WATER

Are we learning from the past?

The industry must look to the past and present to envision the future of water resources.

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Nursery crops research and extension faculty from the southeastern and mid-Atlantic U.S., in collaboration with the Horticultural Research Institute, undertook the task of updating the seminal paper “Strategic vision of container nursery irrigation in the next ten years” by Beeson et al. published in the Journal of Environmental Horticulture in 2004 (https://goo.gl/xyH9Ic (https://goo.gl/xyH9Ic)). The perspectives captured in that paper are foundational for exploring the challenges that lie ahead. We recently reflected on the predictions and conclusions of Beeson et al. and discuss their relevance to today’s nursery and greenhouse industries. The current authors informally surveyed more than 50 nursery and floriculture producers, university faculty and allied industry members to compare the original 10-year strategic plan with events that occurred over that 10-year period (2004-2014), and recently published an updated strategic vision for the next 10 years (2015-2025) in the April issue of HortTechnology

(http://goo.gl/NR1EqS (http://goo.gl/NR1EqS)). The following excerpt summarizes this strategic vision.

Revisiting predictions of the past decade (2005 to 2015)

Container nursery irrigation will be forced to become more efficient and water conserving in the coming decade as a result of diminishing water availability. Consensus of Beeson et al., 2004. J. Env. Hort.

The consensus of Beeson et al. in 2004 was that the availability and consumption of both ground and surface waters by container nurseries would decline in the coming decade (2005 to 2015). In general, water availability would diminish due to either competition with urban areas, for example, population increase coupled with urbanization, direct and indirect effects of drought, decrease in water quality, or to regulations limiting withdrawals. In addition, nurseries would adopt technologies and cultural practices to consume the remaining available water more efficiently, therefore, using less water to produce the same quantity and quality of plant material. In general, in the past 10 years, producers have not adopted more efficient and water conserving practices unless an economic incentive or legal imperative (return on investment or potential for regulation and/or fines) motivated the decision. For example, growers in Florida that enroll in the Florida Department of Agriculture and Consumer Services Best Management Practices (BMPs) Program and implement approved BMPs can maintain “a presumption of compliance with state water quality standards for the pollutants addressed by the BMPs” and are also eligible for cost-share for certain BMPs. In many states within the Chesapeake Bay Watershed, compliance to meet consent decree nutrient limits remains voluntary, yet progress to meet the goals must be achieved between 2017 and 2025.

In New Jersey, some nurseries are implementing changes in irrigation methodology and containment practices to minimize runoff and ensure capture of remaining irrigation runoff water in anticipation of the New Jersey Department of

In the coming decade, nurseries and greenhouses will likely be identified as high water consumers.
Photo by Jim Owen

Environmental Protection imposing a deadline for requiring containment of all production runoff. Growers in Tennessee, through a USDA National Institute of Food and Agriculture-sponsored initiative, are receiving subsidized water conserving technology, consultation, and education as an incentive to adopt water-conserving practices. However, these programs are the exception, not the norm, and except where persistent water scarcity exists, nurseries have not widely adopted water-conserving measures.

Even if solutions to conserve water are available, they will not be broadly adopted until water quantity or quality has an immediate negative economic impact or access to water is threatened through litigation, changes in regulations, and/or climate. Only then will research-based water conservation practices be sought on a widespread basis.

Projections of the coming decade (2015 to 2025)

Resource (e.g. water, fertilizer) management, crop production practices and environmental stewardship will persist in their current state for most parts of the U.S.; however, there will be regions within the U.S. where resources become limited, environmental issues arise or worsen, and regulations become more severe. Contamination of potable (i.e., drinkable) water resources will be an increasingly prominent issue. Moreover, greenhouses and nurseries, as a highly visible part of agriculture, will be identified as high water consumers and more strongly as non-point source (i.e., runoff carries diffuse contaminants into surface or ground waters) contributors that may degrade water quality in impaired waterways (waters too polluted to meet water quality standards). This newfound association will necessitate implementation of new BMPs or further scientific justification of established BMPs. For now, adopting BMPs substitutes for oversight or regulation of compliance as defined by states to meet Clean Water Act standards. However, agriculture may lose some of the current, state specific exemptions that preclude it from responsibility for some environmental laws. For example, the Chesapeake Bay, the Everglades, and Lake Erie recently experienced oversight through local, state, or national government agencies. In the next decade, water use will be more closely monitored, if not regulated, in riparian water rights states in the eastern U.S.

