It's All About Atmosphere

Technology has made dialing in your grow easier than ever. *By Nico Escondido*

When it comes to indoor cultivation, it's all about atmospheric control—after all, that's one of the primary advantages of growing indoors. But what exactly does this entail? What are the best practices for refining your garden to get the best quality and the highest yields?

Let's take a look at some of the major aspects of atmospheric control, as well as some of the latest resources and developments that today's technology has to offer in making your garden a happy home for our favorite plant.

Plants are pretty, but high above the canopy there is a lot going on. Garden: MMJ America, Denver.

NICO ESCONDIDO

The Basics

When we discuss atmospheric control, it all comes down to three major components: light, temperature and humidity. There are tangents to each of these categories that we will touch on as well, but this basic breakdown covers the general elements that most affect conditions in an indoor grow.

Light

We all know that light is essential for plant life. Light supplies the energy used in photosynthesis, the process that creates food for the plant. However, the same light so vital to a plant's health and development also produces a significant amount of heat. This heat needs to be dealt with, and there are several ways of doing that.

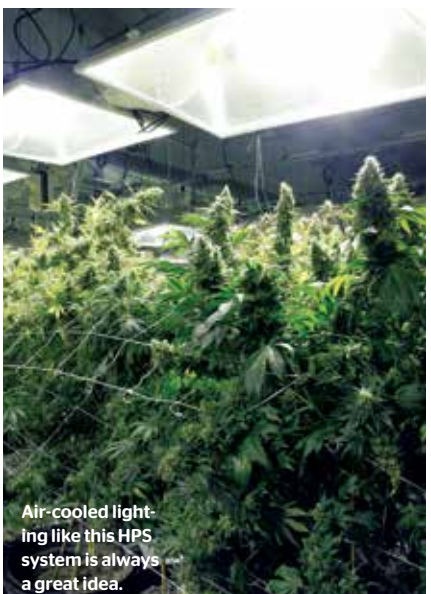
Of course, adding air-conditioning to the growroom is one solution, but this can get costly, especially for larger-scale grows. Perhaps the most popular method for dealing with light-generated heat is to use a combination of lamp cooling and room exhaust (such ventilation will be covered more in a bit). Lamp cooling involves the use of fans either to blow cool air over the bulbs, or to suck hot air off of them and expel it from the garden. Some advanced growers might even consider using water-filled jackets to cool the bulbs, but this technology has proved expensive and less effective.

Another solution is to manage the lighting using timers and controllers that allow individual or groups of lights to alternate their running times when temperatures begin to climb above a set point. Today, there are plenty of controllers that offer options for lighting control, and some of them even allow remote control of the entire growroom (which we'll get to shortly).

Temperature

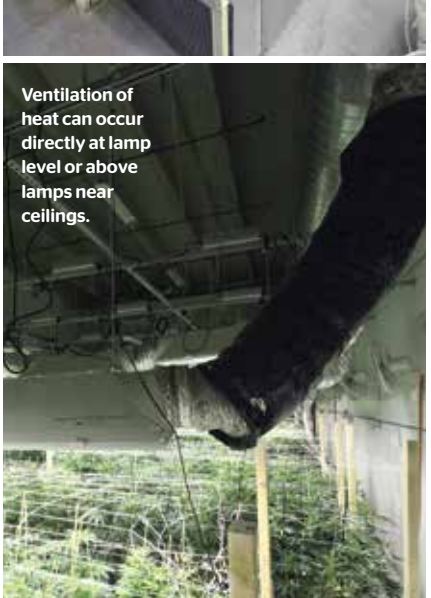
The growroom's temperature is the direct result of both lighting and the outdoor climate: The hotter it is outside, the hotter it gets in your growroom as well. As temperatures begin to rise, photosynthesis, CO_2 uptake and plant growth all begin to slow. In climates with higher temps, growers usually have little choice but to install some sort of AC unit to aid in cooling their gardens.

Optimal temperatures vary, depending on the focus. For cannabis plants (with the exception of cuttings), the ideal growroom temperature is around 72°F, with a minimum of about 66°F and a maximum of 78°F. In terms of the plant's root zone, this needs to be kept fairly cool—usually under 70°F. Grow-medium temperatures can be easily taken with a soil probe or stake thermometer. Equally important in hydroponic systems is the temperature of the nutrient solution being used: Advanced growers will often employ water chillers to keep the temperature below 65°F in order to help cut down on water-borne pathogens.



