves and before weeds have more than two true leaves.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
BEETS (Garden or Table) Postemergence (continued)				
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 60 days of harvest.
	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for annual grasses at 6 to 8 oz per acre or bermudagrass and johnsongrass at 8 oz per acre. For Arrow, Clethodim, or Select, add a crop oil concentrate at 1 gal per acre. For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the liklihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 30 days of harvest.
BEETS (Garde or Table) Row Middles Only				
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. The need for an adjuvant depends on brand used. Do not apply within 14 days of harvest.
Annual broadleaf weeds including morningglory, spiderwort, and very small pigweed	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
BROCCOLI – See Cole Crops				
CABBAGE – See Cole Crops				
CANTALOUPES (MUSKMELONS), Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Transplant only.** Apply no later than one day before planting. Apply prior to transplanting of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil at up to 1 gal per 100 gal of spray solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emerges or before transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, carefully remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant and incorporate into the soil 1 to 2 in. (1 in. incorporation is optimum) with a rototiller or tandem disk, or apply preemergence after seeding and follow with irrigation. Check replant restrictions for small grains and other crops on label.
Annual grasses and broadleaf weeds; weak on pigweed and morningglory	clomazone, MOA 13 (Command) 3 ME	0.4 to 0.67 pt	0.15 to 0.25	Apply immediately after seeding, or just prior to transplanting with transplanted crop. Roots of transplants must be below the chemical barrier when planting. See label for further instruction.
Annual grasses and some small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply to the soil surface immediately after seeding. DO NOT SOIL INCORPORATE. May also be used as a BANDED spray BETWEEN rows of plastic mulch. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting and injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfuralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after seeding crop for preemergence control of weeds. DO NOT APPLY PRIOR TO PLANTING CROP. DO NOT SOIL INCORPORATE. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting. Do not apply over or under plastic mulch.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply after seeding or prior to transplanting crop. For transplanted crop, do not transplant until 7 days after application. Rate can be increased to 1 ounce of product per acre to middles between rows. Do not apply within 57 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CANTALOUPES (MUSKMELONS), Postemergence				
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	**Not labeled for transplanted crop.** To improve preemergence control of late emerging weeds. Apply only when crop has four to five true leaves, is well-established, and growing conditions are favorable. Will not control emerged weeds. Incorporation not recommended. Will not control emerged weeds.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF) 4EC	1 to 2 pt	0.5 to 0.75	**Row middles only.** To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the three to four true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest. Will not control emerged weeds.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply postemergence only after the crop has reached 3 to 5 true leaves but before first female flowers appear. Do not apply sooner than 14 days after transplanting. Controls many broadleaf weeds postemergence including cocklebur, galinsoga, smartweed, ragweed, wild radish, and pigweed. Use nonionic surfactant at 1 qt per 100 gal of spray solution with all postemergence applications. Avoid over-the-top applications during late summer when temperature and humidity are high. Do not apply within 57 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 3 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grass in cantaloupes (muskmelons). For Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
CARROTS, Preplant				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before seeding or crop emergence. Perennial weeds may require higher rates. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
CARROTS, Preplant incorporated (PPI)				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin, Trilin) 4 EC	 1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 in. within 8 hr with a power-driven rototiller or tandem disk. Use lower rate on coarse soils with less than 2% organic matter.
CARROTS, Postemergence				
Annual grasses and broadleaf weeds	linuron, MOA 7 (Lorox DF) 50 WDG	1.5 to 3 lb	0.75 to 1.5	Apply as a broadcast spray after carrots are at least 3 in. tall. Annual grasses should be less than 2 in. tall and annual broadleaf weeds should be less than 6 in. tall. Avoid spraying after three or more cloudy days. Repeat applications may be made, but do not exceed 4 lb of Lorox DF per acre per season. Do not use a surfactant or crop oil. Do not apply within 14 days of harvest.
Annual broadleaf weeds and some grasses	metribuzin, MOA 5 (Dimetric, Metribuzin, TriCor DF) 75 WDG (Metri, TriCor 4F) 4 F	 0.33 lb0.5 lb	0.25	Apply overtop when weeds are less than 1 in. tall and carrots have five to six true leaves. A second application may be made in 3 weeks. Do not apply unless 3 sunny days precede application. Do not apply within 3 days of other pesticide applications. Do not apply within 60 days of harvest.
Emerged annual and perennial grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply to actively growing grasses not under drought stress. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt nonionic surfactant per 100 gal of spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not mix with other pesticides. Very effective in controlling annual bluegrass. Do not apply within 30 days of harvest.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to actively growing grasses not under drought stress. Up to 48 oz of Fusilade DX may be applied per yearSee label for rates for specific weeds. Add 1 gal crop oil concentrate or 1 qt nonionic surfactant per 100 gal spray mix. Do not mix with other pesticides. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Consult manufacturer's label for specific rate and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not apply on days that are unusually hot and humid. Do not apply with other pesticides. Do not apply within 30 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CARROTS, Row Middles				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply as a hooded spray in row middles for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
CAULIFLOWER – See Cole Crops				
CELERY, Preplant				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Cutleaf evening primrose, carolina geranium, henbit, and a few grasses	Oxyfluorfen, MOA 14 (Goaltender) 4 F (Goal 2 XL) 2 EC	 up to 1 pt up to 2 pt	up to 0.5	**Transplants only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting. No research has been conducted in North Carolina, therefore try on a limited number of acres first.
CELERY, Preplant incorporate (PPI) or Preemergence (PRE)				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin, Trilin) 4 EC	1 to 2 pt	0.5 to 1 lb	Apply incorporated to direct seeded or transplant celery before planting, at planting, or immediately after planting. Incorporate within 8 hours of application. Use lower rate on coarse soils with less than 2% organic matter.
	bensulide (Prefar) 4-E	5 to 6 qt	5 to 6	**Transplants only.** Apply after planting. Irrigate immediately after application. See label for rotation restrictions.
CELERY, Postemergence				
Annual broadleaf and grass weeds	linuron, MOA 7 (Lorox DF) 50 WDG	1.5 to 3 lb	0.75 to 1.5	Apply after celery is transplanted and established but before celery is 8 in. tall. Grasses should be less than 2 in. in height, and broadleaf weeds should be less than 6 in. in height. Do not use a surfactant or crop oil. Avoid spraying after 3 or more cloudy days or when temperature exceeds 85F. Not recommended for sands or loamy sand soil. Do not apply within 45 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply to actively growing grasses not under drought stress. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt of nonionic surfactant per 100 gal spray mixture. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Adding crop oil may increase the likelihood of crop injury at high air temperature. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 30 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
COLE CROPS: BROCCOLI, CABBAGE, CAULIFLOWER — Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence or before transplanting. Perennial weeds may required higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Also labeled for Chinese broccoli, broccoli raab, Chinese cabbage (bok choy, Napa), Chinese mustard cabbage (gai choy), and kohlrabi. Apply preplant or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF, Trilin) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Transplants.** Apply preplant and incorporate into the soil 2 to 3 in. within 8 hr. **Direct Seeded.** Apply preplant and incorporate 2 to 3 in. into the seed bed within 8 hr. **Caution**: If soil conditions are cool and wet, reduced stands and stunting may occur.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	Also labeled for rape greens and mustard spinach. Apply immediately after seeding or transplanting. May also be incorporated.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
COLE CROPS: BROCCOLI, CABBAGE, CAULIFLOWER — Preplant and Preemergence (continued)				
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.67 pt 0.67 to 1.3 pt	0.25 0.25 to 0.50	**Direct seeded cabbage only.** Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instructions. Limited research has been done on this product in this crop in North Carolina. **Transplanted cabbage only.** Apply broadcast to the soil prior to transplanting cabbage. See label for further instructions. Offers weak control of pigweed. Limited research has been conducted with this product on this crop in North Carolina.
Hairy galinsoga, common lambsquarters, redroot pigweed, and Palmer amaranth	Sulfentrazone, MOA (Spartan 4 F)	2.25 to 4.5 oz	0.07 to 0.14	**Processing cabbage only. Transplanted cabbage only.** May be applied 60 days prior to planting up to planting time.
Annual grasses and small-seeded broadleaf weeds, including galinsoga, common ragweed, and smartweed	napropamide, MOA 15 (Devrinol) 50 DF	2 to 4 lb	1 to 2	Apply to weed-free soil just after seeding or transplanting as a surface application. Light cultivations, rainfall, or irrigation will be necessary within 24 hr to activate this chemical.
Many broadleaf weeds, including galinsoga, common ragweed, and smartweed	oxyfluorfen, MOA 14 (Goal 2 XL, Galigan) 2 EC (GoalTender) 4 E	1 to 2 pt 0.5 to 1 pt	0.25 to 0.5	**Transplants only.** Surface apply before transplanting. Do not incorporate or knock the bed off after application. *Do not spray over the top of transplants*. Oxyfluorfen is weak on grasses. Expect to see some temporary crop injury.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Broadleaf weeds including sowthistle, clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Solix 3) 3 EC (Stinger) 3 EC	0.25 to 0.5 pt	0.09 to 0.187	Labeled for broccoli, cabbage, cauliflower, broccoli raab, brussel sprouts, cavalo broccolo, Chinese cabbage (bok choy), Chinese broccoli, Chinese mustard, and Chinese cabbage (Napa). Apply to crop when weeds are small and actively growing. Will control most legumes. Do not apply within 30 days of harvest.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. For sethoxydim, add 1 qt of crop oil concentrate per acre. For Arrow, Clethodim, or Select, add crop oil concentrate at 1 gal per 100 gal of spray solution. For Select Max, add 2 pt nonionic surfactant per 100 gal of spray mixture. Adding crop oil to Poast or Select may increase the likelihood of crop injury at high air temperature. Do not apply Poast or Select plus crop oil on days that are unusually hot and humid. Do not apply within 30 days of harvest.
CORN (sweet), Pre-plant Burndown				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 2 EC	0.8 to 1.5 oz	0.008 to 0.025	Apply prior to planting or emergence of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil concentrate or a nonionic surfactant with Aim. See label for directions. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed and minimum tillage application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.5 to 2.7 pt 2.4 to 4 pt	0.6 to 1	Apply in a minimum of 20 gal spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100-gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. May be tank mixed with atrazine or simazine. Check label for directions and specific rates.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult manufacturer's label for rates for specific weeds. Check label for directions. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Broadleaf weeds	2,4-D amine 4, MOA 4 (various brands)	1 to 3 pt	0.5 to 1	May be tank mixed with glyphosate for broad spectrum weed control. See label for planting restrictions if applied prior to planting.
CORN (sweet), Preemergence				
Most annual grass weeds, including fall panicum, broadleaf signalgrass, and small-seeded broadleaf weeds	alachlor, MOA 15 (Micro-Tech) 4 FME	2 to 4 qt	2 to 4	Apply to soil surface immediately after planting. Higher rates will improve control of ragweed and lambsquarter. May be tank mixed with atrazine, glyphosate, or simazine. Various other brands are available. Check label for directions.
	dimethenamid, MOA 15 (Outlook) 6.0 EC	12 to 21 oz	0.56 to 1.0	Apply to soil surface immediately after planting. May be tank mixed with atrazine, glyphosate, or paraquat.
	S-metolachlor, MOA 15 (Brawl II, Dual II Magnum, Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after planting. May be tank mixed with atrazine, glyphosate, or simazine. Check label for directions. Rate is soil-texture and organic-matter dependent. See label for details.
Most annual broadleaf and grass weeds	atrazine, MOA 5 (various brands) 4 F (various brands) 90 WDG	1 to 2 qt 1.1 to 2.2 lb	1 to 2	Apply to soil surface immediately after planting. Shallow cultivations will improve control. Check label for restrictions on rotational crops. See label for reduced rate if soil coverage with plant residue is less than 30% at planting. Does not control fall panicum or smooth crabgrass. May be tank mixed with metolachlor, alachlor, glyphosate, paraquat, bentazon, or simazine. Check label for directions.
	alachlor, MOA 15 + atrazine, MOA 5 (Bullet or Lariat) 4 F	2.5 to 4.25 qt	1.56 to 2.7 + 0.94 to 1.6	Apply to soil surface immediately after planting. Soil texture and organic matter influence application rate. See label for further instruction.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CORN (sweet), Preemergence (continued)				
Most annual broadleaf and grass weeds (continued)	dimethenamid, MOA 15 + atrazine, MOA 5 (Guardsman Max) 5 F	2.5 to 4.6 pt	0.73 to 1.5 + 0.83 to 1.7	
	S-metolachlor, MOA 15 + atrazine, MOA 5 (Bicep II Magnum) 5.5 F	1.3 to 2.6 qt	1 to 2 + 0.78 to 1.56	
CORN (sweet), Postemergence				
Most annual broadleaf and grass weeds	atrazine, MOA 5 (various brands) 4 L (various brands) 90 WDG	2 qt 2.2 lb	2	Apply overtop before weeds exceed 1.5 in. in height. See label for additional information in controlling larger weeds. See label for amount of oil concentrate to add to spray mix.
Annual grasses and broadleaf weeds	dimethenamid, MOA 15 (Outlook) 6.0 EC + atrazine, MOA 5 (AAtrex) 4 F or 90 WDG	8 to 21 oz + See label for rate	0.375 to 1 + See label for rate	Apply overtop corn (8 in. or less) before weeds exceed the two-leaf stage. Larger weeds will not be controlled. Good residual control of annual grass and broadleaf weeds. Also available as the commercial products Guardsman or LeadOff.
	S-metolachlor, MOA 15 (Dual II Magnum) 7.64 EC + atrazine, MOA 5 (AAtrex) 4 F (AAtrex) 90 WDG	1 to 1.67 pt + 1 to 2 qt 1.3 to 2.2 lb	0.95 to 1.58 + 1 to 2	Apply overtop corn (5 in. or less) before weeds exceed the two-leaf stage. Larger weeds will not be controlled. Good residual control of annual grass and broadleaf weeds. Also available as Bicep II or Bicep II Magnum.
Cocklebur, common ragweed, jimsonweed, Pennsylvania smartweed, velvetleaf, yellow nutsedge, and morningglory	bentazon, MOA 6 (Basagran) 4 SL	0.75 to 1 qt	0.75 to 1	Apply early postemergence overtop when weeds are small and corn has one to five leaves. See label for rates according to weed size and special directions for annual morningglory and yellow nutsedge control. Use a crop oil at a rate of 1 qt per acre.
Many broadleaf weeds	mesotrione, MOA 27 (Callisto) 4 EC	3 oz	0.094	Apply overtop corn 30 in. or less or 8 leaves or less to control emerged broadleaf weeds. Use nonionic surfactant at 2 pt per 100 gal of spray solution. DO NOT add VAN or AMS when making post application in sweetcorn or severe injury will occur. Most effective on small weeds, however, if weeds are greater than 5 in. or for improved control of certain weeds, certain atrazine formulations may be mixed with this herbicide. See label for further information. Do not apply within 45 days of harvest.
Annual broadleaf weeds	tembotrione, MOA 27 (Laudis) 3.5 L	3 fl oz	0.082	Can be applied overtop or with drop nozzles to sweet corn from emergence up to V7 stage. Controls most broadleaf weeds.Does not control sicklepod or prickly sida and only suppresses morningglory.Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. Herbicide sensitivity in all hybrids and inbreds of sweet corn has not bee tested. See label for further restrictions and instructions.
	Topramezone, MOA 27 (Impact) 2.8 L	0.75 fl oz	0.016	Can be applied overtop or with drop nozzles to sweet corn from emergence until 45 days prior to harvest. Does not control sicklepod and only suppresses morningglory. Controls or suppresses some grasses. See label for weeds controlled and recommended size for treatment. This product has not been tested on all inbred line for tolerance. See label for further restrictions and instructions.
Velvetleaf, spreading dayflower, morningglory species, and redroot pigweed. Will not control grasses	Fluthiacet-methyl, MOA (Cadet) 0.91 L	0.6 to 0.9 oz	0.0042 to 0.06	**Processing sweet corn only.** Apply to small weeds, generally about 2 inches tall. Will control large velvetleaf.
Velvetleaf, pigweed, nightshade, morningglory, common lambsquarters	carfentrazone-ethyl, MOA 14 (Aim) 2.0 EC	0.5 to 1 oz	0.008 to 0.016	Apply postemergence to actively growing weeds less than 4 in. high (rosettes less than 3 in. across) up to the eight-leaf collar stage of corn. Directed sprays will lessen the chance of crop injury. Coverage of weeds is essential for control. Use nonionic surfactant (2 pt per 100 gal of spray) with all applications. Under dry conditions, the use of crop oil concentrate may improve weed control. Mix with atrazine to improve control of many broadleaf weeds. Limited information is available concerning the use of this product in sweetcorn. Do not apply more than 2 oz per acre per season.
Broadleaf weeds including sowthistle, clover, cocklebur, jimsonweed, ragweed, Jerusalem artichoke, and thistle	clopyralid, MOA 4 (Solix 3, Stinger) 3 EC	0.25 to 0.67 pt	0.095 to 0.25	Apply to sweet corn when weeds are small (less than 5-leaf stage) and actively growing. Do not apply to sweet corn over 18 in. tall. Will control most legumes. Do not apply within 30 days of harvest.
Cocklebur, passionflower (maypop), pigweed, pokeweed, ragweed, smartweed (Pennsylvania), velvetleaf	halosulfuron, MOA 2 (Profine 75, Sandea) 75 WDG	0.67 to 1 oz	0.032 to 0.047	Apply over the top or with drop nozzles to sweet corn from spike to lay-by for control of emerged weeds. Add nonionic surfactant at 1 to 2 qt per 100 gal of spray solution. See label for all instructions and restrictions. Do not apply within 30 days of harvest.
Cocklebur, pigweed, lambs-quarters, morningglory, sicklepod, and many other annual broadleaf weeds	2,4-D amine, MOA 4 (various brands) 3.8 SL	0.5 to 1 pt	0.24 to 0.48	Use 0.25 lb of 2,4-D overtop when corn is 4 to 5 in. tall and weeds are small. Increase rate to 0.5 lb as corn reaches 8 in. Use drop nozzles and direct spray toward base if corn is **over 8 in. tall.** Do not cultivate for about 10 days after spraying as corn may be brittle. Reduce rate of 2,4-D if extremely hot and soil is wet. For better sicklepod and horsenettle control, add a nonionic surfactant when using a directed spray at a rate of 1 qt per 100 gal spray solution.
Annual grasses and broadleaf weeds	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	0.7 to 1.3 pt 1 to 2 pt	0.25 to 0.5	DO NOT SPRAY OVERTOP OF CORN OR SEVERE INJURY WILL OCCUR. Make a postdirected application in a minimum of 20 gal spray mix per acre to emerged weeds when the smallest corn is **at least 10 in. tall.** Use nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. Use of a hooded or shielded sprayer will reduce crop injury.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CORN (sweet), Postemergence (continued)				
Certain grasses, including barnyardgrass, foxtails, Texas panicum, and johnsongrass; and broadleaf weeds, including burcucumber, jimsonweed, pigweed, pokeweed, and smartweeds	nicosulfuron, MOA 2 (Accent) 75 WDG	0.67 oz	0.031	Apply to sweet corn up to 12 in. tall or up to and including 5 leaf collars. For corn 12 to 18 in. tall, apply only with drop nozzles. Sweet corn hybrids vary in their sensitivity to Accent. Do not apply to Merit sweet corn. Contact company representative for information on other local hybrids that have been evaluated with Accent. Accent may be applied to corn previously treated with Fortress, Aztec, or Force, or non-organophosphate soil insecticides regardless of soil type. See label for more information on use of soil insecticides with Accent. Label prohibits applicaiton of Accent to corn previously treated with Counter insecticide, and also indicates that applying Accent to corn previously treated with Counter 20 CR, Lorsban, or Thimet may result in unacceptable crop injury, especially on soils with less than 4% organic matter. See label for information on use of adjuvants.
CUCUMBERS, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant and incorporate into the soil 1 to 2 in. (1 in. incorporation is optimum) with a rototiller or tandem disk, or apply to the soil surface after seeding and follow with irrigation. Check replant restrictions for small grains on label.
Annual grasses and some small-seeded broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	0.4 to 1 pt	0.15 to 0.375	Apply immediately after seeding. Offers weak control of pigweed. See label for further information.
	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply to the soil surface immediately after seeding. DO NOT SOIL INCORPORATE. May also be used as a BANDED spray BETWEEN rows of plastic mulch. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfluralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. DO NOT APPLY PRIOR TO PLANTING CROP. DO NOT SOIL INCORPORATE. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting. Do not apply over or under plastic mulch.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply after seeding or prior to transplanting crop. For transplanting, do not transplant until 7 days after application. For seeded or transplanting cucumbers in plasticulture, do not plant within 7 days of Sandea application. Rate can be increased to 1 ounce of product per acre to middles between rows.
CUCUMBERS, Postemergence				
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 8 to 10 pt	6 to 7.5	**Will not control emerged weeds.** To improve preemergence control of late emerging weeds. Apply only when crop has four to five true leaves, is well-established, and growing conditions are favorable. Will not control emerged weeds. Incorporation not recommended. Not labeled for transplanted crop.
	trifluralin, MOA 3 (Treflan HFP) 4EC (Trifluralin) 4EC (Trifluralin HF) 4EC	1 to 2 pt	0.5 to 0.75	**Will not control emerged weeds. Row middles only.** To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the three to four true leaf stage of growth. Apply as a directed spray to soil between the rows. Will not control emerged weeds. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	Apply postemergence only after the crop has reached 3 to 5 true leaves but before first female flowers appear. Do not apply sooner than 14 days after transplanting. Controls many broadleaf weeds postemergence including cocklebur, galinsoga, smartweed, ragweed, wild radish, and pigweed. Use nonionic surfactant at 1 qt per 100 gal of spray solution with all postemergnce applications. Do not apply within 30 days of harvesting.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
CUCUMBERS, Postemergence (continued)				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 14 days of harvest.
	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125 	Control of emerged grasses. For Arrow, Clethodim, and Select, add 1 gal crop oil concentrate per 100 gal spray mix. For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
EGGPLANT, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150lb/A broadcast) will also be needed when laying first crop mulch to control nutsedge.
EGGPLANT, Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before transplanting as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to transplanting of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a crop oil at up to 1 gal per 100 gal of spray solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 in. incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
Annual grasses and some broadleaf weeds including galinsoga, common ragweed, and smartweed	napropamide, MOA 15 (Devrinol) 50 DF	2 to 4 lb	1 to 2	Apply preplant and incorporate into the soil 1 to 2 in. using a rototiller or tandem disk. Shallow cultivations or irrigations will improve control. See label for replanting restrictions for small grains.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan HFP) 4 EC	1 pt	0.5	Apply and incorporate before transplanting. Avoid transplanting until temperatures have warmed in late spring. **Eggplant tolerance to herbicide may be marginal.**
