



Controlled Environment Agriculture: Creating the Ideal Environment

Diving into CEA methods of growing can be intimidating, but the results — such as crop quality and lower operating expenses — are worth the initial investment.

BY CHRISTOPHER MACHNICH

Controlled environment agriculture (CEA) is the biggest advance 21st century growers have. As opposed to their predecessors, today's growers can create the perfect environment in just about any region. The strawberries they've always wanted to grow in the dead of winter can now be had, and the dreams of flooding the winter market with fresh produce is a feasible task that's worthy of any grower's time.

While CEA can be a great and obvious business decision, a lot of growers and farmers are hesitant to integrate the necessary equipment and techniques into their operations. The startup cost is certainly a factor, but many traditional growers may be intimidated by the required equipment and the new technology. This is a fair concern, but while CEA seems like more work or too complicated, it's quite the opposite.

CEA expert Jon Kozlowski, who designs greenhouses and systems for GrowSpan Greenhouse Structures, says, "CEA allows a grower to accomplish two critical goals: maximizing crop production and quality, as well as optimizing inputs, like energy, labor, water and other operating expenses."

It's clear that CEA is a helpful technique, but those that are still hesitant simply have to identify the environmental factors they want to manipulate, and then set up the tools that will allow them to do this. To create the ideal environment most growers will have to manipulate air temperature, air quality and lighting, and to the surprise of many, this can be done with a number of tools and techniques they are already familiar with.

We'll take a look at these factors shortly, but first it's important to note that implementing

CEA is going to require a growing structure or room. Growers with access to one of these already are in a good starting place, but growers that need a structure or room should strongly consider a greenhouse.

A greenhouse will allow growers to lower operating costs by providing crops with natural light and ventilation, and when designed correctly, greenhouses also allow for the optimal use of the CEA equipment and ensure the structural strength for hanging heaters, fans and other CEA tools.

But let's get back to creating an ideal environment.

TEMPERATURE

Seasonal growers are in a constant battle with their climate, and this is largely due to air temperature. The cold will lead to poor growth, drooping and discoloration, while the heat can

NEXT GENERATION NEEM®

Naturally Protect Your Plants
from Insects with AzaSol™,
Water Soluble Powder from Neem



Effective
6% Azadirachtin

Non-oil based
No residue or burning

Versatile
Spray or drench

Organic
Use on edibles & herbs



When integrated properly, controlled environment agriculture is a relatively easy process that utilizes equipment and tools that growers are already familiar with.

weaken stems, delay flowers and lead to less robust crops. With CEA, maintaining the perfect temperature is easy. For adding heat, growers usually opt for suspended unit heaters or in-ground radiant heat, both of which many will already have some experience with.

For addressing the heat, most growers aren't going to want to use air conditioning to cool their greenhouse. It's way too expensive, and it's going to negate many of the savings that growers seek with CEA. Passive ventilation is a great first option. Utilizing existing ridge vents, roll-up sides and other features on a structure is an inexpensive way to cool a structure, but for many it won't be sufficient in the dead of summer.

When passive ventilation isn't a functional option, evaporative cooling systems are a great solution. These systems feature pads that are located on one end of a structure. The pads are wet, and fans located through the structure pull moisture from the pads, creating a cool atmosphere that is ideal for a wide range of crops. Evaporative cooling is one of the most cost-effective ways to create a cool environment. They can cost up to 50 percent less to operate when compared to traditional air conditioning systems, and are multi-functional — which will soon be addressed.

AIR QUALITY

In terms of air quality, growers will have to consider ventilation, relative humidity and carbon dioxide. Luckily proper ventilation can be achieved with passive techniques, but when this is not enough, air exchange systems can be a helpful tool. Relative humidity is a pretty easy issue for growers using CEA to address, because equipment used for other environmental factors can address humidity issues.

When humidity is too low, transpiration can be reduced and a plant's stigma may dry, decreasing pollination. A great way to increase relative humidity is with an evaporative cooling system. The moisture from the system will add water to the air, creating the perfect humidity level. An added bonus of evaporative cooling systems is that they can also reduce watering requirements.

When humidity is too high, transpiration is going to increase and pollen will begin to clump around the stigma. To address this, growers can try ventilation to see if the fresh, cool outdoor air helps, and if this doesn't help, it's as simple as turning on the heaters used during the winter months. Distributing warm air will help to bring relative humidity down to beneficial levels, allowing plants to thrive.

First time greenhouse and indoor growers often forget about carbon dioxide. When a structure is filled with hundreds or thousands of lush plants, a lot of CO₂ is going to be required. Again, simple ventilation can introduce fresh and nourishing CO₂, but this going to be problematic in the winter months. The cold air can shock the crops, and it would also cause heating costs to sky rocket. Instead a carbon dioxide generator can be used in the winter months. The systems are easy to use and quickly provide the necessary amounts of CO₂.

With the equipment manipulating temperatures and quality, there will no doubt be pockets of heat or low humidity or high CO₂. Addressing this means just adding some HAF fans to keep the air circulating and uniform in how it fills the structure.

able to get more done or to explore other business opportunities.

When integrated properly, controlled environment agriculture is a relatively easy process. It uses a lot of equipment and tools that growers are already familiar with,

and starting with the ability to manipulate temperature, air quality and lighting can allow growers to set up a year-round growing environment. After this base is set growers can explore more advanced CEA techniques, like hydroponics

or fertigation, but a discussion on those is for another time. gpn

Christopher Machnich is a content writer for GrowSpan (www.growspan.com), which specializes in greenhouses and growing solutions.

LIGHTING

Lighting is going to be the last environmental factor growers are going to have to look into. Even in a greenhouse there are benefits to introducing artificial lighting. Growers in the past have mostly used HID lighting, but today LED lighting is becoming more popular. Paying upfront for LED lighting can really pay off in the long run, as LEDs can provide energy savings on a monthly basis.

GREENHOUSE CONTROLS

With the need to control temperature, air quality and lighting, many growers might think that CEA would increase their labor. However, this isn't true, as Kozlowski points out, "I think growers sometimes forget that it's not just the structure or the piece of equipment, it's all of the components working in concert to provide the optimal environment for the crops. It's the greenhouse, grow systems and equipment designed to work as one, and this is easily accomplished with greenhouse controls."

Greenhouse controls allow growers to keep track of all their different inputs and equipment from one convenient system that can be accessed through computers, smart phones or tablets. All the equipment can be scheduled to turn on and off, and when meters are introduced, they can be triggered to turn on when the environment isn't ideal. This means that if a grower isn't present, they don't have to worry if their environment is too cold or humid, because their controller is monitoring these levels and making the necessary adjustments. When controllers are introduced is when CEA really becomes beneficial. Not only are growers able to maintain an ideal environment automatically, but they are also



Bold summer color

HAVANA LANTANA

- Heat-loving and long-blooming
- Uniform, tidy habit
- Medium-compact vigor
- Well-branched with dark green foliage
- Landscape, baskets and containers



Discover the difference at DummenOrange.com

Dümmen Orange | 250 South High Street, Suite 650, Columbus, OH 43215 | 614-850-9551 | Info.NA@DummenOrange.com