CO_2-The Air Additive

Natural Carbon Dioxide Enrichment for Indoor Gardening

By Glen Babcock

Carbon Dioxide (CO_2) enrichment for indoor gardening is nothing new; however, recently growers have been looking for new lower cost alternatives to expensive propane burners and CO_2 bottle systems. With fuel costs continuing to rise with no end in sight propane use for CO_2 will be on the wane. Many growers in this day and age have smaller indoor grow spaces and are looking to save money by not having to spend thousands of dollars to be able to supply their grow space with CO_2. With this in mind, here are some alternatives.

Let us first look at some basics; Photosynthesis is the process by which plant leaves make carbohydrates. Sunlight, CO_2 and water are converted into carbohydrates and oxygen (O_2) by the action of chlorophyll in the chloroplasts of the plant.

Plants growing indoors under artificial light often lack enough CO_2 to efficiently photosynthesize. Plants can quickly use up the available CO_2 and convert it to O_2. When O_2 levels rise too high, stomata on the leaf surface close and plant growth virtually stops. Growing areas that have limited or no air-circulation can be affected even more. Lack of air movement causes CO_2 that would be used by plants to be unavailable due to its distance from the leaf, usually down low in the growing area. Moving air around helps solve this problem. When plants are able to maximize the process of photosynthesis, the result is larger plants with larger yields.

Adequate levels of light, water and nutrients are needed for good plant growth. Therefore, it might seem logical to assume that the growth-promoting effects of indoor CO_2 enrichment would be reduced when these essential resources are present in less-than-adequate amounts. In many instances, in fact, the percentage of growth enhancement provided by indoor CO_2 enrichment is even greater when these important natural resources are present in sub-optimal quantities; and when they are in such short supply that plants cannot survive under ambient CO_2 concentrations, elevated levels of CO_2 often enable such vegetation to grow and successfully reproduce where they would otherwise die. One of the reasons that plants are able to respond to indoor CO_2 enrichment in the face of significant shortages of light, water and nutrients is that CO_2 enriched plants generally have more extensive and active root systems, which allows them to more thoroughly explore larger volumes of soil in search of the things they need.

Ambient CO_2 levels typically hover around 400 parts per million (ppm). Ambient carbon dioxide levels tell the percentage of CO_2 in the air without any enrichment. Indoor plants can quickly convert this CO_2 through photosynthesis and deplete available CO_2. When CO_2 levels fall to around 150ppm, the rate of plant growth quickly declines. Enriching the air in the indoor growing area to around 1200-1500ppm can have a dramatic effect on plant growth. Growth rates typically increase by up to 30 percent. Stems and branches grow faster, and the cells of those areas are more densely packed. Stems can carry more weight without bending or braking. CO_2 enriched plants have more flowering sites due to the increased branching effect.

Carbon dioxide enrichment also affects the way a plant can tolerate high temperatures. At the highest air temperatures encountered by plants, CO_2 enrichment has been demonstrated to be even more valuable; it can often mean the difference between living and dying, as it typically enables plants to maintain positive carbon exchange rates in situations where plants growing under ambient CO_2 levels exhibit negative rates that ultimately lead to their demise. Water rises from the plant roots and is released by the stomata during transpiration. CO_2 enrichment affects transpiration by causing the stomata to partially close. This slows down the loss of water vapor into the air. Foliage on CO_2 enriched plants is much thicker and slower to wilt than plants grown without CO_2.

There are many alternatives to traditional CO_2 production. The utilization of compost for CO_2 has been used for years but with some drawbacks. The composting of organic matter results in bacteria breaking down the organic matter and one of the by-products is CO_2. Many large-scale greenhouses have used composting rooms adjacent to the growing greenhouse to provide CO_2 for their crop. CO_2 is pumped from one room into the other byway of circulation fans. One drawback is that composting so close to your growing area can attract insects that could potentially damage your crop.

Sugars, water and yeast have been used, taking the process from beer making and putting it to use for CO_2. Not a bad deal if you like to brew beer. The yeast eats the sugar and releases carbon dioxide and alcohol as by-products. If you are not into brewing beer, you can simply mix brewer’s yeast and sugar with water. It is important to have the temperature of the water right. Water too hot will kill the yeast and if the water is too cold the yeast will not activate. The process is simple and inexpensive but does have some drawbacks. It can present an odor problem and is somewhat time consuming having to remix every 4-5 days.

Dry ice which is frozen carbon dioxide releases CO_2 when exposed to the atmosphere. As it melts it is converted from a solid to a gas. Dry ice has no liquid stage, which makes it easy to work with and has little clean-up. Dry ice can be expensive for long-term use and it is difficult to store. Using insulated containers can slow the melting process, but it cannot be stopped.

Mycelial based CO_2 production is relatively new. The biological process is not new, but the application is. It is known that mushrooms are more like humans, in that they breathe in oxygen and break down complex carbon compounds and exhale CO_2. As mushroom mycelium colonizes the substrate, it eventually wants to form a fruiting body. After fruiting body development has occurred, the mycelium begins to slow its growth and subsequently reduces CO_2 production. A non-fruiting strain of mycelium has been discovered by a professional mycologist and is now being used for indoor gardening. The strain the company is using is strong and continues to produce CO_2 for at least half a year and at that point CO_2 production begins to slowly decline but CO_2 levels above ambient can still be detected up to 16 months later. There is no maintenance or set-up with this option. Ease of use and low cost make mycelial based CO_2 a good option.

As a grower, you know the time and energy you spend working your indoor garden is tremendous. Adding CO_2 is not only a good idea, but is necessary to have the most efficient growing area possible. No matter how you get CO_2 into your indoor growing area, you will see a benefit. Natural CO_2 production is a good choice in this day and age. The ease of use and the reduced effect on the environment make these options the green choice. They are easy on your budget and your plants will love you for it.

About the Author:

Glen Babcock is the owner of Garden City Fungi and the founder of ExHale Homegrown CO_2. Glen has been involved in Agriculture his entire life. Glen graduated from the University of Montana with a degree in Forestry and has been a mycologist for over 23 years.