EGGPLANT, Postemergence				
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	To improve control of late emerging weeds. Apply over the top of transplants only between 4 and 6 wk after transplanting. Can also be applied after direct seeded plants are 4 to 6 in. tall. Will not control emerged weeds.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 20 days of harvest.
	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125 	Apply postemergence for for control of grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt of nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperature. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 20 days of harvest.
EGGPLANT, Row Middles				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use crop oil concentrate at up to 1 gal per 100 gal solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
EGGPLANT, Row Middles (continued)				
Contact kill of all green foliage	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 pt 2 pt	0.5	Apply in 10 gal spray mix as a shielded spray to emerged weeds between rows of eggplant. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. Do not allow spray to contact crop or injury will result.
GARLIC, Preplant and Preemergence				
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Stale bed application. Apply to emerged weeds at least 3 days before planting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.7 to 2.7 pt 2.5 to 4 pt	0.6 to 1	Apply in a minimum of 20 gal spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. Do not apply within 60 days of harvest.
GARLIC, Preplant incorporated or Preemergence				
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 in. incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
GARLIC, Preemergence				
Annual grasses and small-seeded broadleaf weeds	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	For preemergence weed control. Apply after crop has reached 2 true leaves until a minimum of 30 days before harvest. If applications are made to transplanted crop, DO NOT apply until transplants are in the ground and soil has settled around transplants with several days to recover.
	flumioxazin, MOA 14 (Chateau) 51 WDG	6 oz	0.188	For preemergence weed control. Apply prior to garlic and weed emergence. Application should be made within 3 days after planting garlic. Do not apply more than 6 oz per acre during a single growing season. Provides residual weed control.
	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 AS	 1.2 to 3.6 pt 1.5 to 3 pt	 0.5 to 1.5 0.75 to 1.5	For preemergence weed control. Apply preemergence after planting but prior to weed and crop emergence or postemergence to garlic in the one- to five-true leaf stage. Prowl can be applied sequentially by applying preemergence followed by a post-emergence application. Do not apply within 45 days of harvest.
Annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan, Goal) 2 E (GoalTender) 4 E	 1 to 2 pt 0.25 to 1 pt	0.25 to 0.5	**Transplanted dry bulb only**. Apply as a single application immediately (within 2 days) after transplanting for preemergence control of weeds. See label for rates and instructions for use. Do not apply within 60 days of harvest. See label for seeded garlic.
GARLIC, Postemergence				
Most annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	 0.5 pt 0.5 pt 0.25 pt	0.12	**Dry bulb only.** May be used as a postemergence spray to both the weeds and crop after the garlic has at least two fully developed true leaves. Some injury to garlic may result. Injury will be more severe if the chemical is applied during cool, wet weather. Weeds should be in the two- to four-leaf stage for best results. Do not make more than four applications per year. Do not apply within 60 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	 6 to 16 oz 9 to 32 oz	 0.09 to 0.25 0.07 to 0.25	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt of nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not apply Arrow, Clethodim, or Select on unusually hot and humid days. Do not apply within 45 days of harvest. Very effective in controlling annual bluegrass.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 gal crop oil concentrate or 1 qt nonionic surfactant per 100 gal spray mix. Do not apply on days that are unusually hot and humid. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 pt	0.2	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 30 days of harvest.
Garlic, Row Middles				
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
GREENS (Collard, kale, mustard, and turnip greens or roots), Preplant				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.5 to 2.7 pt 2 to 4 pt	0.6 to 1	**Collard and turnip only.** Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
GREENS (Collard, kale, mustard, and turnip greens or roots), Preplant (continued)				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
GREENS (Collard, kale, mustard, and turnip greens or roots), Preplant incorporated				
	trifluralin, MOA 3 (Treflan HFP) 4 EC	1 to 1.5 pt	0.5 to 0.75	Apply preplant and incorporate into the soil 2 to 3 in. within 8 hr using a rototiller or tandem disk. Do not use if turnip roots are to be consumed.
GREENS (Collard, kale, mustard, and turnip greens or roots), Preplant or Preplant incorporated				
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Also labeled for rape greens. Not labeled for turnip. Apply preplant or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	Also labeled for broccoli raab (raab, raab salad), mizuna, and hanover salad. Apply immediately after seeding. May also be incorporated.
GREENS, Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Solix 3) 3 EC (Stinger) 3 EC	0.3 to 0.5 pt	0.187	**Kale, collards, mustard, turnip, mizuna, mustard spinach, and rape.** Apply to crop when weeds are small and actively growing. Will control most legumes. For kale, collards, mustard, and turnip (roots), do not apply within 30 days of harvest. For turnip tops, do not apply within 15 days of harvest. Mustard green injury has been observed in some research trials.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	 6 to 8 oz 9 to 16 oz	 0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest of green crops. Do not apply within 30 days of harvest of turnips grown for roots.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	ALSO LABELED FOR RAPE GREENS. Do not apply within 14 days of harvest of turnip and 30 days of harvest of other greens. Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply on unusually hot and humid days.
GREENS, Row middles				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Not labeled for turnip greens.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
LETTUCE, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emerges as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray solution or 1 gal approved crop oil concentrate per 100 gal spray mix.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
LETTUCE, Preplant or preemergence				
Annual grasses and small-seeded broadleaf weeds	benefin, MOA 3 (Balan) 60 WDG	2 to 2.5 lb	1.2 to 1.5	Apply preplant and incorporate 2 to 3 in. deep with a rototiller or tandem disk before seeding or transplanting.
	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 in. incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
Most annual grasses and broadleaf weeds	pronamide, MOA 3 (Kerb) 50 WP	2 to 4 lb	1 to 2 lb	**DO NOT APPLY TO LEAF LETTUCE.** Can be used preplant or preemergence. Application can also be made postemergence to head lettuce but should be made before weed germination if possible or before weeds are beyond the two-leaf stage. Moisture is necessary to activate. Do not apply within 55 days of harvest. Make only one application per crop. Consult label for planting restrictions for rotational crops.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
LETTUCE, Postemergence				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Arrow, Clethodim, and Select are only registered for leaf lettuce. Consult manufacturer's label for specific rates and best times to treat. For sethoxydim, add 1 qt of crop oil concentrate per acre. Use of Poast or clethodim with crop oil may increase the likelihood of crop injury at high air temperatures. For Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray solution. With Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Do not apply on days that are unusually hot and humid. Do not apply sethoxydim within 30 days of harvest on head lettuce or within 15 days of harvest on leaf lettuce. For clethodim, do not apply within 14 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.09 to 0.125 0.07 to 0.125	
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
OKRA, Preplant				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to transplanting crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC (Trifluralin) 4 EC (Trilin) 4 EC	1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 in. within 8 hr using a rototiller or tandem disk.
OKRA, Postemergence				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.3 lb	Apply to actively growing grasses not under drought stress. . Do not apply on days that are unusually hot and humid. Do not apply within 14 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
ONIONS, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	**Dry bulb and green onion.** Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.7 to 2.7 pt 2.5 to 4 pt	0.65 to 1	**Seeded onion only.** Apply in a minimum of 20 gal spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix. Do not apply within 60 days of harvest.
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Use on direct seeded onions only. Certain glyphosate formulations require the addition of surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 E	5 to 6 qt	5 to 6	**Dry bulb only.** Apply preplant incorporated (1 in. incorporation is optimum) or preemergence after planting. With preemergence application, irrigate immediately after application. See label for more directions.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 8 to 10 pt	6 to 7.5	**Dry bulb and green.** Apply immediately after seeding or transplanting and/or at layby. See label for timing layby treatments.
Annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	1 to 2 pt 1 to 2 pt 1 pt	0.25 to 0.5 0.25 to 0.5 0.5	**Transplanted dry bulb only.** Apply as a single application immediately (within 2 days) after transplanting for preemergence control of weeds. See label for rates and instructions for use. Do not apply within 45 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
ONIONS, Preplant and Preemergence (continued)				
Most annual grasses and some broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl) 3.8 AS	 1.2 to 3.6 pt 1.5 to 2 pt	 0.5 to 1.5 0.75 to 1.5	**Dry bulb only.** For preemergence weed control. **MINERAL SOILS**. Apply when onions have two to nine true leaves but prior to weed emergence. **ALL SOILS**. Do not apply within 45 days of harvest.
	(Prowl) 3.3 EC (Prowl) 3.8 AS	2.4 to 4.8 pt 4 pt	1 to 2 2	**Dry bulb only.** For preemergence weed control. **MUCK SOILS**. Apply prior to onion emergence through the nine-leaf stage. See label for specific rate for crop growth stage and for all precautions. **ALL SOILS**. Do not apply within 45 days of harvest.
	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	**Dry bulb only.** For preemergence weed control. Apply after crop has reached 2 true leaves until a minimum of 30 days before harvest. If applications are made to transplanted crop, DO NOT apply until transplants are in the ground and soil has settled around transplants with several days to recover.
ONIONS, Postemergence				
Most annual broadleaf weeds	oxyfluorfen, MOA 14 (Galigan) 2 E (Goal 2 XL) 2 EC (GoalTender) 4 E	 0.5 pt 0.5 pt 0.25 pt	0.12	**Dry bulb only.** May be used as a postemergence spray to both the weeds and crop after the onions have at least two fully developed true leaves. Some injury to onions may result. Injury will be more severe if the chemical is applied during cool, wet weather. Weeds should be in the two- to four-leaf stage for best results. Do not make more than four applications per year. Do not apply within 45 days of harvest.
Many broadleaf weeds	Flumioxazin, MOA (Chateau) 51% WDG	2 oz	0.064	**Dry bulb only.** Apply to clean soil surface prior to germination of weeds. Apply to transplanted dry bulb onion between 2 and 6 leaf stage. Apply to directed seeded dry bulb onion between the 3 and 6 leaf stage.
Common lambsquarters, common chickweed, common purslane, black nightshade, ladysthumb, Pennsylvania smartweed, redroot pigweed, and some annual grasses	Ethofumesate, MOA (Nortron) 4 SC	16 to 32 oz	0.5 to 1	Apply at planting or just after planting prior to weed emergence. Rainfall of at least 0.5 inch is needed for activation.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	**Dry bulb only.** Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 gal crop oil concentrate or 1 qt nonionic surfactant per 100 gal spray mix. Do not apply on days that are unusually hot and humid. Do not apply within 45 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	**Dry bulb and green.** Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 30 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	 6 to16 oz 9 to 32 oz	 0.09 to 0.25 0.07 to 0.25	**Dry bulb only.** Apply to emerged grasses. Consult the manufacturer's label for specific rates and best times to treat. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max or Intensity One, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not apply Select on unusually hot and humid days. Do not apply within 45 days of harvest. Very effective in controlling annual bluegrass.
PEAS, GREEN, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to planting or emergence of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	 1.5 to 3 pt	 0.75 to 1.5	**Southern peas and snap beans only.** Apply preplant and incorporate into the soil 2 to 3 in. using a power driven rototiller or by cross disking. DO NOT APPLY AFTER SEEDING.
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan HFP) 4 EC (Trifluralin) 4 EC (Trifluralin HF) 4 EC (Other brands) 4 EC	1 to 1.5 pt	0.5 to 0.75	Apply preplant and incorporate to a depth of 2 to 3 in. within 8 hr with a rototiller or tandem disk.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.4 to 0.67 pt	0.15 to 0.25	Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instruction. Limited research has been done on this product in this crop in North Carolina.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PEAS, GREEN, Preplant and Preemergence (continued)				
Annual grasses, small-seeded broadleaf weeds, and suppression of yellow nutsedge	S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC (Medal) 7.62 EC (Brawl II) 7.64 EC (Dual II Magnum) 7.64 EC (Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after seeding. Shallow cultivations will improve control. See label for specific rate.
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 3 oz	Up to 0.047	**English peas only.** Apply preplant incorporated or to soil surface immediately after planting.
PEAS, GREEN, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	Apply overtop of peas when weeds are small and peas have at least three pairs of leaves (four nodes). DO NOT ADD CROP OIL CONCENTRATE TO SPRAY MIX. Do not apply within 10 days of harvest. Do not apply when peas are in bloom.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See Label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels 0.5 to 0.94	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots or stems, exposed roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. With sethoxydim, add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast or Assure II may increase the likelihood of crop injury at high air temperatures. With quizalofop, add 1 gal oil concentrate or 1 qt nonionic surfactant per 100 gal spray. Do not apply Poast or Assure II on days that are unusually hot and humid. Do not apply sethoxydim within 15 days or Assure within 30 days of harvest.
	quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC (Targa) 0.88 EC	6 to 12 oz	0.04 to 0.08	
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 3 oz	Up to 0.047	**English peas only.** Apply postemergence to 1- to 3-in. weeds (one to four leaves) when peas are at least 3 in. high but prior to five nodes. Add nonionic surfactant at 2 pt per 100 gal of spray mix.
PEAS, SOUTHERN (cowpeas, blackeyed peas), Preplant or Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 20 gal spray solution to emerged weeds before crop emergence as a broadcast or band treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	Up to 2 oz	Up to 0.031	Apply prior to planting or emergence of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See Label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application.	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl H_2O) 3.8 AS	1.5 to 3 pt	0.75 to 1.5	NOT LABELED IN BLACKEYED PEAS. Apply preplant and incorporate into the soil 2 to 3 in. using a power driven rototiller or by cross disking. DO NOT APPLY AFTER SEEDING.
	trifluralin, MOA 3 (Treflan HFP) 4 EC (Trifluralin) 4 EC (Trifluralin HF) 4 EC (Other brands) 4 EC	1 to 2 pt	0.5 to 1	Apply preplant and incorporate into the soil 2 to 3 in. deep within 8 hr with a rototiller or tandem disk.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3ME	0.4 to 0.67 pt	0.15 to 0.25	Apply to the soil surface immediately after seeding. Offers weak control of pigweed. See label for further instruction. Limited research has been done on this product in this crop in North Carolina.
Annual grasses, small-seeded broadleaf weeds, and suppression of yellow nutsedge	S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC (Medal) 7.62 EC (Brawl II) 7.64 EC (Dual II Magnum) 7.64 EC (Medal II) 7.64 EC	1 to 2 pt	0.95 to 1.91	Apply to soil surface immediately after planting. Shallow cultivations will improve control. May also be soil incorporated before planting.
Annual grasses and broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 2 EC	Up to 4 oz	Up to 0.063	Apply preemergence or preplant incorporated. See label for rate for specific pea species.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PEAS, SOUTHERN, Postemergence				
Annual broadleaf weeds and yellow nutsedge	bentazon, MOA 6 (Basagran) 4 SL	1 to 2 pt	0.5 to 1	Apply overtop of peas when weeds are small and peas have at least three pairs of leaves (four nodes). DO NOT ADD CROP OIL CONCENTRATE TO SPRAY MIX. Do not apply within 30 days of harvest. Do not apply when peas are in bloom.
Annual broadleaf weeds including morningglory, pigweed, smartweed, and purslane	imazethapyr, MOA 2 (Pursuit) 70 DG	Up to 1.44 oz	Up to 0.063	**Southern peas and certain dry peas.** Apply postemergence to 1- to 3-in. weeds (one to four leaves) when peas are at least 3 in. in height but prior to five nodes and flowering. Add nonionic surfactant at 2 pt per 100 gal of spray mixture with all postemergence applications. Do not apply within 30 days of harvest. See label for rate for specific pea species.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses	quizalofop p-ethyl, MOA 1 (Assure II) 0.88 EC (Targa) 0.88 EC	6 to 12 oz	0.04 to 0.08	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. With sethoxydim, add 1 qt of crop oil concentrate per acre. With quizalofop, add 1 gal oil concentrate or 1 qt nonionic surfactant per 100 gal spray. Adding crop oil to Assure II or Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Assure II or Poast on days that are unusually hot and humid. With sethoxydim, do not apply within 15 days and 30 days of harvest for succulent and dry peas, respectively. With quizalofop, do not apply within 30 days of harvest of dry Southern peas.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	
	clethodim, MOA 1 (Intensity One, Select Max) 1 EC	9 to 16 oz	0.07 to 0.125 lb	For Select Max or Intensity One, add 2 pt. nonionic surfactant per 100-gal spray mixture. Apply before bloom. Do not make more than one application per acre per season. Do not apply clethodim within 21 days of harvest.
PEPPERS Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150lb/A broadcast) will also be needed when laying first crop mulch to control nutsedge.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal of spray mix per acre to emerged weeds before transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to transplanting of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use crop oil at up to 1 gal per 100 gal of spray solution or a nonionic surfactant at 2 pt per 100 gal of spray solution. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant incorporated (1 in. incorporation is optimum) or preemergence. With preemergence application, irrigate immediately after application. See label for directions.
Annual grasses and small-seeded broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	0.67 to 2.67 pt	0.25 to 1	**Not labeled for banana pepper.** Apply preplant before transplanting. Weak on pigweed. SEE LABEL FOR INSTRUCTIONS ON USE.
	napropamide, MOA 15 (Devrinol) 50 DF (Devrinol) 2 EC	2 to 4 lb 2 to 4 qt	1 to 2	**Bare ground:** Can be used on direct-seeded and transplanted peppers. See label for instructions on use. **Plasticulture:** **In-row.** Apply to a weed-free soil before laying plastic mulch. Soils should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches. Incorporate on the same day as applied using equipment that will result in uniform incorporation of the herbicide to the desired depth. Then apply plastic mulch. If weed pressure is from small seeded annuals, apply to the surface of the bed immediately in front of the laying of plastic mulch. If soil is dry, water or sprinkler irrigate with sufficient water to wet to a depth of 2 to 4 inches before covering with plastic mulch. Apply the plastic mulch over the treated soil the same day. **Between rows.** Apply to a weed-free soil surface between rows of plastic. Apply Devrinol within 24 hours of rainfall, or mechanically incoporate or irrigate Devrinol into the soil to a depth of 1 to 2 inches within 24 hours of application.
	pendimethalin, MOA 3 (Prowl H_2O) 3.8	1 to 3 pt	0.5 to 1.5	May be applied in chili pepper, cooking pepper, pimento, and sweet pepper. Do not apply more than 3 pt per acre per season. See label for specific use rate for your soil type. Emerged weeds will not be controlled. Avoid direct contact with pepper foliage or stems. Do not apply within 70 days of harvest. See label for further instructions and precautions. **Between rows.** Can be applied as a post-directed spray on the soil at the base of the plant beneath plants and between rows. **In-row.** Do not apply Prowl H_2O to the bed if using plasticulture production system. May be applied as a broadcast preplant incorporated surface application prior to transplanting peppers.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PEPPERS Preplant (continued)				
Annual grasses and small-seeded broadleaf weeds (continued)	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin HF, Trilin) 4 EC	1 to 2 pt	0.5 to 1	Apply pretransplant, and incorporate to a depth of 2 to 3 in. within 8 hr with a rototiller or tandem disk.
Broadleaf weeds and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2XL	Up to 2 pt	0.5 lb	**Plasticulture only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting crop for control of many broadleaf weeds including Carolina geranium and cutleaf eveningprimrose. While incorporation is not necessary, it may result in less crop injury. Plastic mulch can be applied anytime after application but best results are likely if applied soon after application.
Annual grass and broadleaf weeds, yellow nutsedge suppression	*S*-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	8 to 12 oz	0.47 to 0.7	**Bell pepper transplants only.** This is a Section 24© special local needs label. Growers must obtain label prior to making Dual Magnum applications. Growes must obtain label at www.farmassist.com Option 1: Apply 8 to 12 oz to the soil surface of pre-formed beds prior to laying plastic. Insure the plastic laying process does not incorporate or disturb the treated bed. Option 2: Apply 12 oz overtop of bell pepper between 1 and 3 weeks after planting. Does not control emerged weeds. Limited data are available for NC. Do not apply more than 12 oz/A as it is likely that injury will occur including decreased crop vigor. Read label for further instructions.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as a preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
PEPPERS, Postemergence				
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 7 days of harvest.
	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC	6 to 8 oz	0.094 to 0.125	Apply postemergence to control grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 20 days of harvest.
	(Select Max) 1 EC	9 to 16 oz	0.07 to 0.125	
PEPPERS, Row Middles				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayer for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75, Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
Contact kill of all green foliage	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 pt 2 pt	0.5	Apply in a minimum of 20 gal spray mix per acre as a shielded spray to emerged weeds between rows of peppers. Use a nonionic surfactant at a rate of 16 oz per 100 gal spray mix.
POTATOES, IRISH, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	0.7 to 1.3 pt 1 to 2 pt	0.26 to 0.5 0.25 to 0.5	Apply in a minimum of 20 gal spray mix per acre to emerged weeds up to ground cracking before crop emergence. May be used instead of the drag-off operation to kill emerged weeds before the application of preemergence herbicides. This procedure should help to provide excellent control of all annual weeds. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply prior to planting or emergence of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	pendimethalin, MOA 3 (Prowl) 3.3 EC (Prowl H_2O) 3.8 AS	1.8 to 3.6 pt 1.5 to 3 pt	0.75 to 1.5 0.75 to 1.5	Apply just after planting or drag-off to weed-free soil before crop emerges or from emergence until crop reaches 6 in. tall.
