

The Role of Water in Agriculture: Perspectives from the Nursery and Greenhouse Industry

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Introduction

The nursery and greenhouse industry, which encompasses environmental horticulture production, plays a major role in the U.S. In 2012 alone there was a \$5.1 billion value attributed to sales in this sector (U.S. Department of Agriculture, 2014). This sector requires large volumes of water for production, competing for water resources with public and industrial users (Fulcher, LeBude, Owen, White, & Beeson, 2016). In addition to criticism over the amount of water consumed, the nursery and greenhouse growers are also criticized for not doing enough to protect natural water resources. Runoff from nurseries and greenhouses are often scrutinized as a part of nonpoint water pollution (Fulcher et al., 2016; Wilson, Albano, Mozdzen, & Riiska, 2010). Recent pressure has been applied to the nursery industry to seek alternative water sources to alleviate and reduce competition for public water needs and to adopt water treatment technologies in order to keep water clean (Chen, Beeson, Yeager, Stamps & Felter, 2013). Extension professionals have been working diligently with the nursery and greenhouse growers to increase adoption of new technologies, but diffusion has been slow (Lamm et al., 2017). Recent research has found nursery and greenhouse growers are stewards of the land, and are interested in protecting natural resources (especially water), but are still not adopting at a fast pace (Lamm, Warner, Martin, White & Fisher, 2017). By incorporating an understanding of nursery and greenhouse growers' relationships with water, extension programs may be targeted to access their systematic thinking process and increase acceptance/adoption. Therefore, this research was guided by the following research questions: 1) How does water play a role in nursery growers' everyday lives? 2) How do nursery growers feel about protecting water resources? 3) How do nursery growers intend to interact with water in the future?

Theoretical Framework

The theoretical framework for this study was based on general systems theory (von Bertalanffy, 1968). The focus of the general systems theory is on the interrelationships between multiple elements, diverse structures, processes, and dynamics within a system. In the realm of agriculture, sustainability as a concept has been examined using the general systems approach. The belief is that a goal of sustainability cannot be reached by simply focusing on the natural sciences or the social sciences, but the integrated scientific system instead (Slegers & Stroosnijder, 2008). System thinking has been used to study the dynamics between individuals, associated networks, and institutions, as well as knowledge, technologies, policies, and the decision-making process (Klerkx, Van Mierlo, & Leeuwis, 2012).

Methodology

A qualitative study using semi-structured interviews and narrative data from nursery growers to answer the research questions. A sample of 24 nursery growers from across the U.S. were selected using purposive sampling (Ary, Jacobs, & Sorenson, 2010). The participants were growers, owners of operations, and upper management personnel. Using a semi-structured interview guide that was reviewed by a panel of experts, interviews were conducted in California, Georgia, South Carolina, Virginia, Maryland, Oregon, Florida, and Michigan. Dispersed geographical locations were selected based on the major nursery industry locations in the U.S. The interviews were conducted in a one-on-one setting to provide a more comfortable environment that could facilitate the experience and perception of sharing. The researcher requested access to the nurseries directly from the growers prior to the visits and built rapport at the beginning of the interview (Creswell, 2007). The 24 interviews were conducted by a single researcher who was trained in qualitative interview techniques. The interviewer had limited knowledge of the nursery industry and did not have existing relationships with interviewees prior

to the interviews. The results were analyzed using the constant comparative method (Fram, 2013). Themes were allowed to emerge naturally and an audit trail kept to ensure transferability (Mays & Pope, 1995). The final results were discussed with a group of horticulture and extension faculty to ensure confirmability.

Results

During the study, four major themes were identified regarding the role water played in the participants' everyday lives in the nursery or greenhouse. Those themes included providing plants' basic water needs, facilitating chemical uses, maintaining control over product quality, and facilitating business operation. Participants indicated the importance of taking weather and climate into consideration when making decisions about under and overwatering. One participant commented, "...underwatering leads to overwatering which ultimately affects plant health contributing to lost sales." Participants also discussed the use of various chemical applications, such as fertilizers, pesticides, and fungicides. A participant said, "the application of pesticides [is needed] to try to control or eliminate [disease]." Another stated "[Chlorine] is probably the most costly chemical application we make" providing an example of how they linked water use and treatments to their overall business operation including possible financial loss, savings, or profit.

Three major themes were identified in regards to protecting water resources: doing the right thing, economic benefits, and regulatory enforcement. Most participants indicated they had an intrinsic motivation to save water, indicating it was the right thing to do. One participant said, "[We've] got to work toward sustainability. We can't just be here sucking up the Earth's resources, and be a zero-sum gain. It's got to be for the environment. We can't just be the taker." When it came to economic benefits, one participant mentioned, "[It's] a huge financial benefit if we reuse and recycle 150 million gallons of water...It also provides us with insurance against a disruption in the water supply."

Additionally, four major themes emerged from participants' future intention to interact with water: combatting water issues, future movement in governmental regulation, seeking additional technology and information about water conservation, and financial challenges. According to one participant, "Water is more precious than gold...between the availability of water and the standardization of what is clean water. Regulation is going to get more and more stringent. It's happening every year in every state."

Conclusions, Implication and Recommendations

The findings of this study provided an in-depth view of growers' opinions and perceptions regarding their water use and revealed how their concerns were directly associated with the future of their business. This finding was congruent with previous research (Hall et al., 2005; Taylor, White, Chandler, Klaine & Whitwell, 2006) in that water used in the nursery industry supports plant needs and health while management practices are directly related to environmental conditions, plant characteristics and conditions. The responses revealed diverse water issues and regulations impacted growers' operations as well. These findings imply extension professionals should incorporate local water issues and state regulations associated with nursery production water uses in their programming. Monetary investment and regulatory enforcement may be the major factors influencing nursery growers' level of involvement in water conservation practices. By conducting additional research to learn more about nursery growers' thoughts about water conservation technologies and practices, more user-friendly water conservation technologies and practices can be developed and adoption rates can be expected to improve. Following up with a national survey to gain a generalizable perspective is recommended.

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