CARBON DIOXIDE **ENRICHMENT (CO2)**

Benefits of CO2

The process of photosynthesis relies on a trinity of elements—water, light, and carbon dioxide. Plant metabolism is regulated primarily by the availability of these three essential requirements. If any of these elements are at levels below what the plant needs, the plant will only be able to perform at that level and no greater.

Enriching a grow room with CO2 allows your plant to use excess water and energy stored in their leaves, resulting in dramatically increased growth. Think about this: the average outdoor CO2 level is 300 to 600 parts per million (ppm). But plants can use much more than that. Here's the wonder of growing indoors—a grow room can be enriched to a level of 1000-2000 ppm. That's 3 to 6 times the amount of CO2 encountered outdoors. The result? Plants grow faster, fuller, and have more zest for life. When using elevated levels of CO2, plant growth rates can increase by as much as 100 to 200%. Even to an already "dialed in" room a 30% increase is to be expected!

It is difficult to maintain optimum CO2 levels in a grow area employing an air intake and/or exhaust. For this reason, the room must be a 'closed' system. Oxygen tends to push additional CO2 out of a room, and since oxygen is created by plants, it is only necessary to vent in order to lower temperature and humidity levels within the space. On the back of this page, we include more information about airflow and venting with CO2.

Using Bottled CO2

The most common way of enriching a grow area with CO2 is by using an injection system. This system runs off of CO2 gas (from a tank, much like a soda dispenser) and is a good choice for a small room. The drawbacks to this kind of enrichment system are the need to consistently change CO2 tanks and the fact that it can often take a long time to enrich a room. The largest room this should be used with is 10' x 15' (and that's pushing it).

A CO2 injection valve consists of a pressure gauge (monitors how much gas is in the tank), a flow meter (monitors the amount of gas being released), and a solenoid valve (turns the flow of gas on and off). Some method of controlling the valve is employed, a timer or a CO2 controller, and an oscillating fan to disperse the CO2. CO2, being heavier than air, fills the garden from the floor up like water in a swimming pool.

CO2 Generators

Most CO2 generators create CO2 as a byproduct of burning propane or natural gas. They are built to run off of liquid propane tanks or a natural gas line. The natural gas option is preferable to most growers as it eliminates the need to constantly refill tanks. Most buildings have a natural gas line, although you may need to have it extended to reach your grow area. We do not suggest you do this on your own. Get help from a professional!

We sell CO2 generators in which a pilot (controlled by an electronic ignition) is used to ignite the gas when the generator is turned on. A thermocouple is used to monitor the pilot flame. If the pilot flame is lost, a safety valve will close so that unburned fuel will not be released into the enclosure. Generators come in different sizes and you want one which is optimum for your room size—one capable of enriching your room in 5–10 minutes.

CO2 generators do create heat, and depending on the size of the generator you choose, you may be adding a considerable amount of heat to your grow room. This combined with grow lights can create a very warm room indeed. The good news is that heat is a necessary catalyst for plants to use the added CO2 and that they prefer warmer temps than they do without CO2 enrichment. Most plants prefer temps of 86° F with CO2 enrichment. If your room doesn't heat up this warm you may need to bring in a heater (this can be the case for greenhouses). More often the room will get too hot and the use of an air conditioner will be employed.

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CO2 Optimization

When enriching a room with CO2, the idea is to produce just enough to be effective, but not so much that precious CO2 is wasted. The simplest way to handle this is to use a timer. If you go this route, we suggest using a timer that is capable of running very precise, timed intervals such as an irrigation timer.

When considering enriching a grow tent or small room with CO2, using a small generator in the form of a bag or canister is a safe and natural method, and is best used in small to medium-sized grow rooms or tents. The **ExHale CO2 Bag** provides up to 6 months of guaranteed CO2 production and comes with a freshness seal which also serves as a hanger for your bag. The way it works is through a mycelial mass inside the vented bag, which inhales oxygen and exhales CO2 through the microporous breather patch. On average, these bags will raise your ambient CO2 levels by 500ppmsand can be used in rooms up to 4' x 4' or 128 cubic feet. The **TNB Naturals CO2 Enhancer Canister** only requires a liter of warm water to activate the carbon dioxide. Each canister will provide up to 2-3 weeks of CO2 dispersion in your grow room, and can effectively double your growth rates and yields. This product is made from all-natural, 100% organic ingredients which when activated create a blast of CO2 that can reach 1200 ppm in a 12x12x12 area.

Professional growers will want to take advantage of automated CO2 control equipment that controls venting actions as well as CO2, and quickly pays for itself by providing a method of accurately controlling CO2-producing equipment. (For more information, read below under CO2, temperature, and humidity.)

CO2, Temperature, and Humidity

CO2-enriched rooms can get extremely wet. This increase in relative humidity is caused by the plants' metabolic processes occurring at a more extreme rate and water is flowing up through the roots and out of the leaves quickly. Most plants do not thrive in an overly humid environment, and when the level of humidity gets too high it needs to be removed with a vent fan or a dehumidifier. The most common problem for growers is finding the balance between exhausting moist air, enriching a room, and keeping the temperature at the right level. If this is done incorrectly, CO2 will be exhausted with the air and plants will not get the benefit of CO2 enrichment. There are many solutions to this conundrum and here are two of them:

If you are using a CO2 emitter system, and are on a budget we suggest using two timers. It is very affordable and easy to use. Timers will turn CO2 enrichment on and off at predetermined intervals, based on the basic information you provide to our CO2 calculator (Room dimensions, desired ppm, size of emitter in CFH) It does all the calculations for you and creates a CO2 on/off schedule. Once you couple this with a 5-10 minute per hour vent-fan exhaust schedule you will be up and running. Remember to not turn your CO2 on at night time because plants cannot utilize any CO2.

For larger situations when a CO2 generator is employed, heat and humidity are even more of an issue. In this growing situation, we highly recommend the grower invest in a CO2 monitor and controller system. These systems monitor and control CO2 levels accurately within the grow environment and allow for a vent fan to be hooked up for high-temperature override control. (If temps get too high then the CO2 is turned off and the room is exhausted.) Environmental controllers—working in conjunction with a monitor and control unit—keeps the environment (temp/humidity) within the accepted levels. The CO2 monitor samples the atmosphere and transmits the values to the controller which then operates its CO2 outlet (and correspondingly the CO2 generator) according to set points. If the sampled level of CO2 is lower than the set point, the CO2 generator will turn on. The generator will stay on until the controller is informed by the monitor that the CO2 level has reached the appropriate point. The controller interrupts the CO2 loop if either the temperature or humidity rises above their designated points on the monitor. For example, if the humidity is set at 60% RH and the humidity in the room rises to 63% RH, the controller will turn the CO2 off and turn the vent fan on. The vent fan will stay on until the room reaches the desired humidity level. At that point, the vent fan turns off and the CO2 turns back on. If the temperature or humidity goes up during dark periods, the vent fans will still function, although CO2 will not.

In rooms with more than two lights, it is difficult to use CO2 without an air conditioner. HID lights are mighty heat generators, so having more than two will invariably cause problems. A CO2 generator (not a tank) will also add excess heat. We recommend using an air conditioner in these situations. Yes, it is possible to avoid using an air conditioner, but it's tricky. You must use a carefully designed system using a CO2 controller and air-cooled lights to avoid wasting precious CO2. We think it's easier to whip out your trusty window mount or "split unit" air conditioner. (Please note: Portable "in-room" AC units do NOT work for CO2—they blow all CO2 out of the back end exhaust port.)