Annual grasses and small-seeded broadleaf weeds, plus yellow nutsedge suppression	S-metolachlor, MOA 15 (Brawl) 7.62 EC (Dual Magnum) 7.62 EC (Medal) 7.62 EC (Brawl II) 7.64 EC (Dual II Magnum) 7.64 EC (Medal II) 7.64 EC	1 to 2 pt	0.95 to1.91	Apply just after planting or drag-off to weed-free soil before crop emerges. Dual Magnum can also be applied at lay-by for control of late season weeds. See label for further instruction.
	dimethenamid-P, MOA 15 (Outlook) 6 EC	12 to 21 oz	0.6 to 1	Apply just after planting or drag-off to weed-free soil before crop emerges. See label for further instruction.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
POTATOES, IRISH, Preplant and Preemergence (continued)				
Annual grasses, most broadleaf weeds, plus yellow and purple nutsedge suppression	EPTC, MOA 8 (Eptam) 7 EC	3.5 pt	3	Apply preplant and incorporate into the soil 2 to 3 in. with a rototiller or tandem disk. The variety “Superior” has been shown to be sensitive to Eptam. See label for specific methods of incorporation.
Most annual broadleaf weeds and some annual grasses	flumioxazin, MOA 14 (Chateau) 51 WDG	1.5 oz	0.047	Apply immediately after hilling. A minimum of 2 in. of soil must cover the vegetative portion of the potato plant at the time of application of Chateau. Do NOT apply to emerged potatoes. DO NOT incorporate Chateau or weed control will be reduced. Can be tank mixed with burndown herbicides if weeds are present at application. See label for further instructions.
	linuron, MOA 7 (Lorox DF) 50 WDG	1.5 to 3 lb	0.75 to 1.5	Apply just after planting or drag-off or hilling but before crop emerges. If emerged weeds are present, add 1 pt surfactant for each 25 gal spray mixture. Weeds may be up to 3 in. tall at time of application.
	metribuzin, MOA 5 (TriCor DF) 75 WDG (Metri DF) 75 WDG	0.3 to 1.3 lb	0.23 to 1	Apply just after planting or drag-off but before crop emerges. Weeds may be emerged at time of application. On sand soils or sensitive varieties, do not exceed 0.67 lb per acre. See label for list of sensitive varieties.
	rimsulfuron, MOA 2 (Matrix) 25 WDG (Pruvin) 25 WDG	1 to 1.5 oz	0.016 to 0.023	Apply after drag-off or hilling but before potatoes and weeds emerge. If emerged weeds are present, add surfactant. See label for rate. Can be tank mixed with Eptam, Prowl, Sencor, Lorox, or Dual Magnum. See label for further instructions.
Yellow and purple nutsedge	EPTC, MOA 8 (Eptam) 7 EC	3.5 pt	3	For late season preemergence nutsedge control, apply and incorporate as a directed spray to the soil on both sides of the crop row.
POTATOES, IRISH Postemergence				
Most annual broadleaf weeds and some annual grasses	metribuzin, MOA 5 (TriCor DF) 75 WDG (Metri DF) 75 WDG	0.33 to 0.67 lb	0.25 to 0.5	Do not use on early maturing smooth-skinned white or red-skinned varieties. Apply only if there have been at least three successive days of sunny weather before application. Treat before weeds are 1 in. tall. Treatment may cause some chlorosis or minor necrosis. Do not apply within 60 days of harvest.
	rimsulfuron, MOA 2 (Matrix) 25 WDG (Pruvin) 25 WDG	1 to 1.5 oz	0.016 to 0.023	Apply to young actively growing weeds after crop emergence but before the crop exceeds 14 in. tall. More effective on small weeds. Add nonionic surfactant at 1 to 2 pt per 100 gal water. Can be tank mixed with Eptam or Sencor or some foliar fungicides. See label for further instructions.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity) (Select) 2 EC (Intensity One) 1 EC (Select Max) 1 EC	 6 to 8 oz 9 to 32 oz	 0.094 to 0.125 0.07 to 0.25	Apply postemergence for control of grasses. With Arrow, Clethodim, Intensity or Select, add 1 qt crop of oil concentrate per acre. With Intensity One orSelect Max, nonionic surfactant of 2 pt per 100 gal spray mixture can be used instead of crop oil concentrate. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 30 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer’s label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply on days that are unusually hot and humid. Do not apply within 30 days of harvest.
PUMPKINS, Preplant and Preemergence				
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 20 gal spray mix per acre to emerged weeds before crop emergence or transplanting as a band or broadcast treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting or treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray solution or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Not registered for use on seeded crop.** Apply prior to transplanting crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer’s label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and some small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant and incorporate into the soil 1 to 2 in. (1 in. incorporation is optimum) with a rototiller or tandem disk, or apply to the soil surface after seeding and follow with irrigation. Check replant restrictions for small grains on label. See label for use rate if Prefar 4 EC is used.
	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply to the soil surface immediately after seeding. DO NOT SOIL INCORPORATE. May also be used as a BANDED spray between rows of pumpkin. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
PUMPKINS, Preplant and Preemergence (continued)				
Annual grasses and some small-seeded broadleaf weeds (continued)	ethalfuralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. DO NOT APPLY PRIOR TO PLANTING CROP. DO NOT SOIL INCORPORATE. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as a preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
PUMPKINS, Postemergence				
Annual grasses and some small- seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Row middles only.** To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the three to four true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Intensity One) 1 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max or Intensity One, add 2 pt of nonionic surfactant per 100 gal spray mixture. Adding crop oil concentrate may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Crop oil may increase the likelihood of crop injury at high temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 14 days of harvest.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
RADISH, preplant				
Annual and perennial grass and broadleaf weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before planting. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and broadleaf weeds	trifluralin, MOA 3 (Treflan, Treflan HFP, Trifluralin, Trifluralin HF, Trilin) 4 EC	1 to 1.5 pt	0.5 to 0.75	Apply preplant and incorporate immediately after application for preemergence weed control. Low rate should be used on coarse-textured soil.
Radish, postemergence				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Annual and perennial grasses	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC (Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.94 to 0.125 0.07 to 0.125	Apply postemergence to emerged grasses. See label for rates for specific grasses. With Arrow, Clethodim, or Select, add crop oil concentrate at 1 gal per 100 gal of spray solution. With Select Max, add nonionic surfactant at 2 pt per 100 gal spray mixture. Do not spray within 15 days of harvest.
SPINACH, Preemergence				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before crop emergence. Do not feed residue to livestock for 8 weeks. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and broadleaf weeds	cyclohexylethylthio-carbamate, MOA 3 (Ro-Neet) 6E	2 qt	3	Use on sandy mineral soils only. Read label for further instructions.
SPINACH, Postemergence				
Broadleaf weeds including sowthistle clover, cocklebur, jimsonweed, and ragweed	clopyralid, MOA 4 (Solix 3) 3 EC (Stinger) 3 EC	0.17 to 0.33 pt	0.0625 to 0.125 lb	Apply to spinach in the 2- to 5-leaf stage when weeds are small and actively growing. Will control most legumes. See label for more precautions. Do not apply within 21 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
SPINACH, Postemergence (continued)				
Broadleaf weeds	phenmedipham, MOA 6 (Spin-aid) 1.3 EC	3 to 6 pt	0.5 to 1	**For processing spinach only.** Do not use when expected high temperatures will be above 75°F. For best results, spray when weeds are in the two-leaf stage. Use the 6-pt rate only on well-established crops that are not under stress. Do not apply within 40 days of harvest. Spinach plants must have more than six true leaves.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Annual and perennial grasses only	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. For sethoxydim, add 1 qt of crop oil concentrate per acre. For Arrow, Clethodim, or Select, add 1 gal of crop oil concentrate per 100 gal spray solution. For Select Max, add nonionic surfactant at 2 pt per 100 gal of spray mixture. Adding crop oil to Poast or Select may increase the likelihood of crop injury at high air temperatures. Do not apply Poast, Arrow, Clethodim, or Select on days that are unusually hot and humid. Do not apply sethoxydim within 15 days of harvest or clethodim within 14 days of harvest.
	clethodim, MOA 1 (Arrow) 2 EC (Clethodim) 2 EC (Intensity) 2 EC (Select) 2 EC	6 to 8 oz	0.094 to 0.125	
	(Intensity One) 1 EC (Select Max) 1 EC	9 to 16 oz	0.07 to 0.125	
SQUASH, Preplant and Preemergence				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before transplanting or crop emergence as a band or broadcast treatment over a preformed row. Use sufficient water to give thorough coverage. Row should be formed several days ahead of planting or treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Not registered for seeded crop. Apply prior to transplanting crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses and small-seeded broadleaf weeds	bensulide, MOA 8 (Prefar) 4 EC	5 to 6 qt	5 to 6	Apply preplant and incorporate into the soil 1 to 2 in. (1 in. incorporation is optimum) with a rototiller or tandem disk, or apply to the soil surface after seeding and follow by irrigation. Check replant restrictions for small grains on label.
	ethalfluralin, MOA 3 (Curbit) 3 EC	1.5 to 2 pt	0.56 to .75	For squash grown on bare ground only. Apply to the soil surface immediately after seeding. Do not soil incorporate. Seed must be covered with soil to prevent crop injury. For coarse-textured soils, use lowest rate of rate range. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. If weather is unusually cold or soil wet and cold, crop stunting or injury may occur. Crop injury can also occur if seeding depth is too shallow. See label for further precautions and instruction.
		3 to 4.5 pt	1.1 to 1.7	For squash grown on plastic only. Apply to the soil surface between the rows of black plastic immediately after seeding or transplanting. Do not use under mulches, row covers, or hot caps. Do not apply prior to planting or over plastic. See label for further instruction.
Annual grasses and broadleaf weeds	ethalfuralin, MOA 3 + clomazone, 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. DO NOT APPLY PRIOR TO PLANTING CROP. DO NOT SOIL INCORPORATE. May also be used as a **banded** treatment **between** rows after crop emergence or transplanting.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
SQUASH, Postemergence				
Annual grasses and small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan) 4 EC (Treflan HFP) 4 EC	1 to 1.5 pt	0.5 to 0.75	**Row middles only.** To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the three to four true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 30 days of harvest. Will not control emerged weeds.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
SQUASH, Postemergence (continued)				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	**Row middles only.** Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 30 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max or Intensity One, add 2 pt of nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast)1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 14 days of harvest.
SWEETPOTATO, Preplant				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds before transplanting. Do not feed crop residue to livestock for 8 weeks following treatment. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations may require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual broadleaf weeds including pigweed	flumioxazin, MOA 14 (Valor) 51 WDG	3 oz	0.094	Apply 2 to 5 days prior to transplanting crop for control of many annual broadleaf weeds and annual sedges. Movement of soil during transplanting should not occur or reduced weed control may result. Do not use on greenhouse-grown transplants. Do not apply postemergence or serious crop injury will occur. Do not use on transplants harvested more than 2 days prior to transplanting. Do not use on transplant propagation beds. See label for instruction on use.
SWEETPOTATO, Preemergence				
Annual grass and broadleaf weeds, Palmer amaranth, yellow nutsedge suppression	S-metolachlor, MOA 15 (Dual Magnum) 7.62 EC	0.75 pt	1.0	This is a Section 24© special local needs label. Growers must obtain label prior to making Dual Magnum applications. Growes must obtain label at www.farmassist.com Apply after the sweetpotatoes have been transplanted but prior to weed emergence. Do not apply preplant. Do not incorporate after application. Injury potential is greatest when applied to sands or loamy sands especially if a heavy rainfall event occurs following application. See label for further information.
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	up to 2 pt	up to 0.75	Posttransplant. Apply within 5 days after transplanting for preemergence control. Weak on pigweed. See label for other instructions and precautions.
	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	Apply to the soil surface immediately after transplanting. May also be applied at layby for preemergence weed control late in the growing season. Applying herbicide in bands over row will reduce cost. Do not apply in plant beds or crop injury will occur.
	napropamide, MOA 15 (Devrinol) 50 DF	2 to 4 lb	1 to 2	**PLANT BEDS.** Apply to the soil surface after sweetpotato roots are covered with soil but prior to soil cracking and sweetpotato plant emergence. Does not control emerged weeds. Check label for more information. **PRODUCTION FIELDS.** Apply to the soil surface immediately after transplanting. If rainfall does not occur within 24 hr, shallow incorporate or irrigate with sufficient water to wet the soil to a depth of 2 to 4 in. Check label for more information.
SWEETPOTATO, Postemergence				
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	6 to 16 oz 9 to 32 oz	0.094 to 0.25 0.07 to 0.25	Apply to actively growing grasses not under drought stress. For Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. For Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Do not apply within 30 days of harvest.
	fluazifop, MOA 1 (Fusilade DX) 2 EC	6 to 16 oz	0.1 to 0.25	Apply to actively growing grasses not under drought stress. Consult manufacturer's label for specific rates and best times to treat. Add 1 gal crop oil concentrate or 1 qt nonionic surfactant per 100 gal spray mix. Do not apply Fusilade on days that are unusually hot and humid. Do not apply within 55 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress.. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 30 days of harvest.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
SWEETPOTATO, Row Middles				
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 ((numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. May cause cracking of sweetpotato storage roots if spray solution comes in contact with sweetpotato foliage. Do not apply within 14 days of harvest.
TOMATOES, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information. Chloropicrin (150lb/A broadcast) will also be needed when laying first crop mulch to control nutsedge.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Not registered for seeded crop.** Apply prior to transplanting of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply to emerged weeds in a minimum of 20 gal spray mix per acre before crop emergence as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
TOMATOES, Preemergence				
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply no sooner than 14 days after transplanting. For pretransplant application under plastic mulch, apply to pre-formed bed just prior to plastic mulch application and delay transplanting at least 7 days. Early season application will give postemergence and preemergence control. The 1 oz rate is for preemergence and postemergence control in row middles. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution. Do not apply within 30 days of harvest.
Yellow nutsedge, annual grasses, and broadleaf weeds	S-metolachlor, MOA 15 (Brawl, Dual Magnum, Medal) 7.62 EC	1 to 2 pt	0.95 to 1.50 lb	Apply preplant or postdirected to transplants after the first settling rain or irrigation. In plasticulture, apply to pre-formed beds just prior to applying plastic mulch. Minimize contact with crop. Do not apply within 90 days of harvest. Also registered for use in row middles, and in seeded crop. See label for further instructions.
Annual grasses and broadleaf weeds, including jimsonweed, common ragweed, smartweed, and velvetleaf	metribuzin, MOA 5 (TriCor DF) 75 WDG (Metri) 4 F	0.33 to 0.67 lb 0.5 to 1 pt	0.25 to 0.5	Apply to soil surface and incorporate 2 to 4 in. deep before transplanting. See label for instructions. Can be applied with trifluralin.
Annual grasses and small-seeded broadleaf weeds	napropamide, MOA 15 (Devrinol) 50 DF	2 to 4 lb	1 to 2	**Bare ground:** Apply preplant and incorporate into the soil 1 to 2 in. as soon as possible with a rototiller or tandem disk. Can be used on direct-seeded or transplanted tomatoes. See label for instructions on use. **Plasticulture:** Apply preplant and incorporate into the soil 1 to 2 in. as soon as possible with a rototiller or tandem disk. May be applied prior to laying plastic if irrigation is available. **In-row:** Apply to a weed-free soil before laying plastic mulch. Soil should be well worked yet moist enough to permit a thorough incorporation to a depth of 2 inches. Incorporate on the same day as applied using equipment that will result in uniform incoporation of the herbicide to the desired depth. Then lay plastic mulch. If weed pressure is from small seeded annuals, apply to the surface of the bed immediately in front of the laying of plastic mulch. If soil is dry, water or sprinkle irrigate with sufficient water to wet to a depth of 2 to 4 inches before covering with plastic mulch.
	pendimethalin, MOA 3 (Prowl H_2O) 3.8	1 to 3 pt	0.5 to 1.5	Do not apply more than 3 pt per acre per season. See label for specific use rate for your soil type. Emerged weeds will not be controlled. Avoid direct contact with tomato foliage or stems. Do not apply within 70 days of harvest. See label for further instructions and precautions. **In-row.** May be applied as a broadcast preplant incorporated surface application prior to transplanting tomatoes. Do not apply Prowl H_2O to the bed if using plasticulture production system.
	trifluralin, MOA 3 (Treflan HFP, Trifluralin, Trifluralin HF, Trilin) 4 EC	1 pt	0.5	Apply pretransplant and incorporate into the soil 2 to 3 in. within 8 hr using a rototiller or tandem disk.
Broadleaf weeds including Carolina geranium and cutleaf eveningprimrose and a few annual grasses	oxyfluorfen, MOA 14 (Goal) 2 XL	Up to 2 pints	0.5 lb	**Plasticulture only.** Apply to soil surface of pre-formed beds at least 30 days prior to transplanting crop. While incorporation is not necessary, it may result in less crop injury. Plastic mulch can be applied anytime after application but best results are likely if applied soon after application.
Annual grasses and broadleaf weeds, including cocklebur, common ragweed, smartweed, and velvetleaf	trifluralin, MOA 3 (Trifluralin) 4 EC + metribuzin, MOA 5 (Metri DF) 75 WDG	1 pt + 0.33 to 0.67 lb	0.5 + 0.25 to 0.5	Apply pretransplant and incorporate to a depth of 2 to 3 in. within 8 hr, using a rototiller or tandem disk. See label for further instructions.
Annual grasses and small-seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	 8 to 10 lb 8 to 10 pt	6 to 7.5	Apply over the top of transplants only between 4 to 6 wk after transplanting to improve preemergence control of late emerging weeds. Will not control emerged weeds.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
TOMATOES, Postemergence				
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution. Some weeds, such as nutsedge, may require two applications of Sandea; if a second application is needed, spot-treat only weed-infested areas. Do not apply within 30 days of harvest. See label for further instructions.
Annual grasses and broadleaf weeds, including cocklebur, common ragweed, smartweed, velvetleaf, jimsonweed, yellow nutsedge, and morningglory	metribuzin, MOA 5 (TriCor DF) 75 WDG	0.33 to 1.33 lb	0.25 to 1	Use either as a broadcast or directed spray but do not exceed 0.5 lb a.i. with a broadcast spray. Do not apply within 7 days of harvest. Do not exceed 1 lb a.i. per year. Do not apply as a broadcast spray unless 3 sunny days precede application.
Most broadleaf weeds including wild radish, common purslane, redroot and smooth pigweed	rimsulfuron, MOA 2 (Matrix) 25 WDG (Pruvin) 25 WDG	1 to 2 oz	0.25 to 0.5 oz	Apply in tomatoes after the crop has at least two true leaves and weeds are small (1 in. or less) and actively growing. Add nonionic surfactant at 1 qt per 100 gal of spray solution. Do not apply within 45 days of tomato harvest. See label for further instruction.
Yellow nutsedge, morningglory, common cocklebur, common lambsquarters, and other broadleaf weeds	trifloxysulfuron-sodium, MOA 2 (Envoke) 75 DG	0.1 to 0.2 oz	0.0047 to 0.0094	I Apply post-directed to tomato grown on plastic for control of nutsedge and certain broadleaf weeds. Crop should be transplanted at least 14 days prior to application. The application should be made prior to fruit set and at least 45 days prior to harvest. Use nonionic surfactant at 1 qt per 100 gal spray solution with all applications.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Select Max) 1 EC	6 to 16 fl oz 9 to 32 oz	0.094 to 0.25 0.07 to 0.25	Apply to actively growing grasses not suffering from drought stress. . With Arrow, Clethodim, or Select, add a crop oil concentrate at 1% by volume (1 gal per 100 gal spray mix). With Select Max, add 2 pt of nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Do not apply on unusually hot and humid days. Very effective in controlling annual bluegrass. Do not apply within 20 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to actively growing grasses not under drought stress. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 20 days of harvest.
Tomatoes, Row Middles				
Yellow nutsedge, morningglory, common cocklebur, common lambsquarters, and other broadleaf weeds	trifloxysulfuron-sodium, MOA 2 (Envoke) 75 DG	0.1 to 0.2 oz	0.0047 to 0.0094	Crop should be transplanted at least 14 days prior to application. Use nonionic surfactant at 1 qt per 100 gal spray solution with all applications. See label for information on registered tank mixes. Tank mixtures with Select or Poast may reduce grass control. See label for more information.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2	0.5 to 1 oz	0.024 to 0.048 lb	For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution. Some weeds, such as nutsedge, may require two applications of Sandea; if a second application is needed, spot-treat only weed-infested areas. Do not apply within 30 days of harvest. See label for further instructions.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Annual grasses and small-seeded broadleaf weeds	napropamide, MOA 15 (Devrinol) 50 DF	2 to 4 lb	1 to 2	**Plasticulture:** Apply to a weed-free soil surface. Apply within 24 hours of rainfall, or mechanically incorporate or irrigate into the soil to a depth of 1 to 2 in.
	pendimethalin, MOA 3 (Prowl H_2O) 3.8	1 to 3 pt	0.5 to 1.5	Do not apply more than 3 pt per acre per season. See label for specific use rate for your soil type. Emerged weeds will not be controlled. Avoid direct contact with tomato foliage or stems. Do not apply within 70 days of harvest. See label for further instructions and precautions.
Contact kill of all green foliage	paraquat, MOA 22 (Firestorm, Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 pt 2 pt	0.5 to 1	Apply for control of emerged weeds between rows of tomatoes. Do not allow spray to contract crop or injury will occur. Do not make more than 3 applications per season. Do not apply within 30 days of harvest.
WATERMELONS, Preplant				
Suppression or control of most annual grasses and broadleaf weeds, full rate required for nutsedge control	metam sodium (Vapam HL) 42%	37.5 to 75 gal	15.7 to 31.5	Rates are dependent on soil type and weeds present. Apply when soil moisture is at field capacity (100 to 125%). Apply through soil injection using a rotary tiller or inject with knives no more than 4 in. apart; follow immediately with a roller to smooth and compact the soil surface or with mulch. May apply through drip irrigation prior to planting a second crop on mulch. Plant back interval is often 14 to 21 days and can be 30 days in some environments. See label for all restrictions and additional information.
Contact kill of all green foliage, stale bed application	paraquat, MOA 22 (Firestorm) 3 SL (Parazone) 3 SL (Gramoxone Inteon) 2 SL	 1.3 to 2.7 pt 2 to 4 pt	0.5 to 1	Apply in a minimum of 10 gal spray mix per acre to emerged weeds before crop emergence or transplanting as a broadcast or band treatment over a preformed row. Row should be formed several days ahead of planting and treating to allow maximum weed emergence. Plant with a minimum of soil movement for best results. Use a nonionic surfactant at a rate of 16 to 32 oz per 100 gal spray mix or 1 gal approved crop oil concentrate per 100 gal spray mix.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	**Not registered for seeded crop.** Apply prior to transplanting of crop for control of emerged weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grasses. Can be tank mixed with other registered burndown herbicides.