Air-cooled lighting like this HPS system is always a great idea.

Industrial-sized AC units help control temps in large format grows.



Ventilation of heat can occur directly at lamp level or above lamps near ceilings.

Humidity

Humidity is a crucial and sometimes-overlooked factor in many indoor grows. If the humidity is too low, CO_2 and light absorption are minimized—but if it's too high, pathogens, bacteria, mold and pests begin to flourish. Both air temperature and ambient moisture contribute to a garden's humidity; as the temperature drops, the humidity level begins to rise.

It's a delicate balancing act, but big swings in a growroom's temperature can severely affect the humidity. If temps drop during the dark cycle by more than 12°F to 14°F, humidity may climb beyond optimal levels, at which point flowers can develop botrytis and mildew may form on the leaves and walls. If condensation sets in, there are big problems brewing. Optimal humidity levels for indoor grows range from 40% to 60%, but the higher levels make plants more susceptible to pests and disease. Advanced growers usually settle on a humidity level from 45% to 50%.

Advanced Atmospheric Control

Ventilation & Circulation

Controlling ventilation and circulation is one of the best (and easiest) ways to address or avoid many of the problems associated with temperature and humidity. Good ventilation—meaning the intake of fresh, filtered air and the exhaust of warm, spent air—is an essential component of atmospheric control. Good air circulation is another important factor, as it prevents heat pockets from building up and helps move air over plants for respiration.

The best place to bring fresh air into the growroom is near the floor, where air temperatures are cooler; the best place to exhaust air is near the ceiling and above the light banks, where air temps are the hottest. It is also wise to filter any incoming air to remove dust and pathogens, and to filter the exhaust to remove any odors.

The best way to coordinate the ventilation in your growroom is through automated-control systems. These act as on/off switches for everything from the intake and exhaust fans to the CO_2-enrichment system and light banks. The controllers measure atmospheric factors such as temperature, humidity and CO_2 levels. When the temp gets too high (i.e., past a specific point set by the grower), the controllers can turn on fans to exhaust the hot air, or turn off certain lights to cool the garden's atmosphere.

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Supplemental CO_2

Carbon dioxide is an essential part of photosynthesis. Many commercial growers add CO_2 to help boost yields, but in smaller gardens it's not always necessary. The primary consideration when using a CO_2-enrichment system is how it interacts with other atmospheric-control systems. For example, careful coordination is needed to ensure that the CO_2 system isn't running at the same time as the exhaust fans—otherwise, the CO_2 will be wasted. Also important is ensuring that the CO_2 system only runs during the light cycle, when photosynthesis is occurring.

Wireless controllers like this SmartBee LTH sensor can be placed directly in the garden where monitoring is most crucial.

Technology & Atmospheric Control

In the past few decades, indoor horticultural has relied on various devices to manage the environmental conditions in our gardens. These devices range from the very basic, such as simple timers, to more complex units that merge several system controls into one platform. The most advanced of these controllers are all-in-one units that can automate and manage entire grows from a single panel.

Today, the manufacturers of these devices are making use of the latest technologies to take the most advanced controllers one step further. Utilizing the power of the Internet and Wi-Fi networks that are virtually omnipresent today, these devices have morphed into fully automated remote-control systems that are accessible anywhere there is a wireless signal.

SmartBee Controllers

One such company on the forefront of fully automated, remote-control garden-management solutions is SmartBee Controllers. Using an array of different sensor types that wirelessly interface with a central control hub, SmartBee's equipment can manage all atmospheric conditions, sending real-time data to a smartphone, tablet or desktop computer for remote access and control over the growroom—even from hundreds of miles away.

How It Works

The SmartBee system uses a series of sensors that continually take measurements of the growroom's atmosphere, including temperature, humidity and CO_2 levels. Other controllers connect to the light system and allow growers to turn these on and off for greater control and flexibility. Additional modules can also connect to the HVAC, irrigation and security systems.

All of the information collected by the sensors is sent to the SmartBee Hive Gateway, which acts as the primary "brain" of the network. It is this nucleus that serves as the main portal for all communication between the wireless sensors, the Internet and your web-enabled devices. Incoming data from the sensors across all of the systems within the growroom is logged, processed, and can be sent to both a local storage device via hardwire and to your preferred web device via the Internet (either Ethernet or Wi-Fi). Various types of data, such as daily temperature swings, humidity ranges and CO_2 levels, are formatted into easy-to-read charts and delivered right to the palm of your hand, anywhere in the world.