To reduce water withdrawals from surface (e.g., pond, reservoir) and

ground water (e.g., well) supplies and to decrease agrochemicals in runoff, irrigation water (and nutrients and pesticides) must be applied more precisely using technology to schedule irrigation. Currently there are several methods to schedule irrigation that range from physically measuring crop water use to integrating current weather, crop, and soil or substrate water status into computer models. Though these techniques are not widely used, they will mature to something more robust, user friendly, and less expensive, perhaps using technologies from other industries and will become commonplace in nurseries and greenhouses of the future. Currently, technologies are being evaluated and refined by on-farm assessments with innovative crop producers connected with university scientists via grants or industry partnerships. In time, early adopters, followed by the early majority of nursery growers watching closely, will begin to implement these newer technologies. Use of technology to refine nursery inputs will become more market driven as adopters realize economic savings due to more refined use of water, nutrients, and pesticides. Moreover, newer generations of employees will adopt technologies that can provide real-time information and that can be used to aid in decision-making or to automate processes such as irrigation scheduling.

Conservation of water is the goal from an environmental and social perspective, while improved plant quality with fewer inputs is a beneficial outcome from a grower's perspective. However, in some states producers are subject to a "use or lose" disincentive for water conservation. Growers who adopt progressive water management practices that reduce total water use, but do not expand production or otherwise use the "saved" water are vulnerable to losing that portion of their water allocation. The nexus of water conservation, allocation, and responsible use must be centered to balance competing needs for nursery production, society, and the environment as well as other water use sectors in the future.

Within regions where resource scarcity is challenged further by increases in population and urbanization, water for human sustenance and economic importance will begin to take precedence. Water scarcity will be realized first in population centers and regions where ground water is not abundant or diminishing and where changing climate alters the periodicity of water availability; this will result in reassessment of the historical methodology of water distribution or allocation. Changes in water appropriations will first occur to ensure adequate quantity and quality for population centers to sustain or increase urbanization and development. Additionally, residential and commercial water use guidelines legislated for times of drought within cities and suburbia may become modified for water

use in non-drought times. Fewer permits for wells will be issued, thus limiting the increase in use of groundwater while increasing reliance on capturing and reusing water. These events might stimulate investment in municipal reclaimed water in municipalities from Florida to California. In fact, legislation in San Diego has cleared the path for reclaimed wastewater to be used as municipal drinking water, provided sanitation thresholds are rigorously ensured. Shifts in awareness and behavior occur during every drought, and inevitably legislation passes that may abruptly move current thinking toward conservation of water. After droughts pass, behavior may slide back to less conservative trends; however, the legislation passed provides some incentive to continue to conserve water, or at least provides a clearer definition of water use in agriculture and urban areas.

Better irrigation scheduling technology will become commonplace in the future.
Photo by Kelli Rodda

The real cost of water will begin to be realized and monetized, defining the product carrying capacity for a given nursery or production land area. The volume of water needed to operate each year can no longer be estimated or unknown by growers, but rather must be well defined and documented so as to be defendable if challenged. Growers cannot afford to operate on the assumption that water rights will persist unaltered throughout the next decade. Eventually, water allocation will be further complicated by preparation for relocation or protection of urban and city centers from inevitable sea-level rise, which will impact real estate, land availability, and access to high quality potable water. This in turn may result in closure or relocation of nurseries to ensure they have affordable land and access to sufficient, quality water.

In the future, the link between water and energy will be more pronounced. For example, currently in California 19 percent of electrical use and 30 percent of natural gas use is due to intrastate water movement as well as treating water. The energetic costs of moving, treating, and heating water in the U.S. account for 290 metric tons (290,000 kg) of CO2 emission per year, or 5 percent of U.S. carbon emissions. The energy savings and associated carbon emission reduction associated with water savings will become increasingly important factors in water use, allocation, and conservation decisions.

The plant palette produced will change to better address water

quality and availability issues within cities and urban areas, as well as address awareness of the environment by current and future generations. This societal awareness will aid horticultural producers in sales of plants that provide design aesthetics along with function. Plants will be used to provide ecosystem services (clean air and water), health benefits (physical and emotional), energy savings (mitigation of heat-island effects), stormwater control, economic development (revitalization of urban centers, home values) and, in part, provide food for homes and communities. There will be increasing need for plants that are low maintenance, drought tolerant, salt tolerant, and provide the aforementioned socioecological functions.

Water availability, quality, and related issues garnered widespread attention in the previous decade and will continue to do so in the future. However, irrigation practices have remained largely unchanged due to existing irrigation system infrastructure, limited pressure from state and federal regulations, and unrealized economic savings or value-added benefits from reducing other inputs along with refined water use. Recent concerns over urbanization and population growth, increased climate variability, and changes in state and federal regulations, including new groundwater withdrawal limitations, create an incentive for growers to investigate efficient and innovative practices for the future. For more detailed perspectives and overarching trends identified please see the full manuscript “The Next Ten Years: Strategic Vision of Water Resources for Nursery Producers” published in HortTechnology (April 2016; http://goo.gl/NR1EqS (http://goo.gl/NR1EqS)).

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