TABLE 7-17. CHEMICAL WEED CONTROL IN VEGETABLE CROPS

Weed	Herbicide, Mode of Action Code* and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
WATERMELONS, Preplant (continued)				
Annual and perennial grass and broadleaf weeds, stale bed application	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply to emerged weeds at least 3 days before seeding or transplanting. When applying Roundup before transplanting crops into plastic mulch, care must be taken to remove residues of this product from the plastic prior to transplanting. To prevent crop injury, residues can be removed by 0.5 in. natural rainfall or by applying water via a sprinkler system. Perennial weeds may require higher rates of glyphosate. Consult the manufacturer's label for rates for specific weeds. Certain glyphosate formulations require the addition of a surfactant. Adding nonionic surfactant to glyphosate formulated with nonionic surfactant may result in reduced weed control.
Annual grasses	bensulide, MOA 8 (Prefar) 4 E	5 to 6 qt	5 to 6	Apply preplant and incorporate into the soil 1 to 2 in. (1 in. incorporation is optimum) with a rototiller or tandem disk, or apply to the soil surface after seeding and follow with irrigation. Check replant restrictions for small grains on label.
WATERMELONS, Preemergence				
Annual grasses and broadleaf weeds	clomazone, MOA 13 (Command) 3 ME	0.4 to 0.67 pt	0.15 to 0.25	Apply immediately after seeding, or just prior to transplanting. Roots of transplants must be below the chemical barrier when planting. Offers weak control of pigweed. See label for further instructions.
Annual grasses and some small-seeded broadleaf weeds	ethalfluralin, MOA 3 (Curbit) 3 EC	3 to 4.5 pt	1.1 to 1.7	Apply to the soil surface immediately after seeding. DO NOT SOIL INCORPORATE. May also be used as a banded spray between rows of plastic mulch. See label for timing. Shallow cultivation, irrigation, or rainfall within 5 days is needed for good weed control. Do not use under mulches, row covers, or hot caps. Under conditions of unusually cold or wet soil and air temperatures, crop stunting or injury may occur. Crop injury can occur if seeding depth is too shallow.
Annual grasses and broadleaf weeds	ethalfuralin, MOA 3 + clomazone, MOA 13 (Strategy) 2.1 L	2 to 6 pt	0.4 to 1.2 + 0.125 to 0.375	Apply to the soil surface immediately after crop seeding for preemergence control of weeds. DO NOT APPLY PRIOR TO PLANTING. DO NOT SOIL INCORPORATE. May also be used as a banded treatment between rows after crop emergence or transplanting.
Broadleaf weeds	terbacil, MOA 5 (Sinbar) 80 WP	2 to 4 oz	0.1 to 0.2	Apply after seeding but before crop emerges, or prior to transplanting crop. With plasticulture, Sinbar may be applied preemergence under plastic mulch or to row middles. May be applied over plastic mulch prior to transplanting, or prior to punching holes into the plastic mulch for transplanting. Sinbar must be washed off the surface of the plastic mulch with a minimum of 0.5 in. of rainfall or irritation prior to punching transplant holes or transplanting watermelon. Do not apply within 70 days of harvest. See label for further instructions.
Yellow and purple nutsedge suppression, pigweed and ragweed control	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 0.75 oz	0.024 to 0.036	**Bareground.** Apply after seeding but before cracking or prior to transplanting crop. **Plasticulture.** Application may be made to preformed beds prior to laying plastic. If application is made prior to planting, wait 7 days after application to seed or transplant. Stunting may occur but should be short lived with no negative effects on yield or maturity in favorable growing conditions. SEE LABEL FOR INFORMATION ON ROTATION RESTRICTIONS AND OTHER RESTRICTIONS.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048 lb	**Row middles only.** Apply to row middles as a preemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. Do not apply within 57 days of harvest. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution.
WATERMELONS, Postemergence				
Annual grasses and some small seeded broadleaf weeds	DCPA, MOA 3 (Dacthal) W-75 (Dacthal) 6 F	8 to 10 lb 8 to 10 pt	6 to 7.5	**Not labeled for transplanted crop.** To improve preemergence control of late emerging weeds, apply only when crop has 4 to 5 true leaves, is well-established, and growing conditions are favorable. Will not control emerged weeds. Incorporation not recommended.
Annual and perennial grasses only	clethodim, MOA 1 (Arrow, Clethodim, Intensity, Select) 2 EC (Intensity One, Select Max) 1 EC	6 to 8 oz 9 to 16 oz	0.094 to 0.125 0.07 to 0.125	Apply postemergence for control of grasses. With Arrow, Clethodim, or Select, add 1 gal crop oil concentrate per 100 gal spray mix. With Select Max, add 2 pt nonionic surfactant per 100 gal spray mixture. Adding crop oil may increase the likelihood of crop injury at high air temperatures. Very effective in controlling annual bluegrass. Apply to actively growing grasses not under drought stress. Do not apply within 14 days of harvest.
	sethoxydim, MOA 1 (Poast) 1.5 EC	1 to 1.5 pt	0.2 to 0.3	Apply to emerged grasses. Consult manufacturer's label for specific rates and best times to treat. Add 1 qt of crop oil concentrate per acre. Adding crop oil to Poast may increase the likelihood of crop injury at high air temperatures. Do not apply Poast on days that are unusually hot and humid. Do not apply within 14 days of harvest.
WATERMELONS, Row Middles				
Annual grasses and some small-seeded broadleaf weeds	trifluralin, MOA 3 (Treflan HFP) 4 EC (Trifluralin) 4 EC (Trifluralin HF) 4 EC	1 to 2 pt	0.5 to 0.75	To improve preemergence control of late emerging weeds. Apply after emergence when crop plants have reached the three to four true leaf stage of growth. Apply as a directed spray to soil between the rows. Avoid contacting foliage as slight crop injury may occur. Set incorporation equipment to move treated soil around base of crop plants. Do not apply within 60 days of harvest. Will not control emerged weeds.
Broadleaf weeds	terbacil, MOA 5 (Sinbar) 80 WP	2 to 4 oz	0.1 to 0.2	With plasticulture, Sinbar may be applied to row middles. Do not apply within 70 days of harvest. See label for further instructions.
Most broadleaf weeds	carfentrazone-ethyl, MOA 14 (Aim) 1.9 EW or 2 EC	up to 2 oz	up to 0.031	Apply post-directed using hooded sprayers for control of emerged weeds. If crop is contacted, burning of contacted area will occur. Most effective on weeds less than 4 in. tall or rosettes less than 3 in. across. Use a nonionic surfactant or crop oil with Aim. See label for rate. Coverage is essential for good weed control. Does not control grass weeds. Can be tank mixed with other registered herbicides.
Most emerged weeds	glyphosate, MOA 9 (numerous brands and formulations)	See labels	See labels	Apply as a hooded spray in row middles, as shielded spray in row middles, as wiper applications in row middles, or post harvest. To avoid severe injury to crop, do not allow herbicide to contact foliage, green shoots, stems, exposed, roots, or fruit of crop. Do not apply within 14 days of harvest.
Yellow and purple nutsedge and broadleaf weeds	halosulfuron-methyl, MOA 2 (Profine 75) 75 DG (Sandea) 75 DG	0.5 to 1 oz	0.024 to 0.048	Apply to row middles as a postemergence spray. In plasticulture, do not allow spray to contact plastic. Early season application will give postemergence and preemergence control. For postemergence applications, use nonionic surfactant at 1 qt per 100 gal of spray solution. Do not apply within 57 days of harvest.

* Mode of action (MOA) code developed by the Weed Science Society of America. See Table 7-11, Herbicide Resistance Management, for details.

Chemical Weed Control in Forest Stands

Compiled by D. HAZEL AND J. JEUCK, NCSU Extension Forestry

Herbicides can be a safe, effective alternative to mechanical or manual forest weed control methods if used according to label directions. To avoid drift, volatilization, or direct damage to areas adjacent to sprayed forests, it is essential to follow label recommendations related to:

1. **Adjuvants**—such as drift control agents or surfactants which increase uptake.
2. **Spray Equipment**—specifically, type of aircraft, spray boom, pressure (psi), or other spray equipment restrictions.
3. **Weather Conditions**—such as temperature, relative humidity, wind speed, and wind direction.
4. **Buffer Strips**—width and location relative to dwellings, other occupied structures, streams, lakes, ditches, gardens, and boundaries.

READ THE LABEL!

These recommendations may not apply to Christmas trees and woody ornamentals.

Additional recommendations for minor forestry uses such as hardwood plantations and specific species may be found in Chapter 17, "Weed Control in Field- and Container-Grown Ornamentals," in the *Nursery Crops Production Manual.** Consult a county Extension agent, professional forester, or weed control specialist before spraying forest stands.

**Contact the Department of Horticultural Science, Box 7609, NC State University, Raleigh, NC 27695-7609. The manual sells for $35. Individual chapter prices vary.*

TABLE 7-18. PINE RELEASE

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre
Foliar Spray			
Many broadleaf weeds, grasses, and woody species (black locust, cherry, oaks, persimmon, maple, sassafras, sumac, sweetgum, yellow-poplar)	Glyphosate, MOA 9 (Rodeo) 5.4L OR Other brands	0.75 qt Rate may vary	Use at end of first growing season for first-year plantings. May be tank mixed with Oust XP and/or Arsenal AC for many pines. See labels.
		1.125 to 1.875 qt	Use late summer or early fall after conifers have hardened off (second and subsequent growing seasons).
		12 to 18 oz	Herbaceous release (early season) for loblolly and longleaf pines. May be tank mixed with Oust XP and/or Arsenal AC for many species.
Woody plants (oaks, sweetgum, elm, and sumac)	Hexazinone, MOA 5 (Velpar L) 2EC OR (Velpar DF) 75%	4 to 6 pt (first-year plantings) 4 to 8 pt (established trees) 1.33 to 1.8 lb (first-year plantings) 1.33 to 2.66 (established trees)	Use spring to early summer. All rates depend on soil type. Use lower rates on coarser soils. See label.
Many grasses, broadleaf weeds, vines, brambles, woody brush, and trees	Imazapyr, MOA 2 (Arsenal) AC	12 to 16 oz up to 20 oz for loblolly	May be tank mixed with Rodeo (only loblolly after late summer hardening off), Oust XP, and, for lobolly only, Oust Extra.
Many grasses, broadleaf weeds, vines, brambles, woody brush, and trees	Imazapyr, MOA 2 (63.2%) + Metsulfuron methyl, MOA 2 (9.5%) (Lineage Clearstand)	9 to 16 oz	Labeled for lobolly and slash pines.
Herbaceous plants (crabgrass, dog fennel, fescue, willoweed [fireweed], goldenrod, horseweed, Kentucky bluegrass, yellow nutsedge, panicums [broadleaf, fall, narrow], pokeweed, ragweed, white snakeroot, and yellow sweetclover)	Sulfometuron methyl, MOA 2 (Oust XP 75%)	2 to 8 oz	Rates depend on soil type and species. Labeled for loblolly, slash, longleaf, Virginia, and white pines. May be tank mixed with Velpar and/or Arsenal for some species. See labels.
Many annual grasses and broadleaf weeds	Hexazinone, MOA 5 63.2% + Sulfometuron methyl, MOA 2 11.8% (Oustar)	10 to 19 oz (first-year control) + 12 to 24 oz (after first year)	Use spring to early summer. All rates depend on soil type. For loblolly, slash, and longleaf pine only. See labels.
Certain hardwoods, weeds, and grasses	Sulfometuron methyl, MOA 2 (15%) + Metsulfuron methyl, MOA 2 (56.25%) (Oust Extra)	2.66 to 4 oz	Loblolly and slash only. May be tank mixed with Arsenal AC for loblolly only. Use lower rates on coarser soils.
Herbaceous weeds	Imazapyr, MOA 2 (Arsenal) AC	2 to 8 oz	May be tank mixed with Oust
Herbaceous weeds (ragweed, marestail, morning glory, and, blackberry. See label for complete list of susceptible broadleaf weeds	Aminopyralid (Milestone)	5 to 7 fl oz	Labeled for use for release of longleaf pine only. Do not apply over the top of other desirable pine species. May be tank mixed with Arsenal AC. Timing is very important. Applications should be performed over the top of longleaf whlle they are in the "grass stage" of development. Applications made to longleaf that have exposed buds may be inuried. Read and follow label recommendations. Do not add surfactant/adjuvant.

TABLE 7-18. PINE RELEASE

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre
Preemergent/ Foliar			
Most annual grasses and many broadleaf weeds	Pendimethalin, MOA 3 (Pendulum) 2 G OR (Pendulum) 3.3 EC	 100 to 200 lb 2.4 to 4.8 qt	Apply at time of planting or to established trees. Planting slit must be closed to avoid root contact. Labeled for loblolly, white and Virginia pines and a number of hardwood species. See label for details.
Spot-gun			
Woody plants (cherry, blackgum, dogwood, elm, hawthorn, hickory, oaks, maple, sweetgum, and sumac)	Hexazinone, MOA 5 (Velpar L) 2EC OR (Velpar DF) 75%	 2 to 8 qt 3 to 10 qt	Apply in calibrated spots on grid pattern. Rate per acre and grid pattern depend on soil texture and species composition. Apply with exact delivery handgun. Apply late winter to early summer. Do not apply spots within 36 in. or directly upslope from seedlings. Poor results may occur if site is burned 3 to 6 months before treatment or on stump sprouts less than 1-year-old.

Forest Site Preparation, Stand Conversion, Timber Stand Improvement

Compiled by D. HAZEL AND J. JEUCK, NCSU Extension Forestry

TABLE 7-19. FOREST SITE PREPARATION, STAND CONVERSION, TIMBER STAND IMPROVEMENT

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray	For control of many broadleaf weeds, annual and perennial grasses, brush, vines and brambles.	Imazapyr, MOA 2 (63.2%) + metsulfuron methy, MOA 2 LI(9.5%) (Lineage Clearstand)	8 – 25 oz for loblolly and slash pine.	Can tank mix with KRENITE-S at 4-6 QT for control of natural pines.
Foliar Spray	For control of natural pines .	Ammonium salt of fosamine, MOA 17 (41.2%) (Krenite-S)	4-6 quarts	Can be tank mixed with most other site prep products. Need highest label rate for control of Virginia pine.
Foliar Spray	Control of woody brush including but not limited to loblolly pine, oak species, legumes, maple, cherry, poplar, etc.	Glyphosate (Accord XRT II) 5.4 lb/gal + Aminopyralid (Milestone) + Imazapyr (Arsenal AC)	6-7.5 qts + 7 fl oz + 24-48 oz	Recommended for use from June – August 31st. Offers broad spectrum hardwood and natural pine control.
Foliar Spray	Control of woody brush including but not limited to southern pines, VA pine, oak species, legumes, maple, cherry, poplar, etc.	Glyphosate (Accord XRT II) 5.4 lb/gal + Aminopyralid/Triclopyr Amine (Caostone) + Imazapyr (Arsenal AC)	7 qts + 3 qts + 24-48 oz	Recommended for sites that have Virginia pine and recommended for use after August 31st. Offers broad spectrum hardwood and natural pine control.
Foliar Spray	Woody brush, trees, vines, grasses, and broadleaf weeds (Alder, berries [blackberry, dewberry, raspberry], elderberry, honeysuckle,, maples [red, sugar], oaks [red, Northern pine, white], multi flora rose, poison ivy, poison oak, trumpet creeper, willow)	Glyphosate, MOA 9 (Accord XRT II) 5.4lb/gal OR Other brands	 2% solution as a high volume spray using a spray to wet basis Rates may vary	Apply over actively growing plants when foliage has fully developed. See labels for appropriate rates for weeds and woody brush. See labels.
Foliar Spray	Kudzu	Aminopyralid, MOA 4 (Milestone)	7 fl oz/A	0.5 oz/gallon of water for spot treatments (assuming 20 gpa)
Cut Stumps	Sweetgum, poplar, oak, sycamore. Suppression of dogwood, blackgum, hickory, and red maple	Glyphosate, MOA 9 (Accord Concentrate) 5.4L OR Other brands	 Spray or brush 50 to 100% solution to freshly cut stumps Rates may vary	Best used mid growing season. Avoid spring sapflow. Treat stumps immediately after cutting. Treat entire stump surface for small trees and just cambium for large trees. See labels.
Cut Stump and Basal treatment	Works on more than 90 woody brush and vine species. See label for a complete list	Triclopyr ester (Garlon 4 Ultra) or Triclopyr ester (Pathinder II)	20-25% Garlon 4 Ultra + 75-80% basal oil or use Pathfinder II as a ready-to-use	Treat the lower 15-18 inches of the target stem down to the ground line making sure to treat completely around the stem. Treat to wet not to the point of runoff. See label for full details.

TABLE 7-19. FOREST SITE PREPARATION, STAND CONVERSION, TIMBER STAND IMPROVEMENT

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray	Annual bluegrass, ash, aspens (bigtooth, trembling), asters, balsam poplar, barnyardgrass, bentgrass, birch, common groundsel, common ragweed, elksedge, elm, false dandelion, fleabane, flowering dogwood, foxtail, hawthorn, hazel, hickory, oaks, oxeye daisy, Pennsylvania smartweed, pinegrass, red maple, sourwood sweetgum, velvetgrass, wild carrot, wild cherry, and willows. Treatment provides partial control of Canada thistle (suppression only), catsear, crabgrass, curly dock, dandelion, willowweed (fireweed) fescue, goldenrod, heath aster, honeysuckle, horseweed, orchardgrass, and perennial grasses (quackgrass and ryegrass)	Hexazinone, MOA 5 (Velpar L) 2 EC OR (Velpar DF) (75%)	4 to 10 qt 2 1/3 to 6 2/3 lb	Labeled for longleaf pine, shortleaf pine, slash pine, Virginia pine, loblolly pine, Scotch pine, and white spruce. All rates depend on soil type. Use lower rates on coarser soils. Read and follow label directions.
Spotgun	Many woody plants (black cherry, blackgum dogwood, elm, hawthorn, hickory, oaks, maple, sweetgum, and sumac)	Hexazinone, MOA 5 (Velpar L) 2 EC OR (Velpar DF) (75%)	4 to 10 qt Mix 2 2/3 lb/gal of water. Apply suspension at 3 to 10 qt/acre, using grid pattern. See label for grid spacing.	Use an exact-delivery handgun applicator and calibrate for precise delivery of the undiluted product. Selection of the rate per acre and "grid" pattern will depend on soil texture and woody plant species composition. Use the higher rates on fine-textured soils and when the major component of the hardwoods is a difficult-to-control species such as blackgum, dogwood, hickory, or red maple. Use the lower rates on medium-to-coarse textured soils where elm, cherry, oak, and sweetgum are dominant. Results may be unsatisfactory where stump sprouts of less than one year's growth predominate. Labeled for loblolly, slash, shortleaf, and longleaf pines. Suspensions of DF require intermittent agitation.
Broadcast Granular	Many woody plants (American elder, balsam poplar, birch, black cherry, blackgum, hickory, boxelder, brambles [blackberry, dewberry, and raspberry], cherry, chokeberry, cottonwood, dogwood Eastern red cedar, elm, green ash, hawthorn, hornbeam, mulberry, multiflora rose, Norway maple, red maple, oaks [black, blackjack, bluejack, post, southern red, Turkey, water, and white oak], Russian olive, sumac, sweetgum, white ash, wild plum, willow, sourwood, and pine)	Hexazinone, MOA 5 (Velpar ULW) 75% granule	2.5 to 6.3 lb	May be applied broadcast or to individual plant stems. Rainfall is required to dissolve the granules and move the herbicide into the root zone. Apply in spring when hardwood leaves are 50% developed but no later than June 15. Results are best on coarse-to-medium textured soils. Not recommended for poorly drained or marsh sites. Labeled for loblolly, longleaf, shortleaf, slash, and Virginia pine.
Foliar Spray	Many grasses, broadleaf annual, and perennial weeds, vines, brambles, woody brush, and trees	Imazapyr, MOA 2 (Arsenal AC) 4 L	Spray 16 to 40 oz in 5 to 40 gal mix. Add 0.5% v/v nonionic surfactant to mix.	Broadcast spray during growing season to prepare site for many conifers. May be tank mixed with Accord Concentrate, Oust, Oust Extra (loblolly only), and others. See labels. Not labeled for hardwood site preparation.
Tree Injection, Frill, or Hack 'N' Squirt	Brush species listed above	Imazapyr, MOA 2 (Arsenal AC) 4L OR Aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR Triclopyr, MOA 4 (Garlon 3A)	25% solution in water Use undiluted and apply 1 ml of undiluted product into each cut 50% solution mixed with water	Use hatchet or tree injector and space sloping cuts evenly around the trunk. Apply 1 ml/3 in. DBH. Best used mid growing season but dormant applications may be used. Avoid spring sapflow. Nearby desirable hardwoods may be injured or killed. Use hatchet or machete and space cuts no more than 2 inches apart and at a 45 degree angle. Make cuts around the tree trunk at a convenient height so that the cuts overlap slightly and make a continuous circle around the trunk. Avoid treatment during periods of heavy sap flow such as the spring. Use hatchet or machete and space cuts no more than 2 inches apart and at a 45 degree angle. Make cuts around the tree trunk at a convenient height so that the cuts overlap slightly and make a continuous circle around the trunk. Avoid treatment during periods of heavy sap flow such as the spring.
Tree Injection Frill, or Hack 'N Squirt	Sweetgum, poplar, oak, sycamore. Suppression of dogwood, blackgum, hickory, and red maple	glyphosate (Rodeo) 5.4 lb/gal OR Other brands	1 ml/2 to 3 in. of the trunk diameter, or use continuous frill and a diluted mix. Rates for other brands may vary	Use hatchet or tree injector and space sloping cuts evenly around the trunk. Best used mid growing season. Avoid spring sapflow. See labels.
Cut Stumps	Brush species listed above	Imazapyr, MOA 2 (Arsenal AC) 4L OR Aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR Triclopyr ester, MOA 4 (Garlon 4 Ultra) 4lb/gal	25% solution in water Spray or brush 6 oz/gal water on freshly cut stump surface. Use 100% solution. Use 20- 25% solution mixed with 75-80% basal oil.	Best used during growing season; avoid spring sapflow. Treat stumps promptly after cutting. Nearby desirable hardwoods may be killed or injured. Best used immediately after cut. Avoid spring sap flow. Spray or brush cambium layer immediately after cut. Can be used all year except when bark is wet. Treat the cambium layer and root collar down to the ground line. Treat to wet and not to the point of run-off. Can be used up to several weeks after cutting.