Additional functionality allows growers to power on or off any growroom systems connected to the SmartBee hardware, including lights, irrigation, intake and exhaust fans, CO_2 enrichment, dehumidifiers and HVAC.

Higher Tech

The SmartBee system enables growers to have full access and control over all of the environmental conditions in their garden, even from thousands of miles away. Here's a quick look at the various types of sensors, controllers and other gear employed by the system, plus their various functions.

LTH Sensors: Also known as light, temperature, and humidity sensors (hence the "LTH"), these small devices are placed around the growroom to continuously monitor these conditions wirelessly. Another smart feature is a pair of solar panels on top of the unit that harvest excess energy from the lights, helping to keep the battery charged at all times. You can deploy multiple LTH sensors to monitor specific areas of your garden, utilizing the readings from individual sensors via your handheld device.

CO_2 Sensors: For use in growrooms employing supplemental CO_2, these sensors take samples of the garden air and send the data to the Hive Gateway. The Hive then activates or deactivates your CO_2-enrichment system and exhaust equipment as necessary to maintain the ppm levels based on your set point.

Soil probes take environmental control to the next level.

Medium & Irrigation Control: Among the most useful components of the SmartBee system are the soil probes and irrigation controls. These combine the benefits of timed and measured feedings with actual measurements of the volumetric water content of your medium.

As the water-content sensors measure the moisture level within the medium, alerts can be sent to the grower if the levels fall below a set limit. These probes can also be used more simply as an automated timer that turns a watering system on and off at set times and durations, depending on the moisture content within the medium. Once the set points are established, the Hive Gateway gathers and interprets sensor data and waters accordingly, thus maximizing the efficiency of your current irrigation system.

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Power & Security Control: Power-control modules and security interfaces are also available with the SmartBee system. These modules are used in conjunction with the Hive Gateway to create a more comprehensive smart network using all of your existing grow equipment.

The power controls come in the form of a four-outlet smart power strip, allowing for up to four electronic devices to be powered on or off independently from anywhere. There is also a smaller, single-outlet smart plug for individual gear pieces or more remote locations in the growroom. These intelligent outlets allow you to remotely set schedules and thresholds, affording wireless control of humidifiers, fans, heaters and so on. Power-failure detection, active electric-current monitoring and fail-safe features make these outlets even more attractive.

SmartBee will also soon be offering motion detectors, door and window sensors, and video monitoring with text-message alerts and remote wireless feeds from your growroom to your mobile device. Using infrared technology, the motion detectors and entryway sensors ensure that intruders cannot gain access to your growroom unnoticed. These sensors can also be configured to turn on lights or alarms.

Access: Having a networked garden that offers wireless remote control of all atmospheric and environmental conditions may seem futuristic, but the reality is that the future is already here. Bluetooth, satellite and Wi-Fi signals are commonplace in today's world, and this technology has fully infiltrated our growrooms as well. It is time to use it to our full advantage.

Data collection and presentation make a garden's needs easy to understand, removing any guesswork or uncertainty about the growroom's conditions.

Of course, smart growers understand that technology is no substitute for actually being in the garden, seeing the plants with their own eyes. But systems like the SmartBee help to ensure that they can manage their garden if circumstances require their presence elsewhere, and that everything works on schedule—or corrects itself when the schedule needs adjusting. Also, the data collection and presentation make a garden's needs easy to understand, removing any guesswork or uncertainty about the growroom's conditions.

As the Hive Gateway manages the incoming sensor data from your garden, it delivers continuous and secure updates, accessed via an authorized account that monitors and controls the modules inside your growroom (or rooms). This data is delivered right to your hands via any mobile or desktop device that can connect to the Internet.

The interface first offers a dashboard giving the average atmospheric conditions for each room. From there, users can toggle through various screen types and formats that offer the data in simple-to-read charts, graphs, or lists for each sensor and control system in use. Lighting, heating, cooling, humidity, dehumidifying, irrigation, CO_2, brightness, moisture and soil conditions are all measured and reported back to the grower. This data can be viewed separately or all together, and it can also be separated into levels for the past hour, past day or past week. On/off controls for each system are at the grower's fingertips, as is the ability to adjust settings.

All told, there's not much that an intelligent remote-control system like this cannot help a grower to do. And, just like that, cannabis cultivation has emerged in a new way in the 21st century.