CONTROLLED ENVIRONMENT TECHNOLOGY

Greenhouses, growth chambers, and other controlled environments are used to produce high quality food, fiber, ornamental, and biomaterial crops. Being able to precisely control temperature, humidity, light, and other conditions is particularly useful for research purposes, growing specialty crops, and growing plants in harsh climates.

These facilities can be expensive to operate and require careful management to ensure desired conditions. For over 40 years, a committee of land-grant university researchers, Extension specialists, and international partners has worked to advance controlled environment design, technology, and management.

LOWERING ENERGY USE & COSTS

This committee maintains instruments others can rent and use to calibrate their own instruments. Calibrating instruments ensures controlled environment parameters are set precisely.

New handbooks for measuring and setting environmental parameters help operators run facilities efficiently. Growers using research-based recommendations have reduced energy use 5% to 30%. New management guidelines save an average-sized greenhouse business about $20,000 in operating costs each year.

New wireless sensor networks automatically apply irrigation as needed, helping growers provide high-quality plants and reduce water waste. If 50% of ornamental plant growers used these sensors, they could save 223 billion liters of water per year (enough for 400,000 U.S. households).

A new tool has potential to define exactly when light, carbon dioxide, and temperature changes are needed, helping growers save money on these inputs.

When sunlight increases, new adaptive lighting systems automatically dim, minimizing energy use. These systems are easy to adopt and have a quick return on investment.

Newly developed plant varieties require less energy and labor to grow in controlled environments.

IMPROVING CROP QUALITY & VALUE

With a new tool, growers can adjust light and temperature so that plants flower on specific dates. Being able to control flowering makes profits more predictable and reliable.

Including far-red radiation in lighting can increase leaf size and accelerate flowering, which can increase crop value and the price growers receive.

GROWING PLANTS IN SPACE

Researchers are designing growth systems and hardware that hold up during space travel. Researchers are also recommending growth system settings that produce smaller plants that meet the strict size and weight limits on spaceflights. The International Space Station crew recently ate lettuce grown using this technology. On long spaceflights, plants provide fresh food, improve air quality, and offer psychological benefits.

ENSURING FOOD SECURITY

Iowa State University researchers are developing the Enviratron growth chamber facility, which will utilize a specially designed robot to gather unprecedented amounts of reliable data on plant growth under different environmental conditions. That means this facility will be particularly useful for studying the impacts of climate change on plants. This research will help overcome future threats to crop productivity and food security.

SUPPORTING NEW BUSINESSES

Controlled environment research projects are supporting new industries and bringing new businesses into the U.S. market, including grafting nurseries and robotics companies. New businesses support new job opportunities and offer easier, faster access to new products.

ENHANCING STEM EDUCATION

Research on controlled environments for growing plants in space is sparking interest in science, technology, engineering and math among high school and college students. In collaboration with NASA and Fairchild Tropical Botanic Gardens, middle and high school students at over 100 schools in south Florida are conducting experiments to help NASA determine which edible plants can be grown on the International Space Station. Engaging in experiments with real-world applications provides valuable training for the next generation of scientists.

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