TABLE 7-19. FOREST SITE PREPARATION, STAND CONVERSION, TIMBER STAND IMPROVEMENT

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Foliar Spray	Many species of brush and broadleaf weeds, including: **BRUSH**: Ash, aspen, birches, brambles, cedar, cherry, dogwood, elms, gooseberry, honeylocust, multiflora rose, oak, poplar, shortleaf pine, sumac, wild plum, willows, sycamore, spruce, blackberry, black locust, buckbrush, cottonwood, honeysuckle. **WEEDS**: bedstraw, burdock, chicory, dock, kudzu, morning glory, poison ivy, poison oak, thistles, trumpet vine	Imazapyr, MOA 2 (Chopper GEN2) + Glyphosate, MOA 9 (Accord XRT II)	32 to 64 oz + 2 qts	Apply during growing season to prepare site for many conifers. A seed oil mix that is 12 to 50% of volume is recommended. Use 5 to 40 gal mix/acre for good coverage. Not labeled for hardwood site preparation. Tank mixing Accord XRT II with Chopper treatments will enhance brown-out of target vegetation thus enabling landowner to more effectively to burn.
	Most grasses, broadleaf annual and perennial weeds, vines, brambles, hardwoods and pines	Imazapyr, MOA 2 (Chopper GEN2) + Glyphosate, MOA 9 (Accord XRT II)) + Aminopyralid, MOA 4 (Milestone)	32 - 64 oz + 6-7.5 qts/A + 7 fl oz/A	Effective broad-spectrum site preparation for hardwoods and natural pine.
Basal Bark	Controls over 90 woody plants and vines	Triclopyr, MOA 4 (Pathfinder II) OR Triclopyr, MOA 4 (Garlon 4 Ultra)	100% solution ready to use formulation of Garlon 4 Ultra 20-25% solution mixed with 75-80% basal oil	Spray or wet lower 12 to 18 in. of stems. Best used on rough bark species no more than4 inches diameter and smooth bark species no more than 6 inches diameter. Perform year round except when bark is wet. Spray to wet but not to the point of run-off.
Foliar Spray	Many woody species and broadleaf weeds, grasses	Glufosinate-ammonium, MOA 10 (Derringer F) 1 lb a.i./gal	2 to 6 qt	May be used to prepare site for planting hardwoods and conifers. Use higher rate for woody or heavy dense brush. See label for specific details. May be tank mixed with Arsenal AC and Chopper for conifer site preparation.
Foliar Spray	Alder, birch, blackberry, black cherry, blackjack oak, black locust, currant, fir, gooseberry, hemlock, honeysuckle, oaks, pine, poison ivy, poison oak, poplar, red elm, red maple, serviceberry, spruce, sycamore, tulip poplar, willow, winged elm	Dicamba, MOA 4 + 2,4-D, MOA 4 (Veteran 720) 2.9 lb a.i./gal	1 to 2 gal	Apply 1 to 2 gal in 20 to 100 gal water per acre depending upon density of brush.
Frill, Hack 'N' Squirt, Tree Injection	Alder, ash, basswood, beech, birch, black cherry, elderberry, elm, hemlock, oaks, persimmon, pine, poplar, red maple, serviceberry, spruce, sycamore, tulip poplar, willow, winged elm	Dicamba, MOA 4 (Veteran CST) 1 lb a.i./gal		Spray product into overlapping cuts around tree. Or inject 1 ml at 1- to 2-inch intervals.
Cut Stump	Ailanthus, ash, birch, black locust, blackgum, blue beech, boxelder, chokecherry, cherry (black, pin), elm (American, red, winged), hackberry, hickory, ironwood, red maple, multiflora rose, osage orange, oak (black, chestnut, pin, red, water, white) persimmon, pine (Southern, Virginia, white) poison ivy, red cedar, sassafras, spruce, sumac, sweetgum, sycamore, tallowtree, tulip poplar, wax myrtle	Same as above		Spray or paint freshly cut stumps. *May treat only cambium area of larger stumps.* Best used during growing season.
Foliar Spray	Many brush species (alder, ash, basswood, beech, birch, blackberry, black gum, cedar, cherry, cottonwood, dogwood, elm, grape, hawthorn, hemlock, hickory, honeysuckle, hornbeam, poison ivy, kudzu, locust, maple, oaks, persimmon, pines, poplar, sassafras, sumac, sweetgum, sycamore, willow) Controls many woody plants including yaupon, gallberry, wax myrtle, Baccharis spp., and many bay species.	triclopyr(amine), MOA 4 (Garlon 3A) 3 lb a.i./gal OR triclopyr (ester), MOA 4 (Forestry Garlon XRT) 6.3 lb/gal	0.5 to 3 gal 21 fl. oz. to 1 gal/A	Ground applications: Mix product in water (20 to 100 gal; enough for good coverage) + 0.5% v/v nonionic surfactant. May also be tank mixed with other products. See labels. Use higher rates for woody plant control.
Tree Injection, Frill, Hack 'N' Squirt	Same as above	triclopyr(amine), MOA 4 (Garlon 3A) 3 lb a.i./gal		Inject 0.5 ml undiluted or 1 ml diluted/inch tree diameter. Space cuts evenly. Best used during growing season.
Cut Stump	Same as above	Same as above	Use 50% solution mixed with water	Spray or paint fresh cut stumps. Best used during the growing season.
Cut Surface Treatment	Same as above	Dicamba, MOA 4 (Banvel CST) 1 S	See label	Inject 1 ml undiluted at 1- to 2-in. intervals. Spray or paint frill or girdle OR spray or paint cut stumps with undiluted herbicide

TABLE 7-19. FOREST SITE PREPARATION, STAND CONVERSION, TIMBER STAND IMPROVEMENT

Type Application	Plants Controlled	Herbicide and Formulation	Amount of Formulation Per Acre	Uses, Remarks, and Precautions
Basal Bark or Dormant Stem Treatment	Same as above	Dicamba, MOA 4 + 2,4-D(ester), MOA 4 (Banvel 520) 2.9 lb total a.i./gal	1 to 5 gal	For hydraulic sprayers use 1 to 3 gal Banvel 520 per 100 gal water or oil to water emulsion per acre. For backpack sprayers mix 8 to 16 gal Banvel per 100 gal water or oil to water emulsion and apply 30 gal mix per acre. **BASAL BARK**—Apply year around to lower 1.5 to 2 feet of stem, allowing runoff. **DORMANT STEM**—Apply anytime brush is dormant by thoroughly wetting stems to point of runoff.
Foliar Spray	Same as above	Picloram, MOA 4 + 2,4-D, MOA 4 (Tordon 101 M) 2.54 lb a.i./gal	0.5 to 2 gal	Use heavier rate for woody brush control and lower rate for broadleaf weeds. Apply in enough water for good coverage, usually 20 to 40 gal/acre. A nonionic surfactant (0.5 to 1.0%) is recommended. Tank mixes may provide additional benefits. Tordon is a Restricted Use product.
Foliar Spray	**WOODY**: Alder, ash, beech, birch, blackberry, blackgum, cherry, cottonwood, dogwood, elderberry, elm, hawthorn, hickory, hornbeam, locust, maples, mulberry, oaks, persimmon, pine, poison oak, poplar, sassafras, sumac, sweetbay, magnolia, sweetgum, sycamore, tulip poplar, willow, winged elm **ANNUAL AND PERENNIAL BROADLEAF WEEDS**: Bindweed, burdock, Canada thistle, chicory, curly dock, dandelion, field bindweed, lambsquarter, plantain, ragweed, smartweed, tansy ragwort, vetch, wild lettuce	Triclopyr-(amine), MOA 4 (Garlon 3A) 3 lb/gal	0.5 to 3 gal	**Aerial Application**—Mix 2 to 3 gal herbicide with 0.25 to 1 pt agricultural surfactant OR 1 to 1.5 gal herbicide with 1 to 2 gal (3.8 lb/gal) 2,4-D low volatile ester or Tordon 101. Apply in 10 to 30 gal water per acre. **Ground High-Volume Application**—Mix 0.5 to 1 gal herbicide in water to make 100 gal solution OR 0.25 to 0.5 gal tank mixed with 0.25 to 0.5 gal DMA 4, 2,4-D low volatile ester or Tordon 101. **Ground Low-Volume Application**—Mix 2 to 3 gal herbicide with 0.25 to 1 pt surfactant OR 0.5 to 1 gal tank mixed with 1 to 2 gal of DMA 4, 2,4-D low volatile ester or Tordon 101.
Tree Injection, Frill, Hack 'N' Squirt	See woody plants above	Aminopyralid, MOA 4 + triclopyr amine, MOA 4 (Capstone) OR Picloram, MOA 4 + 2,4-D, MOA 4 (Pathway) 1.25 lb a.i./gal	Apply as ready to use mixtures (100% solution)	Inject Capstone undiluted making cuts no more than 2 inches apart. Use 1 ml/inch of Pathway undiluted. Space injections evenly. Best used during the summer or fall.
Frill or Girdle	See woody plants above	Same as above	Use undiluted	Make a single hack girdle or "frill" of overlapping cuts through the bark completely around the tree. Spray or paint the cuts with undiluted product using enough volume to wet the treated areas.
Cut Stump	See woody plants above	Same as above	Use undiluted.	Spray or paint cambium of freshly cut stumps with undiluted Milestone VM Plus. Use Pathway undiluted.
Foliar Spray	Same as above	Triclopyr (ester), MOA 4 (Forestry Garlon XRT) 6.3 lb a.i./gal	21 fl oz to 1 gal/ A	Use higher rates to control woody species. Apply in enough water for good coverage, usually 20 to 40 gal per acre. A nonionic surfactant (0.5 to 1.0%) is recommended. Tank mixes may provide additional benefits. Will not control most native grasses. Complete coverage of target vegetation is necessary for best results.
Basal Bark	Same as above	Same as above OR Triclopyr, MOA 4 (Pathfinder II) 0.75 lb a.i./gal	13% Forestry Garlon XRT + 87% basal oil Apply as a ready to use formulation (100% solution)	Spray 13% solution of Forestry Garlon XRT in oil penetrant (diesel or vegetable oil) to lower 12 to 18 inches of tree trunk to point of runoff. Most effective on trees less than 6 in. in diameter with smooth or thin bark. Apply to dry bark in winter or summer. Avoid spring sap flow
Foliar	Many annual and biennial broadleaf weeds and woody brush	Picloram, MOA 4 (Tordon K) 2 lb a.i./gal	0.25 to 4 qt	Restricted use chemical. See label for specific rates for given situations, tank mixes, and volumes per acre.
Foliar	Many annual and biennial broadleaf and woody brush species	Diglycolamine salt of dicamba, MOA 4 (Vanquish) 4 lb a.i./gal	0.5 to 4 pt	Use lower rates for annual and biennial weeds and heavy rates for woody brush. Many tank mixes are available. Apply in 15 or more gallons of water/acre with a nonionic surfactant (0.5 to 1% v/v).
Tree Injection, Frill, Hack 'N' Squirt	Many species of hardwood trees and brush	Same as above	See label	Apply undiluted product using injector or hatchet with one cut per inch tree diameter. Or apply diluted mixture (1:1-3 parts water) to overlapping cuts (frill).
Cut Stump	Same as above	Same as above	See label	Dilute 1 to 1 with water. Spray or paint the freshly cut stump cambium.
Dormant Stem	Many species of hardwood trees and brush. Controls woody vines and conifers	Triclopyr ester (Garlon 4 Ultra) 4 lb/gal	2-3 gallons of Garlon 4 Ultra + 3 gal of Crop oil per 100 gallons of water	Spray upper and lower stems of dormant brush to wet. See label for more details.
Cut Surface and Basal Spray	Many species of hardwood trees and brush	Triclopyr ester, MOA 4 + 2,4-DP, MOA 4 (Crossbow)	See label	Read label carefully as rates and dilutions vary widely depending on tree species to control and type of application.

Aquatic Weed Control

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Several options, including hand removal, cultural, mechanical, biological, and chemical control techniques are available for the management of aquatic weeds. The applicator should choose the most efficacious, environmentally acceptable and cost-effective alternative that is available for a particular weed problem. The particular management strategy to use in a given situation will depend on the intended use of the body of water, fish, and wildlife populations that may be impacted, type of environment in which the weed problem occurs, and the particular weed species of concern. Before selecting your management strategy, **be sure to have the weed(s) of concern identified by a qualified individual**.

Assistance in weed identification is available from the Cooperative Extension center in your county. Additional information on management techniques also may be obtained from the county Extension center; ask for AG-437, *Weed Management in Small Ponds*; AG-438, *Weed Control in Irrigation Water Supplies;* and AG-449, *Hydrilla, A Rapidly Spreading Aquatic Weed in North Carolina*. Information on pond construction, stocking, and general pond management may be found in AG-424, *Pond Management Guide*. Additional information may be found on the Aquatic Weed Management Web site:

http://www.weedscience.ncsu.edu/aquaticweeds.

For the purpose of description and management, aquatic weeds may be grouped either on the basis of their botanical relationships or on the basis of their growth habits. Most plants in each group are managed similarly, with some exceptions.

TABLE 7-20A. AQUATIC WEED GROUPS — Grouping of Aquatic Plants on the Basis of Botanical Relationships

Category and Description	Examples
Algae — These plants may be either microscopic or visible to the naked eye, exist as single cells or occur in clusters or filaments containing many cells, and may be either free floating (planktonic) or attached to the soil, rocks, or vegetation. Filamentous algae may be unbranched, slightly or highly branched, or net-like. Some planktonic algae are mobile. Certain types of algae (macroalgae) may be large, very coarse, and resemble submersed vascular plants. Most algae (except macroalgae) usually require magnification to be identified accurately. Algae do not contain vascular (water conducting) tissues, consequently all chemicals used for algae control have only contact activity. Algae reproduce by cell division, fragmentation, and sexually by spores.	**Filamentous Algae** Bluegreens or Cyanobacteria Giant *Lyngbya* Green algae *Oedogonium* *Hydrodictyon* (water net) *Spirogyra* *Pithophora* **Planktonic Algae** Bluegreens or Cyanobacteria *Lyngbya* *Anabaena* *Oscillatoria* *Microcystis* Euglenoids (*Euglena*) **Macroalgae** Muskgrass (*Chara*) Stonewort (*Nitella*)
Mosses — These plants are visible to the naked eye and resemble delicate, leafy submersed plants. The mosses lack vascular tissues or roots, but usually are attached to the soil. Mosses reproduce sexually by spore production.	*Fontinalis* *Sphagnum* (peat moss)
Ferns — These plants are visible to the naked eye, either free floating or rooted to the bottom, occasionally forming loosely consolidated floating mats. Ferns have vascular tissues and reproduce by vegetative propagation and sexually by spores.	Giant salvinia (*Salvinia molesta*) Mosquito fern (*Azolla* spp.) Water clover (*Marsilea quadrifolia*) Water spangles (*Salvinia minima*)
Vascular flowering plants — These plants may be rooted or unrooted, free floating, submersed, floating-leaved, or emergent. Most reproduce vegetatively by means of rhizomes, stolons, and various other vegetative perennating structures including turions and tubers. Most also produce flowers and may set seeds. This group has a vascular system that shows varying degrees of development from rudimentary in the case of the duckweeds and submersed species to very complex and highly developed in emergent plants and includes annual and perennial herbaceous forms and several woody species.	Bald cypress (*Taxodium distichum*) Bladderwort (*Utricularia* spp.) Bulrushes (*Scirpus* spp.) Cattail (*Typha* spp.) Duckweed (*Lemna* spp. and *Spirodela* spp.) Hydrilla (*Hydrilla verticillata*) Naiads (*Najas* spp.) Pondweeds (*Potamogeton* spp.) Rushes (*Juncus* spp.) Spikerushes (*Eleocharis* spp.) Waterhyacinth (*Eichhornia crassipes*) Watermilfoils (*Myriophyllum* spp.)
Submersed plants — Plants in this group grow beneath the surface of the water and may be rooted to the bottom or free floating, with or without roots. Flowers usually are produced above the surface of the water and occasionally may be supported by specialized floatation structures. Some species will produce emergent floral spikes that extend several inches above the surface of the water and are covered with bracts that resemble leaves. Submersed plants usually have poorly developed vascular systems and very limited structural tissue and depend on the water's buoyancy for support. Filamentous algae and macroalgae also could be considered submersed plants.	American elodea (*Elodea canadensis* and *E. nuttallii*) Bladderwort (*Utricularia* spp.) Brazilian elodea (*Egeria densa*) Brittle naiad (*Najas minor*) Coontail (*Ceratophyllum demersum*) Creeping rush (*Juncus repens*) Eurasian watermilfoil (*Myriophyllum spicatum)* Fanwort (*Cabomba caroliniana*) Hydrilla (*Hydrilla verticillata)* Parrotfeather (*Myriophyllum aquaticum*) Pondweeds (*Potamogeton* spp.) Proliferating spikerush (*Eleocharis baldwinii*) Southern naiad (*Najas guadalupensis*) Variable-leaf milfoil (*Myriophyllum heterophyllum*) Widgeongrass (*Ruppia maritima*) Wild celery (*Vallisneria americana*)

TABLE 7-20B. AQUATIC WEED GROUPS — Grouping of Aquatic Plants on the Basis of Growth Habit

NOTE: Some species have growth habits that overlap and may be listed more than once.

Category and Description	Examples
Submersed plants — Plants in this group grow beneath the surface of the water and may be rooted to the bottom or free floating, with or without roots. Flowers usually are produced above the surface of the water and occasionally may be supported by specialized floatation structures. Some species will produce emergent floral spikes that extend several inches above the surface of the water and are covered with bracts that resemble leaves. Submersed plants usually have poorly developed vascular systems and very limited structural tissue and depend on the water's buoyancy for support. Filamentous algae and macroalgae also could be considered submersed plants.	American elodea (*Elodea canadensis* and *E. nuttallii*) Bladderwort (*Utricularia* spp.) Brazilian elodea (*Egeria densa*) Brittle naiad (*Najas minor*) Coontail (*Ceratophyllum demersum*) Creeping rush (*Juncus repens*) Eurasian watermilfoil (*Myriophyllum spicatum)* Fanwort (*Cabomba caroliniana*) Hydrilla (*Hydrilla verticillata)* Parrotfeather (*Myriophyllum aquaticum*) Pondweeds (*Potamogeton* spp.) Proliferating spikerush (*Eleocharis baldwinii*) Southern naiad (*Najas guadalupensis*) Variable-leaf milfoil (*Myriophyllum heterophyllum*) Widgeongrass (*Ruppia maritima*) Wild celery (*Vallisneria americana*)
Free-floating plants — Plants in this group float on the surface of the water and may lie flat on the water or be raised well above the surface. These plants, with the exception of the duckweeds, watermeal, and mosquito ferns, have well-developed vascular systems and substantial supportive tissues. Most form true roots. Flowers extend above the surface of the water in the flowering plants.	Duckweeds (*Lemna* spp. and *Spirodela* spp.) Floating heart (*Nymphoides aquatica*) Frogbit (*Limnobium spongia)* Giant salvinia (*Salvinia molesta)* Mosquito fern (*Azolla caroliniana*) Waterhyacinth (*Eichhornia crassipes*) Waterlettuce (*Pistia stratiotes*) Watermeal (*Wolffia* spp.)
Floating leaf plants — These plants are rooted in the bottom and have their leaves attached to long, tough stems that extend to the surface from depths up to 6 ft or more. The leaves float directly on the surface of the water. Mature leaves of some species may push well above the surface into an emergent position. Most of these plants have extensive root and rhizome systems and well-developed vascular systems and supportive tissues. Flowers float just above the surface or are extended well above the surface on a tough stem. A few nonvascular representatives.	American lotus (*Nelumbo lutea)* Fragrant waterlily (*Nymphaea odorata*) Illinois pondweed (*Potamogeton illinoiensis*) Spatterdock (*Nuphar luteum*) Water clover (*Marsilea quadrifolia*) Watershield (*Brasenia schreberi*)
Emergent plants — These plants grow rooted in the bottom with their leaves and green stems extending well above the surface of the water. A few species also may form floating mats. All have extensive root and rhizome systems and well-developed vascular systems and supportive tissues. Reproduction occurs vegetatively by rhizomes and stolons; floating mat-forming species also reproduce readily by stem fragmentation. Most flower prolifically and form many seeds.	**Broadleaf Species** Arrow arum (*Peltandra virginica*) Arrowhead (*Sagittaria* spp.) Asian spiderwort (*Murdannia keisak*) Frogbit (*Limnobium spongia*) Lizard's tail (*Saururus cernuus)* Pickerelweed (*Pondederia cordata*) Smartweeds (*Polygonum* spp.) **Mat-forming Broadleaf Species** Alligatorweed (*Alternanthera philoxeroides)* Creeping waterprimrose (*Ludwigia hexapetala*) Water pennywort (*Hydrocotyle* spp.) Water willow (*Justicia americana*) **Sedges, Rushes, Spikerushes, and Grasses** Bulrush (*Scirpus* spp.) Cattail (*Typha* spp.) Common reed (*Phragmites australis)* Flat sedge (*Carex* spp.) Foursquare (*Eleocharis quadrangulata*) Maidencane (*Panicum hemitomon*) Rushes (*Juncus* spp.) Sedge (*Cyperus* spp.) Soft rush (*Juncus effusus*) Softstem bulrush (*Scirpus validus*) Southern wildrice (*Zizaniopsis miliacea*) Spikerushes (*Eleocharis* spp.) Threesquare bulrush (*Scirpus americanus*) Torpedograss (*Panicum repens*) Water paspalum (*Paspalum repens*) Woolgrass (*Scirpus cyperinus)* **Other Common Species** Bur-reed (*Sparganium americanum)* Scouring rush (*Equisetum hymale*)
Woody plants — These are obligate, aquatic species of trees usually growing totally flooded or in saturated soils, but occasionally occur in upland areas (usually planted there). Some form systems of "knees" to provide aeration for the root systems. They are deciduous, dropping leaves in the autumn, and are rarely if ever vegetative during winter months.	Bald cypress *(Taxodium distichum)* Pond cypress *(Taxodium ascendens)* Tupelo *(Nyssa aquatica)*

Biological Control of Aquatic Weeds with Triploid Grass Carp

While the triploid, sterile grass carp is a cost-effective control method, it is best suited for use in small ponds, where submersed aquatic plants are not required for fish and wildlife habitat. Grass carp are effective on most **submersed weeds**. They generally are less effective on algae and weeds in the floating and emergent groups. Refer to the chart below for information on the relative effectiveness of grass carp for different weeds.

