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Taking Advantage of CO2 Enrichment

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Optimal photosynthesis, generally resulting in maximal growth and yields, is just one of the many benefits of CO2 enrichment in the garden. In order for your plants to really enjoy effective CO2 enrichment, it is important to do it the right way. The following article suggests different tricks to ensure these advantages are fully accessible to your plants.

Choosing an appropriate enrichment method for the garden

Certain criteria must be taken into consideration when choosing a source of CO2, such as the price, the impact on the garden's climate and potential toxicity. However, bottled CO2 and combustion generators are the most effective and common way to enrich your garden.

The importance of CO2 distribution in the cultural environment

Once the ideal CO2 source is identified, the positioning of the equipment must be carefully studied to make sure the plants absorb the precious CO2 at maximum capacity. According to some research, the best results are obtained by injecting CO2 in the upper third part of the plants where photosynthetic activity is at its highest.

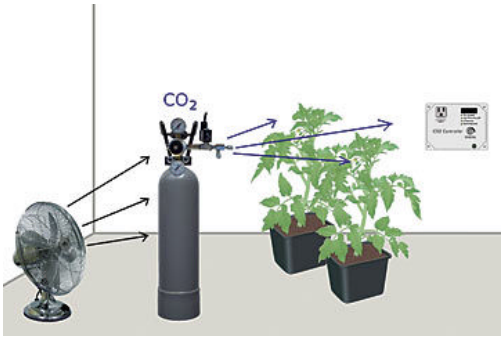

Figure One: Placing a fan near the gas exit moves and distributes the CO2 around the room and the plants.

CO2 movement in the air

Several factors influence CO2 movement in the air, including some relatively simple physical principles. When these principles are understood, it is possible to foresee CO2 movement in the garden, and control it directly toward the leaf area.

The first factor to consider is CO2's weight. At ambient temperatures, CO2 tends to drop as its weight is heavier than the air's weight (composed mainly of nitrogen and oxygen). For example, at 77°F, CO2 weighs 66 ounces per three feet cubed in comparison to 42 ounces per three feet cubed for the air. This means that CO2 will naturally go down to the ground. A second physical factor that influences CO2 movement is the temperature. Hot air tends to rise and cold air descends; this is also true for CO2. This is why the cold CO2 from the bottle will normally go down while the hot CO2 generated by combustion will rapidly rise up to the ceiling.

The diffusion principle is also responsible for CO2 movement. Diffusion is simply explained by the fact that gas tends to take up as much room as possible. Generally, it will direct itself from a location where its concentration is elevated to another where its concentration is lower. Although this principle is applicable to CO2, this gas does not travel very far by simple diffusion.

The air movement also influences significant CO2 displacement in the garden. In fact, CO2 follows the air path, which can be created with a fan.

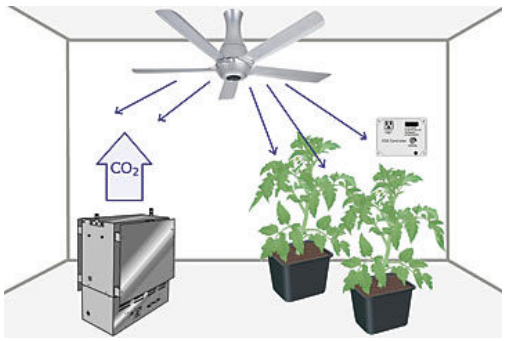

Figure Two: A ceiling fan can be used to mix the CO2 with the air and bring it down at the plants' level.

Here is an example to summarize the above statements. A garden is enriched with a regulated CO2 bottle. After the injection, CO2 tends to drop (weight and temperature) and then moves in the air towards the locations that are less concentrated (diffusion). Once CO2 is diffused in the air, it does not stay on the ground but instead follows the rising movement of the hot air (temperature and air movement).

Effective distribution systems

Regardless of which enrichment method is being used, good CO2 distribution in the garden is important so your plants can absorb it properly. To obtain a homogeneous CO2 concentration in the garden, it is beneficial to inject it at different locations. To do so, use several CO2 generators with average power in one room instead of one high flow rate unit. This same principle is

also applicable to CO2 bottles. With bottled CO2, which tends to drop due to its weight and the temperature, it is logical and favorable to inject it lightly above the plants or directly at their third upper part. When CO2 comes from combustion, the generator's location may vary; wherever it is, hot CO2 will rise up towards the ceiling anyway. However, it is important to avoid installing the generator directly on the ground to protect it against water damages or close to the ceiling to avoid fire hazards. Whatever the source is, it is beneficial to place it far from an exhaust fan to avoid wasting CO2 outside.

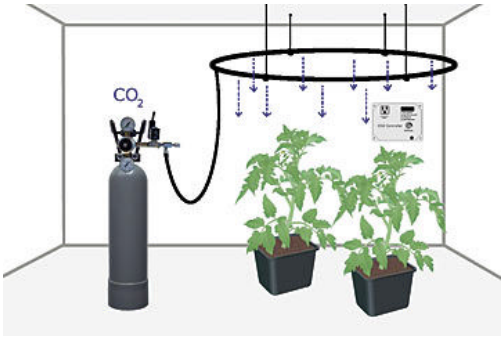

Figure Three: Connecting a perforated plastic tube to the regulator is an ingenious and simple way to ensure an even distribution of the CO2.

Not only is it important to install CO2 sources in strategic locations, it is also recommended to use rotating fans to create air movement that quickly directs CO2 towards the plants. For bottled CO2, simply placing a fan near the gas outlet will move and distribute CO2 evenly around the room and the plants (figure one). For CO2 generators, a ceiling fan can be used to mix CO2 in the air and to bring it down to the plants' level (figure one).

Using fans is also really effective in renewing the air and CO2 around the plants. In just a few minutes, leaves can absorb all the available CO2 around them. Because this gas moves really slowly by diffusion and only on a short distance, ventilation is essential to provide the plants with a proper and stable concentration for their growth.

In the case of bottled CO2, another ingenious and simple system is to connect a perforated plastic tube to the regulator and install it above the plants. CO2 will then be vaporized trough the small holes and homogeneously distributed near the plants (figure three). It is easily possible to pierce the holes on the tube by placing it under water while injecting CO2. The holes' size and location will determine the CO2 distribution.

A controller combined with an effective distribution system will maintain a precise and stable CO2 concentration in the garden. Like all other equipment, the controller must be installed at a logical location to be effective. It is only the CO2 sensor that has to be placed at a location representative of the concentration around the plants. Depending on the controller's model, the sensor might be inside or outside the controller's enclosure. It is best to install it in the center of the garden at a height that is equivalent to the upper third part of the foliage. This way, CO2 concentration will be steady near the plants and will perfectly fulfill their needs!

A good application of the advices mentioned above will surely have a positive impact on your yield's quality and quantity. However, other aspects have to be taken into consideration for ensuring optimal plant growth and avoid wasting CO2. Here are a few:

Good climate management

In order to fully benefit from CO2 enrichment, all of the environmental parameters must be well managed. It is important to perfectly master your plants' needs on every level—temperature, relative humidity, lighting, CO2 concentration, etc. The moment one of these parameters is no longer ideal, it becomes an obstacle to plant growth. In a garden enriched with CO2, it is important to consider that the best temperature for plants will be slightly higher than usual.

Effective gardening with CO2 requires careful planning and appropriate choices of equipments and layout, all based on the plant's needs and the garden type. A predetermined plan for a perfect distribution system does not exist; the ideal plan varies for each cultural environment and is established according to a strict analysis of the location. Finally, the best CO2 enrichment system will only be effective if all of the plant's needs are satisfied!