# EXHALE HOMEGROWN CO2

first carbon dioxide bags in the world


## The missing ingredient

# $CO_2$- The Missing Ingredient

**By Glen Babcock**

Carbon Dioxide has been a hot topic as of late. There are questions about its effectiveness on improving plant health and increasing yields. Let's take a look at some of those questions and try to clarify a few things.

First and foremost, the most important biological function of a plant is that of photosynthesis. Without this chemical process, plants are unable to provide themselves with food. Many gardeners believe that nutrients provide all the food that a plant needs to develop. The truth is nutrients are not consumed as food. Nutrients contain minerals that the plant utilizes in conjunction with light and $CO_2$ during photosynthesis to produce the complex sugars that it needs for energy and growth. The leaves provide plants with all their food because they turn sunlight into food energy. Chlorophyll makes this energy transformation possible. Leaves also make the oxygen in the air that we breathe. Chlorophyll is a pigment found in the cells of leaves which is formed only in the presence of light and is what makes plants green. Chlorophyll is contained in the chloroplasts and has the ability to capture light energy. Sunlight shines through the top of the leaf and reaches the next layer of cells.

The light energy is trapped by the chlorophyll in the chloroplasts. In the chloroplasts, a process that uses water changes the light energy into a kind of chemical energy. This chemical energy is stored in the chloroplasts. The chloroplasts use the chemical energy to make food. Air enters the leaf through the stomata and moves into tiny spaces around the food-making cells in the leaf. $CO_2$ from the air passes through the cell walls and membranes of the cells. $CO_2$ enters the chloroplasts where the previously stored chemical energy converts the $CO_2$ into sugar. Tubes in the plant carry the sugar from the leaf cells to other parts of the plant, such as roots, stems, and flowers. Cells in these parts of the plant are storage for some of that sugar.

## Does $CO_2$ help with clones and rooting?

An often overlooked and under studied aspect of plant response to $CO_2$ is on the below ground processes. When exposed to increased $CO_2$, roots have been observed to become more numerous, longer, thicker, and faster growing in many plant species. When cloning plants, root growth appears 3-5 days sooner with $CO_2$ enrichment versus without. Although some things are known about root responses to $CO_2$ enrichment, much remains to be learned. Nevertheless, it is clear that plant roots, like other parts of the plant, typically do better in $CO_2$ enriched air versus ambient air.

## What does light have to do with $CO_2$?

Photosynthesis has two parts. The light dependent reactions and the light independent ones. The light dependent part is the use of light to "steal" electrons from water. This is the process that produces oxygen. The light independent part is carbon fixation.

Plants produce $CO_2$ during respiration when they break down sugars just as humans do. They do this day and night, but during photosynthesis they tend to take more $CO_2$ out of the air than they put in. They reduce $CO_2$ output during the carbon fixation steps of the light-independent reactions of photosynthesis. Both processes go on all of time, except carbon fixation tends to be more active during the day. They only release Oxygen during the day since they require light to do it.

## Does CO2 really improve yields or just make for a healthier plant?

The answer is both. The goal of $CO_2$ enrichment is to reduce the time from seedling to harvest and to speed up growth and increase yields. Plants grown with elevated $CO_2$ are more able to resist insects and diseases, which makes for a healthier plant. In a study, lettuce was

grown in a greenhouse with ambient air versus lettuce grown in a greenhouse with $CO_2$ enrichment. The test showed the lettuce grown in the greenhouse with ambient air was ready to harvest in 59 days. In the greenhouse with $CO_2$ enrichment the lettuce was harvested in 48 days.

By weight the $CO_2$ enriched greenhouse lettuce weighed 30% more. In studies here at our farm, we have found that by supplying tomato plants with elevated $CO_2$, those plants produced 20% more fruit (more tomatoes) than those plants that did not receive the elevated $CO_2$. By harvestable weight the plants receiving more $CO_2$ out produced those without by 25%.

Tests performed on strawberries showed that strawberries grown with elevated levels of $CO_2$ contained more sugars and physical mass to support a greater number flowering sites. The fact that there were more flowering sites led to a greater number of strawberries being formed and therefore led to more overall production.

## Can you have too much CO2?

Too much $CO_2$ can be detrimental for plants. When $CO_2$ levels rise to high, the plants ability to perform transpiration during photosynthesis is reduced. With lower transpiration rates, fewer nutrients are drawn thru the plant, thus less food enters the plant and growth slows down. High $CO_2$ levels can cause necrosis spots to appear on leaves. These dead tissue spots are an invitation for bacteria and mold to appear. The bacteria and mold feed on the dead tissue and can cause plant damage, lower yields and in some cases cause crop failure. It has been shown that $CO_2$ levels around 1200- 1500 ppm provide for optimal growth. With levels above this you are only wasting $CO_2$ and potentially asking for trouble.

## Conclusion

$CO_2$ is often overlooked as not being a necessary additive for indoor gardening. While plants can survive without it, you are not maximizing your gardens potential. Even slight elevations can be of benefit for your garden. With ambient air, $CO_2$ levels hover around 400 ppm. Raising this level to 1000-1200 ppm will give you great rewards. When beginning $CO_2$ enhancement in a garden the first noticeable thing you will see is the fact that your garden is greener. This is proof that your garden is benefiting

from the $CO_2$ you are providing. Greener plants mean more Chlorophyll is present in the leaves and shows more that more photosynthesis is taking place. There are many options available for $CO_2$ enrichment. Do your research and find the option that works best for you. You and your garden will be better off in doing so!!

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 24 years.

His research has been published in scientific journals worldwide.