Grass carp are normally stocked at 15 fish per acre in small ponds. In larger ponds, they are usually stocked at 15 to 20 fish per **vegetated** acre. Large fish (minimum of 8 to 10 inches long) should be stocked to prevent loss due to predation by large bass and wading birds. If the surface of the pond is **completely covered** with vegetation, some limited herbicide application or mechanical removal of weeds from a portion of the pond will be necessary before stocking to allow oxygen to reach the underlying water. Grass carp may be stocked at any time of the growing season, but best results are usually obtained by a late summer or fall stocking.

No permit is required to purchase up to 150 triploid grass carp for stocking a private pond. At a stocking rate of 15 fish per acre of water, 150 triploid grass carp are adequate to control vegetation in a 10-acre pond. A permit from the Wildlife Resources Commission is required for larger stockings. Grass carp may be purchased from a licensed distributor. (For a list of North Carolina vendors, see http://www.ncagr.com/aquacult/grasscarp.html.) Permits, a list of certified distributors, and additional information on stocking of the triploid grass carp may be obtained from the Wildlife Resources Commission, Chief of Inland Fisheries, 1721 Mail Service Center, Raleigh, NC 27699-1721, or call at (919) 733-3633.

TABLE 7-21. BIOLOGICAL CONTROL OF AQUATIC WEEDS WITH TRIPLOID GRASS CARP

Weed	Relative Effectiveness	Comments
ALGAE Filamentous (green and bluegreen) and planktonic	Poor	High stocking rates (60 to 75 or more fish per acre) with small fish (4 to 6 in. size) are required to achieve temporary control; control usually decreases as fish grow larger and are unable to feed on the algae.
MACROALGAE Chara and Nitella	Good to Excellent	Chara usually is beneficial to fish and wildlife.
FLOATING AND FLOATING-LEAVED WEEDS Duckweeds, watermeal	Poor	Small fish at very high stocking rates (see filamentous algae above) may give control; larger fish at normal stocking rates usually are not effective.
Water ferns (Azolla and Salvinia)	Fair to Poor	
Alligatorweed, water lilies, water primrose, lotus, watershield, spadderdock, waterhyacinth	Poor	Grass carp may feed lightly on weeds in this group, but control is usually unacceptable.
EMERGENT AND MARGINAL WEEDS Cattails, rushes, common reed, bulrushes, pickerelweed, pennywort, arrowhead	Poor	Grass carp may feed lightly on weeds in this group, but control is usually unacceptable.
SUBMERSED WEEDS	Good to Excellent	Most rooted and free-floating submersed weeds in ponds are readily controlled with triploid grass carp; control may be poorer on the watermilfoils, particularly Eurasian waterfoil.

Chemical Control of Aquatic Plants

TABLE 7-22. CHEMICAL CONTROL OF AQUATIC PLANTS

Herbicide, Formulation, and Mode of Action Code	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
ALGAE, blue-green			
copper sulfate (various)	See label	0.5 to 1 ppm	Apply crystals or powder at early stage of growth by any method to give rapid and uniform dispersion. For best results, apply on a clear day. Do not apply to muddy water. **Warning: Copper is toxic to fish.** Formulated copper products have a greater margin of safety to fish.
sodium carbonate peroxyhydrate (various)	See label	0.3 to 1.7 ppm	Apply with 8 to 10 hours of daylight remaining. Do not reapply within 48 hours.
ALGAE, filamentous and planktonic			
copper complex (various)	0.6 gal/acre ft	0.2 ppm	Dilute with water in ratio of at least 9-to-1 and apply uniformly. For best results, apply on a clear day and break up floating mats of filamentous algae before treatment. **Warning: Copper is toxic to fish.**
copper sulfate (various)	See label	0.5 to 1 ppm	Same as under Algae, blue-green. For best results break up floating mats of filamentous algae before treatment. **Warning: Copper is toxic to fish**. Formulated copper products have a greater margin of safety to fish.
diquat (Reward) 2 lb/gal MOA 22	See label	0.18 to 0.37 ppm	For certain filamentous algae—*Pithophora* spp. and *Spirogyra* spp. Check label for application instructions. For best results, break up floating mats before treatment.
ALGAE, macro, chara, nitella			
copper complex (Cutrine-Plus Granular) 3.7 G (Cutrine-Plus) 0.9 lb/gal (K-Tea) 0.8 lb/gal	60 lb/surface acre 1.2 gal/acre ft 1.7 to 3.4 gal/acre ft	2.2 lb/acre 0.4 ppm 0.5 to 1.0 ppm	Distribute granular formulation evenly over infested area when plants are young. If chara is in water less than 3 ft deep or growth is near the surface, the liquid formulation may be used. Dilute with water in ratio of at least 9-to-1 and apply uniformly. **Warning: Copper is toxic to fish.**

TABLE 7-22. CHEMICAL CONTROL OF AQUATIC PLANTS

Herbicide, Formulation, and Mode of Action Code	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
ALGAE, Pithophora and cladophoraa			
flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/A	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective. If vegetation is dense, treat in sections to avoid reducing dissolved oxgen. Water pH > 7.5 will reduce effectiveness.
FLOATING WEEDS (except watermeal)			
2,4-D amine (various) MOA 4	See label	2 to 4 lb/acre	Thorough wetting of foliage is essential. Apply in 100 to 400 gal of water per acre. Use low pressure, large nozzle, and spray thickener. **For use on nonirrigation ditchbanks only. Do not apply to water.**
bispyribac (Tradewind) 80% MOA 2	1 to 2 oz/A	0.8 to 1.6 oz ai/A	Controls duckweed, mosquito fern, salvinia, water hyacinth, water lettuce, and water pennywort. Apply with at least 30 gpa water volume. Include appropriate adjuvant.
carafentrazone (Stingray) 1.9 lb/gal, MOA 14	3.4 to 13.5 fl oz/acre	0.05 to 0.2 lb/acre	Controls water lettuce, waterhyacinth, salvia, duckweed, mosquito fern, and water spinach. Rates vary according to target species. Methylated seed oil or nonionic surfactant recommended.
diquat (Reward) 2 lb/gal MOA 22	0.5 to 0.75 gal/ surface acre	1 to 1.5 lb/acre	Weeds controlled: pennywort, salvinia, waterhyacinth, waterlettuce. Apply in a spray volume of 150 to 200 gal of water per acre plus 1 pt nonionic surfactant.
	1 gal/surface acre	2 lb/acre	For duckweed control, apply in a spray volume of 50 to 150 gal of water per acre. Take care to cover all plants on water and damp marginal areas. Will require retreatment. A nonionic surfactant at 0.5% by volume will be needed.
glyphosate (various) MOA 9	See label	See label	For control of waterlillies, spadderdock, and lotus, apply as foliar spray on a calm day when there is little to no wave action. Vegetation must be on or above the surface for treatment to be effective. A nonionic surfactant (e.g. Cide-Kick or Induce) is required with Rodeo. If applying from a boat, take care not to create waves that may wash the herbicide off floating leaves. Will not control small floating plants, such as azolla, duckweed, or watermeal.
imazamox (Clearcast) 1 lb/gal, MOA 2	32 to 64 fl oz/acre	0.25 to 0.5 lb ai/acre 50 to 150 ppb	See label for specific weeds controlled. A nonionic surfactant or methylated seed oil is recommended for foliar applications. Spot treatments may be made with up to 5% solution by volume.
imazapyr (Habitat) MOA 2	1 to 4 pt/acre	0.25 to 1.5 lb/acre	Rates vary according to target species. Retreatment of some plants may be required. A nonionic surfactant is recommended. Will not control small floating plants, such as azolla, duckweed, or watermeal.
penoxsulam (Galleon) 2 lb/gal, MOA 2	2 to 5.6 fl oz/acre	0.03 to 0.09 lb/acre 5 to 150 ppb	A nonionic surfactant is recommended for foliar applications.
triclopyr (Renovate 3) MOA 4	0.5 to 2 gal/acre	1.5 to 6 lb/acre	Rates vary according to target species. Addition of approved nonionic surfactant is recommended.
FLOATING WEEDS (watermeal and others)			
flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/A	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective. If vegetation is dense, treat in sections to avoid reducing dissolved oxgen. Water pH > 7.5 will reduce effectiveness. A follow-up application may be needed for watermeal control.
fluridone (Sonar) 4 AS MOA 12	Ponds: 0.16 to 1.5 qt/acre	0.16 to 1 lb/acre 10 to 90 ppb	Use the maximum labelled rate for the average depth of your pond. Do not apply when there is substantial outflow from the pond. Do not apply as a spot treatment. See label for specific weeds controlled. For watermeal, use 45 to 90 ppb. Other floating species may be controlled with lower rates. Do not use treated water for irrigation for 7 to 30 days. See label for irrigation precautions. **Warning: 30 days may be insufficient restriction if pond water will be used to irrigate very sensitive crops, such as tobacco, tomatoes, or peppers.**
EMERGENT, MARGINAL, and DITCHBANK WEEDS			
2,4-D amine (various) MOA 4	See label	2 to 4 lb/acre	Thorough wetting of foliage is essential. Apply in 100 to 400 gal of water per acre. Use low pressure, large nozzle and spray thickener. **For use on nonirrigation ditchbanks only. Do not apply to water.**
2,4-D granular (Navigate) 20 G (2,4-D Gran 20) 20 G MOA 4	150 to 200 lb/surface acre	30 to 40 lb/acre	Weeds controlled: arrowhead, bulrush, creeping waterprimrose, pickerelweed, smartweed, spadderdock, waterchestnut, waterlily, watershield. Rate depends upon species and depth of water. Check label. Apply early, when weeds are actively growing, with a rotary seeder. Spadderdock may require retreatment.
bispyribac (Tradewind) 80% MOA 2	1 to 2 oz/A	0.8 to 1.6 oz ai/A	Controls alligatorweed and parrotfeather. Apply with at least 30 gpa water volume. Include appropriate adjuvant.
carfentrazone (Stingray) 1.9 lb/gal, MOA 14	6.7 to 13.5 fl oz/acre	0.2 lb/acre	Suppresses alligatorweed and waterprimrose.
diquat (Reward) 2 lb/gal (Weedtrine) 0.4 lb/gal MOA 22	1 gal/surface acre	2 lb/acre	For control of cattails in ponds or lakes. For top kill, apply in 100 gal of water per acre with 0.25% to 0.5% nonionic surfactant. Apply before flowering for best results. Retreat as needed.
flumioxazin (Clipper) 51% MOA 14	6 to 12 oz/A	3 to 6 ai/A or 100 to 400 ppb	Early morning applications may be more effective. If vegetation is dense, treat in sections to avoid reducing dissolved oxgen. Ensure adequate coverage of dense vegetation or a follow-up application may be necessary.
glyphosate (various) MOA 9	See label	See label	Rates vary according to target species. Retreatment of alligatorweed is necessary. Aquatic-approved nonionic surfactant (e.g. Cide-Kick or Induce) required with Rodeo. Note: The use of very hard water or water containing high concentrations of iron to prepare spray solutions may result in reduced efficacy of glyphosate.
imazamox (Clearcast) 1 lb/gal MOA 2	32 to 64 fl oz/acre	0.25 to 0.5 lb ai/acre 50 to 500 ppb	See label for specific weeds controlled. A nonionic surfactant or methylated seed oil is recommended for foliar applications. Spot treatments may be made with up to 5% solution by volume. Rates vary according to target species. Retreatment of some plants may be required. A nonionic surfactant is recommended.
imazapyr (Habitat) MOA 2	1 to 6 pt/acre	0.25 to 1.5 lb/acre	Rates vary according to target species. Retreatment of some plants may be required. A nonionic surfactant is recommended.
penoxsulam (Galleon) 2 lb/gal, MOA 2	2 to 5.6 fl oz/acre	0.03 to 0.09 lb/acre 5 to 500 ppb	See label for specific weeds controlled and application details.
triclopyr (Renovate 3) MOA 4	0.5 to 2 gal/ acre	1.5 to 6 lb/acre	Rates vary according to target species. Addition of an approved nonionic surfactant is recommended.

TABLE 7-22. CHEMICAL CONTROL OF AQUATIC PLANTS

Herbicide, Formulation, and Mode of Action Code	Amount of Formulation	Active Ingredient Rate or Concentration	Precautions and Remarks[2]
SUBMERSED WEEDS[3]			
2,4-D granular (Navigate) 20 G, MOA 4	100 to 200 lb/ surface acre	20 to 40 lb/acre	Rate depends upon weed to be controlled and depth of water. Check labels for species and rates. Apply uniformly with a rotary seeder.
bispyribac (Tradewind) 80% MOA 2	See label	10 to 45 ppb	Controls hydrilla, sago pondweed, and Eurasian watermilfoil. Do not apply in areas of high water flow or water diffusion. Refer to label for specific details on application rate based on water volume.
carfentrazone (Stingray) 1.9 lb/gal MOA 4	0.286 to 5.75 gal/acre	200 ppb	Controls Eurasian watermilfoil. Apply in spring or early summer as a subsurface application or with an appropriate adjuvant to ensure sinking and mixing of the spray mix.
diquat (Reward) 2 lb/gal MOA 22	1 to 2 gal/ surface acre	2 to 4 lb/acre	Weeds controlled: bladderwort, coontail, elodea, naiads, pondweeds. Apply early in season by pouring directly into water in strips 40 ft apart. Later in season, as weeds reach surface, pour in strips 20 ft apart or inject a dilute solution. Not effective in muddy water.
endothall (Aquathol K) 4.2 lb/gal (Aquathol Super K) 63 G	0.3 to 2.6 gal/acre ft 2.2 to 17.6 lb/acre ft	0.5 to 5 ppm	Weeds controlled: bass weed, bur reed, coontail, hydrilla (Aquathol K only), pondweeds, watermilfoil, water star grass. Rate depends upon weed species and type of treatment. Spot or marginal treatments require higher rates. Aquathol Granular is especially useful for spot or marginal treatments.
flumioxazin (Clipper) 51% MOA 14	See label	100 to 400 ppb	Early morning applications may be more effective. If vegetation is dense, treat in sections to avoid reducing dissolved oxygen. Water pH > 7.5 will reduce effectiveness.
fluridone (Sonar) AS MOA 12 (Sonar SRP) MOA 12	 Ponds: 0.16 to 1 qt/acre Lakes: 0.2 to 4 qt/acre Canals: 2 qt/acre Ponds: 3.2 to 30 lb/acre Lakes: 4 to 80 lb/acre Canals: 40 lb/acre Rivers: 40 lb/acre	 0.16 to 1 lb/acre 0.2 to 4 lb/acre 2 lb/acre 0.16 to1.5 lb/acre 0.2 to 4 lb/acre 2 lb/acre 2 lb/acre	Do not use water for irrigation for 7 to 30 days. See label for specific irrigation precautions. Application to canals should be made only if water flow can be restricted. **Warning: 30 days may be insufficient restriction if applied to small ponds and pond water will be used to irrigate very sensitive crops, such as tobacco, tomatoes, or peppers.**
imazamox (Clearcast) 1 lb/gal, MOA 2	See label	50 to 500 ppb	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.
penoxsulam (Galleon) 2 lb/gal, MOA 2	See label	5 to 150 ppb	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.
triclopyr (Renovate 3 or OTF), MOA 4	See label	1.5 to 6 lb/acre 0.5 to 2.5 ppm	Rates vary according to target species and depth to be treated. See label for specific weeds controlled and application details.

[1] Mode of Action (MOA) code developed by the Weed Science Society of America. Cooper compounds, endothall. and sodium carbonate peroxyhydrate have not been assigned codes.

[2] Also see comments for specific herbicides under “Labeled Sites and Restrictions.”

[3] Grass carp give cost-effective control on the majority of the weeds in this group and should be given consideration *before* using herbicides. See text at beginning of this section under *Biological Control of Aquatic Weeds with Triploid Grass Carp*. A permit is required to purchase more than 150 grass carp or for stocking in impoundments larger than 10 acres. Grass carp usually are **not effective** on filamentous algae, duckweed, watermeal, or any of the plants in the floating or emergent groups.

TABLE 7-23. WAITING PERIOD (IN DAYS) BEFORE USING WATER AFTER APPLICATION OF HERBICIDES FOR AQUATIC WEED CONTROL

Herbicide	Irrigation[1]	Fish Consumption	Watering Livestock	Swimming
2,4-D (various formulations and manufacturers)	Water use restrictions vary by formulation and manufacturer. In general, if water is used for irrigating sensitive crops, 2,4-D should not be used. Turfgrasses are generally tolerant to low concentrations of 2,4-D. Also, many 2,4-D formulations are NOT labelled for aquatic use. Read the label before purchasing and/or use.			
Bispyribac (Tradewind)	Do not irrigate until concentrations are < 1 ppb	No restrictions	No restrictions	No restrictions
carfentrazone (Stingray)	1 to 14	No restrictions	0 to 1	No restrictions
copper (Copper sulfate pentahydrate, including Bluestone and EarthTec; and complexed copper formulations, including Algae-Pro, Captain, Clearigate, Cutrine-Plus, Cutrine-Plus Granular, K-Tea, Komeen, etc.)	No restrictions	No restrictions	No restrictions	No restrictions
diquat (Reward)	3 to 5[4]	No restrictions	1	No restrictions
endothall (Aquathol K) (Aquathol Super K) (Hydrothol 191) (Hydrothol 191 granular)	 No restrictions 7 No restrictions 7 to 25	No restrictions	 7 to 25 No restrictions 7 to 25 7 to 25	No restrictions
Flumioxazin (Clipper)	5	No restrictions	No restrictions	No restrictions
fluridone (Sonar 4AS, Sonar SRP)	7 to 30[3]	No restrictions	No restrictions	No restrictions
Glyphosate (AquaMaster, Aqua Neat, Rodeo, Touchdown Pro)	No restrictions	No restrictions	No restrictions	No restrictions
imazamox (Clearcast)	0+[4]	No restrictions	No restrictions	No restrictions
Imazapyr (Habitat)	120	No restrictions	No restrictions	No restrictions
penoxsulam (Galleon)	Do not irrigate food crops until residues ≤ 1 ppb	No restrictions	No restrictions	No restrictions
sodium carbonate peroxyhydrate (GreenClean Pro, Pak 27)	No restrictions	No restrictions	No restrictions	No restrictions
triclopyr (Renovate 3, Renovate OTF)	120 0 to established grass	No restrictions	Next growing season for lactating dairy animals	No restrictions

[1] Irrigation restrictions may be removed for specific products if a laboratory assay of treated water meets a standard as stated on the product label.
[2] Water use restrictions of 3 days apply to irrigation of turf and nonfood crops; the five-day restriction is for food crops (including tobacco) and preparation of agricultural sprays.
[3] Water-use restrictions for irrigation vary with formulation. See label for precautions. A 30-day restriction may be insufficient if applied to small ponds intended for irrigation of very sensitive crops, such as tobacco.
[4] Refer to product label for specific restrictions.

TABLE 7-24. EFFECTIVENESS OF HERBICIDES AND TRIPLOID GRASS CARP FOR CONTROL OF WEEDS COMMONLY FOUND IN NORTH CAROLINA PONDS

Weeds	2,4-D	carfentrazone	copper compounds	diquat	diquat +copper	endothall		fluridone	glyphosate	imazamox	imazapyr	peroxide compounds	penoxsulam	triclopyr	triploid grass carp
						Aquathol	Hydrothol								
ALGAE															
Planktonic	NR	NR	G	P	G	NR	P	NR	NR	NR	NR	G	NR	NR	NR
Filamentous	NR	NR	G	E	E	NR	E	NR	NR	NR	NR	ID	NR	NR	P
Chara / Nitella	NR	ID	G	G	E	NR	G	NR	NR	NR	NR	ID	NR	NR	E
FLOATING PLANTS															
Azolla (mosquito fern)	NR	ID	F	E	E	NR	NR	E	NR	ID	NR	NR	G	NR	P
Duckweed	P	G	P	G	G	NR	NR	E	NR	NR	NR	NR	G	P	P
Frogbit	F	ID	NR	E	E	NR	NR	NR	P	E	E	NR	ID	G	P
Salvinia, common	NR	ID	P	E	E	NR	NR	E	G	E	ID	NR	ID	NR	P
Salvinia, giant	NR	ID	P	E	E	F	NR	E	G	P	G	NR	E	NR	P
Waterhyacinth	E	G	NR	G	G	NR	NR	F	G	E	G	NR	E	E	P
Watermeal	NR	NR	NR	P	P	NR	NR	G	NR	NR	NR	NR	P	NR	P
Water lettuce	NR	G	NR	G	G	G	G	NR	E	G	E	NR	E	NR	P
EMERSED PLANTS															
Alligatorweed	P	F	NR	NR	NR	NR	NR	F	G	G	G	NR	G	G	P
American lotus	G	NR	NR	NR	NR	NR	NR	G	E	F	G	NR	ID	G	P
Cattail	F	NR	NR	F	F	NR	NR	G	E	G-E	E	NR	ID	F	P
Creeping waterprimrose	E	F	NR	NR	NR	NR	NR	F	E	F	E	NR	G	E	P
Floating hearts	P	NR	NR	F	F	E	E	F	G	G	G	NR	F	P	P
Fragrant waterlily	G	NR	NR	NR	NR	NR	NR	G	E	G	E	NR	ID	G	P
Grass species	NR	NR	NR	F	F	NR	NR	F	E	F	E	NR	ID	NR	P
Parrotfeather	E	F	NR	NR	NR	NR	NR	NR	F	G	E	NR	G	E	NR
Phragmites (Common reed)	NR	NR	NR	NR	NR	NR	NR	NR	G	F-G	E	NR	NR	F	P
Pickeralweed	G	NR	NR	NR	NR	NR	NR	NR	F	E	E	NR	ID	G	P
Rush	NR	NR	NR	NR	NR	NR	NR	NR	G	ID	G	NR	ID	F	P
Spatterdock	G	NR	NR	NR	NR	NR	NR	G	E	G	E	NR	ID	F	P
Smartweeds	F	NR	NR	F	F	NR	NR	F	G	G	G	NR	F	G	P
Waterpennywort	G	NR	NR	F	F	NR	NR	G	E	E	E	NR	F	G	P
Watershield	E	NR	NR	F	F	NR	NR	F	E	G	G	NR	ID	E	P
SUBMERSED PLANTS															
Bladderwort	P	ID	NR	F	F	P	P	E	NR	F-G	NR	NR	ID	P	E
Cabomba	NR	ID	NR	F	F	F	F	F	NR	F	NR	NR	ID	NR	F
Coontail	G	ID	NR	E	E	E	E	E	NR	NR	NR	NR	ID	G	E
Egeria (Brazilian elodea)	NR	ID	F	E	E	P	P	E	NR	ID	NR	NR	G	NR	E
Eurasian watermilfoil	E	G	NR	G	G	E	NR	E	NR	F	NR	NR	G	E	P
Hydrilla, monoecious	NR	ID	F	G	E	E	E	E	NR	F	NR	NR	G	NR	E
Naiad, brittle	NR	ID	G	E	E	E	E	E	NR	ID	NR	NR	F	NR	E
Naiad, Southern	NR	ID	G	P	G	P	P	G	NR	ID	NR	NR	F	NR	E
Parrotfeather	E	ID	NR	G	G	E	E	E	NR	F	NR	NR	G	E	F
Pondweed species	NR	ID	NR	E	E	E	E	E	NR	G	NR	NR	G	NR	E
Proliferating spikerush	NR	ID	NR	NR	NR	NR	NR	F	NR	F	NR	NR	F	NR	E
Variable leaf milfoil	E	G	NR	E	E	E	E	G	NR	NR	NR	NR	NR	E	P

Key: NR = Not Recommended; P = Poor; G=Good ; ID = Insufficient Data; F = Fair; E = Excellent

Pond Dyes

Pond dyes may be used to prevent the growth of filamentous algae and submersed macrophyte vegetation. Pond dyes are not herbicides and do not directly kill aquatic plants. They function by blocking light penetration to the bottom of the pond. As a result, these products are most effective when applied very early in the growing season.

