MANAGING CONTROLLED ENVIRONMENTS EFFICIENTLY

In controlled environmental agriculture, plants are grown inside a greenhouse or other type of enclosure where growers can maintain optimal growing conditions, such as light, temperature, humidity, water, and nutrients. In the northeastern climate, controlled environments play a vital role in year-round production, but growers need more information about how to fine-tune their environments to achieve optimal plant growth and quality with the fewest possible resources. As new technologies emerge, growers need to know whether these tools are technically and financially feasible and how to use them correctly. Optimizing controlled environment production conserves water and energy, lowers production costs, and makes it possible to grow plants year-round in areas with harsh climates and extreme weather.

Twenty-four researchers from land-grant universities across the U.S. are working together to develop practices and tools that help growers manage controlled environment resources efficiently. Growers who have adopted recommended facility designs, management practices, and tools have seen energy savings of 5% to 30% and average-sized businesses have saved $20,000 per year in operating and maintenance costs. Many of the technologies developed by members of this project are now industry standards and are widely used.

Researchers developed guidelines that have reduced fertilizer leaching fivefold.

Information on the exact water requirements of plants and nuanced irrigation recommendations have helped growers avoid overwatering plants, prevent disease and runoff, improve plant quality, conserve freshwater, and cut costs.

Research on using low-quality or reclaimed water sources and growing plants with lower water requirements has helped growers use less freshwater. In particular, researchers identified drought-tolerant herbs and demonstrated that water with high sodium can be used to grow zinnias, pansies, and poinsettias.

Researchers have identified more efficient lighting, energy-saving greenhouse designs, and tools to monitor energy use. For example, greenhouses using polyethylene film covers developed by project members have lower energy requirements compared to those with glass or polycarbonate covers. These covers have become the industry standard. Other studies found that cold-tolerant bedding plants can be grown in energy-efficient unheated high tunnels in the spring instead of heated greenhouses. Researchers also showed that a coordinated-daily predictive approach to supplemental lighting reduces energy costs more than 30%.

Several lighting manufacturers have expressed interest in using a new product label created by the team. The label will help growers make informed decisions about supplemental lamps and could reduce the industry's annual supplemental lighting costs by 5%.

Project members are involved with prototypes of the lunar greenhouse and are contributing to designs for research facilities in Antarctica.

Project members from the University of Arizona helped support development of a Bayer production greenhouse complex in Arizona, which greatly reduces water needs and shortens the plant breeding process several years compared to field procedures, allowing faster, more efficient development of seed corn varieties used globally.

With additional funding from a USDA-NIFA Higher Education Challenge Grant, University of Arizona, Ohio State University, and Rutgers University created educational YouTube videos that have over 20,000 views and are used in curricula at many institutions.

Professional short courses reached 750 people. Research findings have been published in books, journals, magazines, and nearly 300 Extension bulletins with readerships totalling almost 30,000.

Multistate Research Fund **IMPACTS**

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