The use of a pond dye in aquacultural ponds usually is not recommended, as they tend to inhibit phytoplankton productivity that is needed to produce oxygen and provide food for zooplankton, which are the major food of fry and the smaller juvenile fishes. Application rates usually are about one part per million or 1 gallon per acre for a pond averaging 4 feet deep (i.e., 1 gallon per 4 acre-feet of water) for algae and most submersed weeds. For hydrilla, the rate needs to be doubled, due to its ability to grow at very low light levels. Several of the available pond dyes are registered by the EPA for aquatic weed control. Pond dyes *should not be applied to drinking water supplies or to streams or any body of water where there is any substantial outflow.*

TABLE 7-25. POND DYES

Examples of Pond Dyes	EPA Registered
dmiral Liquid	Yes
Aquashade	Yes

TABLE 7-26. LABELED SITES AND RESTRICTIONS

Herbicide and Formulation	Labeled Sites	Restrictions
2, 4-D amine (Weedar 64) 3.8 lb a.i./gal Other formulations	potable water reservoirs, farm and fish ponds, lakes, golf course water hazards, fish hatcheries	Delay the use of treated waters for irrigation and domestic purposes for 3 weeks after application unless an assay indicates that chemical water concentrates are below the minimum amount as specified on the product label. Do not treat irrigation ditches where water will be used for overhead irrigation of susceptible crops. Refer to specific product label for restrictions.
2,4-D granular (Navigate) 20 G	ponds and lakes	Do not apply to water used for irrigation, agricultural sprays, watering dairy animals, or domestic water supplies.
Bispyribac (Tradewind) 80%	Bayous, canals, fresh water ponds, lakes, marshes, and reservoirs	Do not irrigate until water concentrations are less than 1 ppb. Do not treat water used for crawfish production.
copper-complex (Cutrine-Plus) 0.9 lb/gal (Cutrine-Plus) 3.7 G (K-Tea) 0.8 lb/gal **copper sulfate**	potable water reservoirs, farm and fish ponds, lakes, golf course water hazards, fish hatcheries	No restrictions on use of treated water. Check tolerance of crop to copper applied in irrigation water. Trout are very susceptible to copper. Toxicity to other fish increases with decreasing hardness of water.
carfentrazone (Stingray) 1.9 lb/gal	ponds, lakes, reservoirs, marshes, wetlands, drainage ditches, canals, streams, rivers, etc.	Irrigation: Do not use treated water in commercial nurseries or greenhouses. Field crops may be irrigated after 1 day if less than 20% of surface area was treated, or after 14 days if treatment was 20% or more of surface area or until an assay indicates that chemical water concentrates are below a minimum amount as specifed on the product label. Treated water may be used for turf irrigation with no restriction if less than 20% of the total water body was treated. A 14-day restriction applies for larger area treatments. Do not apply within 0.25 miles an active potable water intake (upstream only in flowing waters), or turn intake off for at least 24 hours as specified on product label. Do not drink or water livestock for 1 day if 20% or more of total surface area was treated. Applicators must be liscensed or certified by the state.
diquat (Reward) 2 lb/gal	lakes, still ponds, ditches, laterals, waterways	Apply only to still water and/or public waters. Do not apply to turbid waters. Do not use treated water for irrigation of food crops, preparation of agricultural sprays, or for drinking for 5 days after application. Turf and nonfood crops may be irrigated 3 days after treatment. Do not use water for livestock for one day after treatment. Water use restrictions may be removed if an approved assay is conducted and water concentration is less than the maximum contaminant level as specified on the product label.
dyes (Admiral Liquid) (Aquashade)	ponds and lakes with little to no outflow	No not apply to water bodies not under direct control of user. Do not apply to water that will be used for human consumption.
endothall (Aquathol K) 4.23 lb/gal (Aquathol Super K granular) 63% (Hydrothol 191) 2 lb a.i./gal (Hydrothol granular) 11.2%	drainage canals, lakes, ponds	Restrictions up to 25 days may apply to waters used for domestic uses, irrigation, or watering livestock. Setback distance of at least 600 ft from functioning potable water intakes may also apply. Refer to specific product label for current restrictions on domestic use, irrigation, livestock use, and setback distance. Hydrothol formulations may kill fish when rates exceed 0.3 ppm. Check label for drinking water restrictions. Fish may be killed by rates exceeding 0.3 ppm. Irrigation and animal consumption restrictions o f7 to 25 days, depending on rate.
Flumioxazin (Clipper) 51%	Bayous, canals, fresh water ponds, lakes, marshes, and reservoirs	Do not irrigate from treated water for at least 5 days. Do not treat water used for crawfish production.
fluridone (Sonar 4 AS or SRP)	lakes, ponds, canals	Treated ponds may not be used for irrigaton for 7 to 30 days. See label for irrigation precautions.[1]
glyphosate (AquaMaster) 5.4 lb a.i./gal (AquaNeat) 5.4 lb a.i./gal (Rodeo) 5.4 lb a.i./gal (Touchdown Pro) 3 lb a.e./gal Other formulations	all bodies of fresh water and all types of aquatic sites	Do not apply within 0.5 mile of an active potable water intake (upstream only in flowing waters), or turn intake off for at least 48 hours as specified on product label. Refer to specific product label for restrictions.
imazamox (Clearcast)	in and around aquatic and noncropland sites	Irrigation: Do not apply to water to be used for irrigation of greenhouse or nursery plants. Do not irrigate from still or quiescent bodies of water within 24 hours of applilcation. Do not irrigate if concentrations exceed 50 ppb.
imazapyr (Habitat)	in and around standing and flowing waters, including estuarine and marine sites	Irrigation: Do not use treated water for 120 days following application or until an assay indicates that chemical water concentrations are below a minimum amount as specified on the product label. Do not apply within 0.5 miles of an active potable water intake (upstream only in flowing waters), or turn intake off for at least 48 hours as specified on product label. Do not apply to fast-moving waters. Do not apply to irrigation ditches or canals within 1 mile of an active irrigation water intake unless the irrigation restrictions can be observed. Applicators must be licensed or certified by the state.

TABLE 7-26. LABELED SITES AND RESTRICTIONS

Herbicide and Formulation	Labeled Sites	Restrictions
penoxsulam (Galleon)	in and around quiescent water bodies and exposed sediments of de-watered areas	Do not apply to flowing water. Irrigation: Do not apply to water to be used for irrigation of greenhouse or nursery plants. Do not irrigate established food crops, other than rice, if concentrations exceed 1 ppb. Do not irrigate established rice if concentrations in treated water exceed 30 ppb. No restrictions on use of treated water for turf irrigation, if concentrations are less than 30 ppb. Consult SePRO for other situations/commodities.
sodium carbonate peroxyhydrate (GreenClean Pro) (PAK 27)	ponds, lakes, lagoons, canals, ditches, etc.	Do not apply to treated, finished drinking water reservoirs.
triclopyr (Renovate 3) 3 lb/gal (Renovate OTF) 10 G	quiescent and slow-moving waters; non-irrigation canals	Irrigation: Do not use treated water for 120 days following application or until treated water has a non-detectable triclopyr level by an assay as specified on the product label. There is no restriction on irrigation of established grass. Applications around potable water intakes must observe minimum setback distances and/or minimum water concentrations as specified on the product label. Do not apply directly to or allow to come in direct contact with grapes, tobacco, vegetable crops, flowers, and other desirable broadleaf plants. Do not apply to esturarine or marine sites; do not apply directly to un-impounded rivers or streams; and do not apply to irrigation ditches or canals. Do not allow lactating dairy animals to graze treated areas until the next growing season after application unless spot-treatment was applied to less than 10% of total grazable area. Animals for slaughter must be removed from the treated area for at least 3 days.

[1] Water use restrictions for irrigation vary with formulation. See label for precautions. A 30-day restriction may be insufficient if applied to small ponds intended for irrigation of very sensitive crops, such as tobacco, tomatoes, or peppers.

Chemical Control of Specific Weeds

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TABLE 7-27. CHEMICAL CONTROL OF SPECIFIC WEEDS

Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
ARTICHOKE, BETONY or FLORIDA BETONY			
dichlobenil (Casoron) 50 WP (Casoron) 4 G	 8 to 20/lb/acre 100 to 250 lb/acre	Any time. Fall or winter best.	*Do not use on cropland.* See Precautions and Remarks under **Weed Control in Woody Ornamentals.** In order to comply with state noxious weed regulations, contact your local plant protection specialist or NCDA&CS weed specialist at 919-733-6932.
mesotrione (Tenacity) 4 SC	4 to 8 fl oz/acre	Apply to young, actively growing weeds.	Use a nonionic surfactant at 0.25% v/v. Reapply in 3 weeks. Controls Florida betony.
BAMBOO (CANE)			
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL	2% solution sprayed to wet 1 part herbicide + 2 parts water, applied with sponge	Midsummer to early fall while actively growing. Whenever new shoots are in the "husk" stage (before leaves open) and are 12 ft to 24 in. in height.	For large canes; first cut canes and allow to regrow to 4 to 6 ft in height. Avoid drift to desirable vegetation. Use Accord for forestry and utility rights-of-way sites. Wear rubber gloves. Wipe entire shoot with a sponge dampened with the herbicide. Sponge should not be dripping wet. Do not allow contact with desirable vegetation; avoid dripping onto grass.
BERMUDAGRASS			
glyphosate + fluazifop (Roundup PRO) 4 SL + (Fusilade DX) 2 EC	2 to 0.75 qt/acre	See Precautions and Remarks	Apply when bermudagrass is actively growing. Repeat applications when bermudagrass regrows. Wait 30 days after last application to seed, sprig, or sod new bermudagrass.
BERRIES (*Rubus* spp.)			
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	3 to 4 qt/acre as broadcast spray or 1% to 1.5% solution with handheld equipment	After bloom stage.	Use higher rate for plants that have reached the woody stage of growth. Best results are obtained when sprayed in late summer after berries are formed. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
triclopyr amine (Garlon 3 A) 3 SL	1 gal/100 gal water	After leaves fully expand in spring and before leaf color change in fall.	See comments under kudzu.
FLORIDA BETONY			
atrazine (Purge) 2F (AAtrex 4L) 4L	 2 to 4 qt/A 1 to 2 qt/A	Fall and/or winter	May be used on centipedegrass, St. Augustinegrass and dormant bermudagrass. Do not apply after Dec. 31 on bermudagrass unless delay in greenup is acceptable.
triclopyr + clopyralid (Confront) 3 SL	1 to 2 pt/A	Fall and/or winter	Do not apply to home lawns. May be used on centipedegrass, bermudagrass, and zoysiagrass. Do not apply to bermudagrass during transition. Repeat applications may be required.
MCPA amine + triclopyr amine + dicamba (Horsepower) 4.56 L	2 to 3 pt/A	Fall and/or winter	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial uses such as sod or seed production. May be used on bermudagrass, zoysiagrass and bahiagrasss.
MCPA ester + triclopyr ester + dicamba (Coolpower) 3.6 L	2.5 to 3.5 pt/A	Fall and/or winter	May be applied to home lawns by a commercial applicator. Not for use on turf grown for resale or other commercial uses such as sod or seed production. May be used on bermudagrass, zoysiagrass and bahiagrasss.
HONEYSUCKLE			
dicamba (Banvel) 4 SL	1 gal/100 gal water	When actively growing, prior to bloom.	Using hand-held equipment, spray to wet leaves. Add a nonionic surfactant at the rate of 2 qt/100 gal of finished spray solution to improve wetting. Keep spray off desired plants. Do not spray in rooting zone of desired plants.
2,4-D amine (various) 4 SL	1.5 qt/50 gal water		
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	3 to 4 qt/acre as broadcast spray or 1% to 1.5% solution with handheld equipment	When plants are actively growing at or beyond the bloom stage of growth.	Use the higher rate for plants that have reached the woody stage of growth. Ensure thorough spray coverage with hand-held equipment. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
KUDZU			
aminopyralid (Milestone) 2 SL	7 oz/A	Apply to young, actively growing plants	May be used in permanent grass pastures, rangeland, noncrop areas, nonirrigation ditch banks and other natural areas. Due to crop sensitivity, use extreme caution around sensitive crops including but not limited to alfalfa, cotton, potatoes, soybeans, tobacco and other broadleaf or vegetable crops, fruit trees, or ornamental plants. Do not use aminopyralid-treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed treated areas in compost or mulch that will be in contact with susceptible broadleaf plants. There are no restrictions on grazing or hay harvest following aminopyralid applications. Check and follow label directions for completed list and precautions.
clopyralid (Transline) 3 SL	1 to 3 qt/100 gal	During active growth.	Spray to wet leaves. Do not apply more than 1.337 pt per acre.
dicamba (Banvel) 4 SL	1 gal/100 gal water	When actively growing, before bloom.	Using hand-held equipment, spray to wet leaves. Keep spray off desired plants. Do not spray in rooting zones of desired plants. Add a nonionic surfactant at the rate of 2 qt per 100 gal of finished spray solution to improve wetting.
(Vanquish) 4 SL	0.5 gal/100 gal water	Dormant season; just prior to budbreak (early to mid-March).	Do not spray in rooting zones of desired plants. Regrowth should be sprayed in mid- to late summer with glyphosate or clopryalid.
fosamine (Krenite) 4 SL	1.5 to 3 gal/acre	August through September.	Spray to wet leaves thoroughly. Good coverage is necessary.
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	4 qt/acre as broadcast spray or 2% solution with handheld equipment	When actively growing at or beyond bloom stage of growth.	Repeat applications are necessary to maintain control. Ensure thorough spray coverage with hand-held equipment. Apply before frost in the fall. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
metsulfuron methyl (Escort) 60 WDG	3 to 4 oz/acre	When actively growing.	Add 1 qt nonionic surfactant per 100 gal of water plus a drift control agent. Do not apply by air.

TABLE 7-27. CHEMICAL CONTROL OF SPECIFIC WEEDS

Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
KUDZU (continued)			
sulfometuron methyl (Oust) 75 WDG	12 oz/acre per 100 gal water	When actively growing.	Add 1 qt nonionic surfactant per 100 gal of water plus a drift control agent. Do not apply by air.
triclopyr amine (Garlon 3 A) 3 SL	2 gal/100 gal water	During mid-season when plants are actively growing.	Spray to wet leaves thoroughly. Do not allow to drift; this product is very toxic to tobacco, soybeans, and many other broadleaf crops, trees, and ornamentals. Most grasses are very resistant.
MUGWORT *(Artemisia vulgaris)*			
dichlobenil (Casoron) 50 WP (Casoron) 4 G	8 to 20 lb/acre 100 to 250 lb/acre	Any time. Fall or winter best.	*Do not use on cropland*. See Precautions and Remarks under **Weed Control in Woody Ornamentals.**
EPTC (Eptam) 7 EC	6.75 pt/acre	Spring or fall.	Plow area before treatment. Incorporate chemical into soil immediately after application. Rototilling is the preferred method, but deep cross-disking is satisfactory. Treatment most effective when soil is moist but not wet. Under normal conditions the herbicide will be dissipated in 8 to 12 weeks. Tilling the soil several times before planting will help dissipate chemical from soil.
MULTIFLORA ROSE (See publication AG-536 for more details)			
2,4-D + triclopyr (Crossbow) 3 EC	1 to 1.5 gal in 100 gal water (handgun application) or a 1% to 1.5% solution for smaller amounts	At fall vegetative stage prior to full bloom	Spray to wet all leaves and green stems to drip point. Use low spraying pressure to prevent drift. For best results, apply when plants are actively growing during the early to mid-flowering stage.
	Undiluted herbicide		Small plants may be controlled by a thinline basal application of undiluted herbicide across all stems at a height where the stems are less than 0.5 inch in diameter. Apply approximately 20 ml of undiluted product per bush. Treat when bark is dry and rain is not forecast. For bushes with more than 3 or 4 stems, coverage of each stem may be difficult; basal bark or dormant stem applications may be more effective (see these sections under **Chemical Control of Woody Vegetation**). **Warning:** *Restrictions on grazing or harvesting of green forage:* Do not graze lactating dairy animals or harvest green forage for 14 days following treatment with 2 gal per acre or less; with treatment rates greater than 2 gal per acre, do not graze or harvest green forage until the following growing season. For other livestock, no grazing restrictions apply at rates under 2 gal per acre. Above 2 gal per acre, do not graze or harvest green forage from treated areas for 14 days after treatment. *Restrictions on haying (harvesting of dried forage):* For lactating dairy animals, do ot harvest hay until the next growing season. For other livestock, do not harvest hay for 7 days after treatment at rates under 2 gal per acre. Above 2 gal per acre, do not harvest hay for 14 days after treatment. *Slaughter restrictions:* Withdraw livestock from grazing treated grass or treated hay at least 3 days before slaughter. This restriction applies to grazing during the season following treatment or hay harvested during the season following treatment.
dicamba (Banvel) 4 SL	1 gal/100 gal water	At full vegetative stage, prior to bloom.	Can be used in pastures and noncropland. A maximum of 200 gal of spray solution can be used per acre. Spray with a handgun and completely wet foliage and stems, allowing spray solution to run down the stems. Add a nonionic surfactant at the rate of 2 qt/100 gal of finished spray solution to improve wetting. Do not graze dairy animals for 60 days. There is no waiting period between treatment and grazing beef cattle or other livestock. Do not spray desired plants or in rooting zone of desired plants. Follow-up treatments may be necessary in subsequent years.
fosamine (Krenite S) 4 SL	1.5 to 3 gal/ 100 gal water	Apply to foliage during the 2-month period before fall leaf coloration.	Thoroughly and uniformly cover plants without drenching. Use 1 to 2 qt per 100 gal of a penetrating type, oil-based surfactant to improve activity. Use in noncropland, fence lines, etc.
gyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	1 gal/100 gal water	Apply to foliage after full bloom until August 1.	Use handgun and thoroughly cover bush. May be used in noncropland and pasture. Do not graze livestock for 10 days following treatment. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
metsulfuron methyl (Escort) 60 WDG	0.5 to 1 oz/acre	Early spring after bushes are fully leaved out.	Escort is not labelled for pastures; Cimarron may be used to control roses in pastures. For effective broadcast treatments, rose bushes should not be taller than 3 feet. For spot treatment, apply as foliar spray to runoff, and do not exceed 75 gal total spray per acre. Use 1 pt to 1 qt surfactant per 100 gal spray.
metsulfuron methyl (Cimmaron) 60 WDG	0.3 oz/acre for broadcast; 1 oz per 100 gal water for spot treatment		
tebuthiuron (Spike) 20 P	20 lb/acre	Apply after ground thaws in spring before or soon after leaf flush. May require 2 yr for kill of large canes.	Broadcast over root zone. Do not apply near desirable trees or shrubs. Ground may be bare for 3 to 5 yr where applied.
(Spike) 80 WP	5 lb/acre		Apply in water with a backpack sprayer as a band at the base of bushes or lace overtop of bushes. Same precautions as above for Spike 20 P.
NUTSEDGE			
2,4-D amine (various brands) 4 SL	1 qt/acre	Early in growing season following a thorough disking. Repeat at 3-week intervals for 3 treatments.	Corn crop can be produced while using 2,4-D. Apply preemergence rate. Follow 3 to 4 weeks later with rate suggested for corn and repeat. Rate suggested can be used following tobacco harvest.
dichlobenil (Casoron)	See section on **Weed Control in Woody Ornamentals**. Do not use on row crop land.		
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	3 qt/acre	See remarks.	Apply when plants are in flower or when new nutlets can be found at rhizome tips. Tillage two weeks after application will improve control. Repeat treatment will be required for long-term control. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
bentazon (Basagran) 4 SL	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression. Bentazon and S-metholachlor control yellow nutsedge only.

TABLE 7-27. CHEMICAL CONTROL OF SPECIFIC WEEDS

Herbicide and Formulation	Amount of Formulation	Time of Application	Precautions and Remarks
NUTSEDGE (continued)			
chlorimuron (Classic) 25 WDG	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
EPTC (Eptam) 7 EC	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
EPTC + safener (Eradicane) 6.7 EC	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
halosulfuron (Sandea, Sedgehammer) 75 DF	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
imazaquin (Image) 70 DG	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
imazethapyr (Pursuit) 70 WDG	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
pebulate (Tillam) 6 E	Follow label directions	Follow label directions	See weed control for specific field, turf, or vegetable crop for nutsedge suppression.
S-metolachlor (Dual Magnum, Dual II Magnum)	Follow label directions	Follow label directions.	See weed control for specific field, turf, or vegetable crop for nutsedge suppression. Bentazon and S-metholachlor control yellow nutsedge only.
sulfosulfuron (Certainty) 75 WG	1.25 oz/acre	Apply in May for June.	Add a nonionic surfactant at 0.25% v/v. Make a second application in 6 to 10 weeks, if needed. Certainty and Monument control yellow nutsedge, purple nutsedge, and kyllinga species.
trifloxysulfuron (Monument) 75 WG	0.45 to 0.56 oz/acre	Apply in May for June.	Add a nonionic surfactant at 0.25% v/v. Make a second application in 6 to 10 weeks, if needed. Certainty and Monument control yellow nutsedge, purple nutsedge, and kyllinga species.
POISON IVY and POISON OAK			
2,4-D amine (various brands) 4 SL	2 qt/100 gal water	Apply in late spring or early summer when the plants are growing rapidly.	Apply only to plant material to be killed. Apply as a wetting spray. Avoid drift. Repeat in 6 to 8 weeks if needed. Use Accord for forestry and utility rights-of-way sites. Roundup PRO should be used for industrial and other noncropland areas. Use Roundup ULTRA on agricultural areas.
dicamba (Banvel) 4 SL	1 gal/100 gal water	At full vegetative stage, before bloom.	See comments for honeysuckle.
glyphosate (Accord) 4 SL (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	4 to 5 qt/acre as a broadcast spray or 2% solution with handheld equipment	After leaves fully expand in the spring and before leaf color changes in the fall.	
triclopyr amine (Garlon 3 A) 3 SL	1 gal/100 gal water	After leaves fully expand in spring and before leaf color changes in fall.	See comments for Kudzu.
TREE OF HEAVEN *(Ailanthus altissima)*			
metsulfuron methyl (Escort) 60 WDG	1 oz/100 gal water for high-volume treatment 1 oz/20 gal water for low-volume treatment	Mid-summer	For right-of-way use only. Escort is not labeled for pastures.

Chemical Control of Woody Plants

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TABLE 7-28. CHEMICAL CONTROL OF WOODY PLANTS

Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
FOLIAGE TREATMENT, most woody species: ash, red maple, and persimmon generally resistant. Rhododendron resistant		
2,4-D amine (various brands) 4 SL, MOA 4	2 gal in 100 gal water	Use amine formulations to reduce vapor drift hazard. Use low spraying pressure to prevent spray drift. Wet foliage and stems thoroughly. Most effective results obtained by spraying within 6 weeks after plants have reached full-leaf stage. This treatment used primarily on trees or brush less than 6 ft tall. Only certain brands of 2,4-D can be used on ditch banks or near other bodies of water; check labels.
2,4-D low volatile ester or oil-soluble amine (various brands and concentrations)	varies	Use as invert emulsion to reduce drift hazards See remarks for 2,4-D amine.
2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	1 to 1.5 gal in 100 gal water (handgun application) 1.5 to 4 gal in water to deliver 15 to 30 gal total spray/acre	Spray to wet all leaves and green stems to drip point. Use low spraying pressure to prevent drift. For best results, apply when plants are actively growing after full leaf in spring to early summer. This treatment is used primarily on trees and brush less than 6 feet tall. For application via boom or other broadcast spray equipment. For aerial application (helicopter only), use Nalcotrol to prevent drift. See label for specific information. **Warning:** *Restrictions on grazing or harvesting of green forage:* Do not graze lactating dairy animals or harvest green forage for 14 days following treatment with 2 gal per acre or less; with treatment rates greater than 2 gal per acre, do not graze or harvest green forage until the following growing season. For other livestock, no grazing restrictions apply at rates under 2 gal per acre. Above 2 gal/acre, do not graze or harvest green forage from treated areas for 14 days after treatment. *Restrictions on haying (harvesting of dried forage):* For lactating dairy animals, do not harvest hay until the next growing season. For other livestock, do not harvest hay for 7 days after treatment at rates under 2 gal per acre. Above 2 gal per acre, do not harvest hay for 14 days after treatment. *Slaughter restrictions:* Withdraw livestock from grazing treated grass or treated hay at lest 3 days before slaughter. This restriction applies to grazing during the season following treatment or hay harvested during the season following treatment.
fosamine (Krenite S) 4 SL	1.5 to 3 gal in 100 gal water	Apply to foliage during the 2-month period prior to fall leaf coloration. Thoroughly and uniformly cover plants without drenching. Add surfactant WK at the rate of 1 qt per 100 gal of spray. Surfactant WK is not needed with Krenite S. Rate and gallonage depend on plant size and species to be controlled. Check label. Use in noncropland, fence lines, etc.
dicamba (Banvel) 4 SL	1 gal in 100 gal	Apply when leaves are fully developed. Spray with a handgun to completely wet foliage, and allow spray to run down the stem. Add a nonionic surfactant at the rate of 2 qt per 100 gal of finished spray solution to improve wetting. Retreatment may be required, but do not exceed 2 gal per treated acre during one growing season. Keep spray off desired plants. Do not spray in rooting zone of desired plants.
triclopyr (Garlon 3A) 3 SL (Garlon) 4.4 EC	 2 to 3 gal in 100 gal water 1 to 3 gal in 100 gal water	Spray to thoroughly wet leaves, stems, and root collars. Can be mixed with other woody plant herbicides. See label. Avoid drift.
FOLIAGE TREATMENT, woody brush and trees		
2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	2 to 8 pt/acre	Apply when weeds are small and actively growing before bud stage. Bienennial and perennial species are best controlled in seedling to rosette stage before flower stalks appear.
dicamba (Vanquish) 4 SL, MOA 4	0.5 to 4 pt in 25 to 200 gal water	For low volume applications, apply 3 to 5% v/v rate. Check product label for tank mix partners for woody brush and vines.
glyphosate (Accord Concentrate) 5.4 SL, MOA 9	5 to 8% solution	If brush has been mowed or trees cut, wait until regrowth reaches recommended stage before treating. Apply as a low volume directed spray on at least 50% of the targeted foliage using a lateral zigzag motion from top to bottom. Spray to wet, not runoff. Add NIS at 2 qt per 100 gal of spray solution.
metsulfuron methyl (Escort XP) 60 DF, MOA 2	0.33 to 4 oz/acre in 10 to 50 gal water	For industrial, noncrop sites on young, actively growing weeds and brush. High volume ground application: mix 0.5 to 3 oz per 100 gal spray solution, and apply at 100 to 400 gal per acre. Low volume and ultra-low volume ground applications: mix 4 to 8 oz per 100 gal spray solution, and apply at 10 to 50 gal per acre.
triclopyr (Remedy) 4 EC, MOA 4	2 pt in 10 gal water/acre	Treat after rapid growth period in spring when leaf tissue is fully expanded and terminal growth has slowed. During drought conditions or for hard-to-control weeds, add 2 to 3 qt of 2,4-D low volatile ester to spray solution.
triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 lb/gal, MOA 4	3 to 8 pt/acre	Broadcast applications: treat in late spring through summer when leaves are fully expanded and terminal growth has slowed. If brush has been mowed, allow 9 to 12 months of regrowth before treating. NIS or liquid fertilizer at 1 to 2 qt per 100 gal of spray solution may improve control. High volume foliar treatment of individual plants: apply 1 to 2 gal of PastureGard plus 1 qt NIS per 100 gal of spray solution.
FOLIAGE TREATMENT, black locust, honey locust, mimosa, redbud, and wisteria		
aminopyralid (Milestone VM) 2 SL, MOA 4	4 to 7 fl oz/A	Treat when weeds are actively growing. Include a non-ionic surfactant. Avoid mowing for 14 days after application.
FOLIAGE TREATMENT, numerous woody species		
aminopyralid + triclopyr (Milestone VM Plus) 1.1 SL, MOA 4	6 to 9 pints/A	Treat when weeds are actively growing. Include a non-ionic surfactant.
FOLIAGE TREATMENT, most vegetation		
imazapyr (various) 2 SL, MOA 2	0.5 to 5% v/v 0.6 to 6.4 fl oz/gal	Most effective with 1% methylated seed oil.
BASAL STEM TREATMENT, most woody species; black locust resistant		
2,4-D low volatile ester (various brands) 4 SL, MOA 4	2 gal in 100 gal high quality mineral oil	Spray lower 12 in. of stem or trunk and let some solution run into ground. May be used any time of year, but is much more effective during dormant season. One growing season required before plants die completely. This treatment used primarily on plants less than 6 in. in diameter. Root suckering species may be resistant. *Both dormant stem and basal treatments useful to farmers and landowners because during winter there is less hazard to crops and more labor probably available.* Do not use around the home or ditch banks.
triclopyr (Garlon) 4.4 EC, MOA 4	1 to 3 gal in 100 gal high quality mineral oil	

TABLE 7-28. CHEMICAL CONTROL OF WOODY PLANTS

Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
BASAL STEM TREATMENT, most woody species; black locust resistant (continued)		
2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	4 gal in high quality mineral oil to make 100 gal spray	Spray basal portions of trees or brush to a height of 15 to 20 in. from the ground. Thoroughly wet all basal bark areas, including crown and ground sprouts and ground area at base of stems or trunk. For trees larger than 6 to 8 inches diameter, use stump treatment. Winter and early spring treatments give best results. See warning for livestock and haying usage for Crossbow listed above under “Most Woody Species.”
BASAL STEM TREATMENT, most woody species		
imazapyr (Stalker) 2 SL, MOA 2	8 to 12 fl oz in 1 gal high quality mineral oil	Treat lower 18 inches of stem. May be used on stems up to 4 inches DBH. Do not apply to point of dripping or puddling.
BASAL STEM TREATMENT, woody brush and trees		
2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	8 qt in 100 gal water or 2.6 fl oz in 1 gal water	Thoroughly wet the base and root collar of all stems until the spray accumulates around the root collar at the ground line. Wetting the stems will aid in control.
triclopyr (Remedy) 4 EC, MOA 4	2 gal in 98 gal high quality mineral oil	Spray basal 15 to 20 in. of plant to point of runoff at soil surface.
triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 lb/gal, MOA 4	50% PastureGard + 50% high quality mineral oil	Apply at any time to stems less than 6 in. in diameter except when snow or water prevents spraying to ground line. Use solid cone or flat fan nozzles at low pressure. Spray to wet but not runoff.
DORMANT STEM TREATMENT, most woody species		
2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	1 to 4 gal in high quality mineral oil to make 100 gal spray	Thoroughly wet upper and lower stems, including root collar and any ground sprouts. Treat when brush is dormant and the bark is dry, but not when snow or water prevents spraying to ground line. Best results occur with late-winter to early spring applications. Brush over 8 ft in height is difficult to control with this method. See warning for livestock and haying usage for Crossbow listed above under “Most Woody Species.”
DORMANT STEM TREATMENT, woody brush and trees		
triclopyr (Remedy) 4 EC, MOA 4	3 to 6 qt in high quality mineral oil to make 100 gal spray	Treat any time brush is dormant and most foliage has dropped. Use 20 to 40 psi with knapsack or power spraying equipment. Do not apply if snow or water prevents spraying to ground line. Wet stems to point of runoff and ground below the plant for root suckering species, such as sumac, sassafras, or locust.
STUMP TREATMENT TO PREVENT REGROWTH, most woody species		
2,4-D low volatile ester (various brands) 4 SL, MOA 4	3 gal in 100 gal high quality mineral oil	Soak freshly cut stumps with spray solution to prevent sprouting, or use AMS crystals on stump. Hasten decay of stump by covering with layers of soil and a nitrogen fertilizer. Keep moist.
2,4-D + triclopyr (Crossbow) EC 2.0 + 1.0 lb/gal, MOA 4	4 gal in high quality mineral oil to make 100 gal spray	Cut down trees and treat stumps, including the freshly cut surface, bark, crown, and ground sprouts. Winter and early spring treatments (before growth begins) give best results.
dicamba (Banvel) 4 SL, MOA 4	16.5 gal in 100 gal water	Spray or paint freshly cut surface with the solution. Area adjacent to bark should be thoroughly wet.
STUMP TREATMENT TO PREVENT REGROWTH, Woody brush and trees		
2,4-D amine (DMA 4 IVM) 3.8 SL, MOA 4	8 qt in 100 gal water or 2.6 fl oz in 1 gal water	Apply as soon as possible after cutting trees. Thoroughly soak entire stump including cut surface, bark, and exposed roots.
dicamba (Vanquish) 4 SL, MOA 4	1 gal in 1 to 3 gal water	NIS or oil may be added to enhance control. Make application within 30 minutes of cutting. Area adjacent to the bark should be thoroughly wet.
triclopyr (Remedy) 4 EC, MOA 4	20 to 30 gal in high quality mineral oil to make 100 gal spray	Treat with a backpack or knapsack sprayer using low pressure and a solid cone or flat fan nozzle. Spray stump sides and outer portion of cut surface but not to point of runoff. Apply anytime except when snow or water prevent spraying to ground line.
triclopyr + fluroxypyr (PastureGard) 2 EC 1.5 + 0.5 lb/gal, MOA 4	50% PastureGard + 50% high quality mineral oil	Apply to freshly cut stumps using solid cone or flat fan nozzles at low pressure. Wet stump sides, root collar, and outer portion of cut surface but not to point of runoff. Apply anytime except when snow or water prevent spraying to ground line.
STUMP TREATMENT TO PREVENT REGROWTH, woody species, such as alder, dogwood, hickory, maple, oak, poplar, sweet gum, sycamore, and willow		
glyphosate (Accord Concentrate) 5.4 SL, MOA 9	50 to 100% solution	Treat freshly cut stumps or resprouts. Apply to freshly cut stumps immediately after cutting or reduced performance may occur.
STUMP TREATMENT, numerous wood species		
aminopyralid + triclopyr (Milestone VM Plus) 1.1 SL, MOA 4	apply undiluted	Apply as soon as possible after cutting stems.
STUMP TREATMENT, most woody species		
imazapyr (Stalker) 2 SL, MOA 2	8 to 16 ox in 1 gal high quality mineral oil	Apply as soon as possible after cutting stems.
SOIL TREATMENT BENEATH WOODY PLANTS, most woody species		
hexazinone (Velpar L) 2 SL, MOA 5	2 to 4 gal in 100 gal water	Apply as a coarse spray, using a handgun applicator. Direct spray beneath plants to be controlled. Apply during the period between late winter and early summer. Do not apply in vicinity of desirable plants.
bromacil (Hyvar X-L) 2 SL, MOA 5	varies	Apply as a coarse spray, using a handgun applicator. Use at least 200 gal of spray per acre. Direct spray beneath plants to be controlled just before or during the period of active growth. Do not apply in vicinity of desirable plants. Rates depend on species to be controlled. Check label.
tebuthiuron (Spike) 20 P, MOA 7	5 to 30 lb/acre	Rates depend on species to be controlled. Check label for specific rates. Apply any time when ground is not frozen. Do not apply to the root zone of desirable trees or shrubs or where runoff can carry the herbicide to desired plants.

Total Vegetation Control in Noncropland

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Controlling all weeds for extended periods is expensive; it is practical only where complete vegetation control is desirable and soil erosion is not an important factor. Such areas are around signposts and buildings, along highways and railroads, under guardrails and fences, and in parking lots. Do not use any of the treatments where adjacent trees, ornamentals, or crops might be affected. Roots of nearby desirable plants, especially trees and shrubs, may grow into an area that has been treated and be killed.

Effective rates for control vary with the weed species, degree of infestation, soil type, and environmental conditions. The lower rates are generally applied to annuals, biennials, shallow-rooted perennials, and seedling perennials, whereas the higher rates are applied to established, deep-rooted, and other hard-to-kill perennials. For specific details, read and follow directions on the label.

TABLE 8-29. TOTAL VEGETATION CONTROL IN NONCROPLAND

Herbicide and Formulation	Amount of Formulation	Precautions and Remarks
bromacil (Hyvar X) 80 WP (Hyvar X-L) 2 SL	3 to 30 lb/acre 1.5 to 12 gal/acre	For handgun sprayer, use at least 200 gal of water per acre. For treating small areas, use a hand sprayer or sprinkling can. For retreatment apply 2 to 6 lb of active material per acre when annual weeds and grasses reappear on sites where weed growth has been controlled. Rates depend on weeds to be controlled. Check label.
bromacil + diuron (Krovar I) 80 WDG	4 to 30 lb/acre	Rates depend on weeds to be controlled. Check label. For retreatment use 4 to 6 lb per acre.
diuron (Karmex) 80 WDG	5 to 15 lb/acre	For most annual weeds.
	20 to 60 lb/acre	For perennial weeds. Addition of paraquat at the rate of 0.5 lb per acre plus nonionic surfactant will provide quick kill of existing vegetation and allow lower rates of diuron to be used.
imazapic + glyphosate (Journey) 0.75 + 1.5 lb/gal AS	0.33 to 1 qt/acre	For broadcast or spot treatment of annual and perennial grass and broadleaf weeds and vine species. May be applied preemergence or postemergence but postemergence is preferred. Depending on weed species, use a 5 to 20% active MSO at 1 to 2 pt per acre or a NIS at least 60% active with HLB ratio between 12 and 17 at 0.25% v/v. Nitrogen-based liquid fertilizers may be added but not substituted for spray adjuvants. For extended residual control, tank mix with Arsenal, Endurance, Escort, Karmex, Krova, Oust, Pendulum, Roundup Pro, Sahara, Tordon, Vanquish, or 2,4-D. Spot treat with 0.8 to 17 oz per gallon + 1% v/v MSO.
glyphosate (Roundup PRO) 4 SL (Roundup ULTRA) 4 SL	4 qt/100 gal water or 2 to 3 oz/gal water/1,000 sq ft	For industrial and nonagricultural uses in hand-held, high-volume equipment, mix 4 qt of Roundup PRO in 100 gal of water and spray to wet. For farmstead weed control, use 1% to 2% solution of Roundup ULTRA. Use a 2% solution for perennial weeds.
imazapyr (Arsenal) 2 SL	0.25 to 0.5 gal/acre	See label instructions.
imazapic + glyphosate (Journey) 0.75 + 1.5 lb/gal AS	0.33 to 1 qt/acre	For broadcast or spot treatment of annual and perennial grass and broadleaf weeds and vine species. May be applied preemergence or postemergence but postemergence is preferred. Depending on weed species, use a 5 to 20% active MSO at 1 to 2 pt per acre or a NIS at least 60% active with HLB ration between 12 and 17 at 0.25% v/v. Nitrogen-based liquid fertilizers may be added but not substituted for spray adjuvants. For extended residual control, tank mix with Arsenal, Endurance, Escort, Karmex, Krovan, Oust, Pendulum, Roundup Pro, Sahara, Tordon, Vanquish, or 2,4-D. Spot treat with 0.8 to 17 oz per gallon + 1% v/v MSO.
oryzalin + glyphosate (Surflan AS Specialty) 4 AS + (Roundup PRO) 4 SL	4 to 6 qt/acre + 4 to 6 qt/acre	For safer total vegetation control in vicinity of desirable vegetation. Rates depend upon size and weeds to be controlled. See Surflan label. Apply in 100 gal water per acre.
prometon (Pramitol 25 E) 2 EC	5 to 30 gal/acre	For annuals, use 5 to 7.5 gal per acre. For perennials, use 20 to 30 gal per acre. Apply in 50 to 100 gal of water. For faster knockdown of established weeds and grasses, apply in 100 to 200 gal oil. For maintenance application in following seasons, reduce rate in half.
(Pramitol) 5 PS	0.5 to 2 lb/100 sq ft	Pellets containing 5% prometon, 0.5% simazine, 40% sodium chlorate, and 50% sodium metaborate. For maintenance use 1 lb per 100 sq ft.
sulfometuron methyl + chlorsulfuron (Landmark MP) 50 + 25 DG (Landmark II MP) 56.25 + 18.75 DG	4.5 to 9 oz/acre 2.66 to 10 oz/acre	Controls many annual and perennial grass and broadleaf weeds on terrestrial non-crop sites, including public, private, and military lands. Do not apply to recreation areas or paved surfaces. Can be applied to areas where temporary surface water has collected. Treat weeds preemergence or early postemergence when actively germinating or growing.

Additional Information

Additional information on weed management can be found in the following publications available either online or from county Cooperative Extension centers:

Aquatic Weeds — http://www.weedscience.ncsu.edu/aquaticweeds/

Cotton — *Cotton Information* (current edition), AG-417; http://ipm.ncsu.edu/production_guides/cotton/contents.pdf

Corn — *The North Carolina Corn Production Guide,* http://www.ces.ncsu.edu/plymouth/cropsci/cornguide/

Flowers and Ornamentals

Weed Control for Bulbs in the Landscape. Horticultural Information Leaflet No. 643

Weed Control in Flower Beds, Horticultural Information Leaflet No. 644

The Nursery Crops Production Manual. To order, contact Department of Horticultural Science, Box 7609, N.C. State University, Raleigh, NC 27695-7609

Controlling Sedges in Landscape Plantings, http://www.ces.ncsu.edu/depts/hort/hil/hil-647.*html*

Postemergence, Nonselective Herbicides for Landscapes and Nurseries, http://www.ces.ncsu.edu/depts/hort/hil/hil-648.html

Weed Management in Annual Color Beds, http://www.ces.ncsu.edu/depts/hort/hil/hil-644.html

Weed Management for Wildflowers, http://www.ces.ncsu.edu/depts/hort/hil/hil-645.html

Fruit and Vegetables

2004 Integrated Orchard Management Guide for Commercial Apples in the Southeast, http://ipm.ncsu.edu/apple/orchardguide/contents.html

Orchard Floor Management in Pecans, http://www.ces.ncsu.edu/depts/hort/hil/hil-380.html

Weed Control Options for Strawberries on Plastic, http://www.ces.ncsu.edu/depts/hort/hil/hil-205-b.html

Noncropland

Invasive Weed Fact Sheets, http://www.weedscience.ncsu.edu/noncroplandweeds/factsheets.html

Peanuts — *Peanuts Information* (current edition), AG-331, http://ipm.ncsu.edu/production_guides/peanuts/main.pdf

Small Grains — *Small Grain Production Guide*, AG-580. *Small Grain Weed Control*, http://www.smallgrains.ncsu.edu/Guide/Chapter14.html

Tobacco

Flue-cured Tobacco Guide (current edition), http://ipm.ncsu.edu/Production_Guides/Flue-Cured/flue_cured.pdf

Burley Tobacco Production Information, http://ipm.ncsu.edu/Production_Guides/Burley/burley.pdf

Turf

Pest Control Recommendations for Turfgrass Managers, AG-408

TurfFiles, http://www.turffiles.ncsu.edu