Using CO2 / Carbon Dioxide

No single factor is more important to accelerated plant growth than Carbon Dioxide / CO2. Normal CO2 levels (ambient levels) present in everyday normal air is between 375-400 parts-per-million (PPM). Plants have adapted to varying levels of CO2 in the atmosphere over the eons and can use up to 1500 PPM. If you are growing using hydroponics, you can increase the CO2 level in your greenhouse to 1500 PPM and the plant's rate of growth could be as much as 30% faster. Some people claim even higher gains in growth and size.

Commercial greenhouses use propane or natural gas fired "CO2 generators" to increase CO2 levels. Burning propane or natural gas produces primarilly CO2, water vapor and heat with other trace gases. If hobby growers want to take advantage of increased production by using supplemental CO2, they can use a CO2 generator. Small versions are produced by a couple of manufacturers and they are relatively safe. CO2 generators are also very efficient and inexpensive to operate. Standard propane tanks or a natural gas line provides the fuel for the generator. The CO2 generator simply burns the fuel in a controlled manner.It is important for the generator to maintain a clean blue flame. Blue flames are an indication that all of the fuel is being converted into CO2. Yellow flames indicate the generator is running "rich". Incomplete (rich) combustion will create other gasses besides CO2 which are bad for the plants and for humans.

If you have a smaller application / growing area, compressed CO2 may work better for you. Using compressed CO2 is better in some cases because you are not burning a gas and producing unwanted heat. However, compressed CO2 is difficult to handle and quite a bit more expensive than operating a CO2 generator. Compressed CO2 comes in very heavy steel or aluminum "cylinders" that are highly pressurized.

To properly control the CO2 level, it is important to use a controller that can actually measure the CO2 level inside the area. When it detects the CO2 level is too low, it will activate the CO2 device to add more CO2 to the area. Once the controller detects the CO2 level has increased, the CO2 device is turned off, the process repeats throughout the "day" time. CO2 is NOT used at night, so the better CO2 controllers also sense whether or not it is daytime and will turn OFF the CO2 at night.

Once the CO2 level has been optimized between 1200-1500 PPM, the other factors which are critical are temperature and humidity. Normally, hydroponics is used indoors where all aspects of the environment can be easily controlled. Whether you operate a large commercial greenhouse or a small indoor garden in the corner of your garage, the same principles apply. There are such wide ranges of conditions, which affect today's greenhouse operators and hobby gardeners; no two applications are exactly the same.

One thing that is always shared is the need to maintain specific temperature and humidity levels. It is extremely important to consider the heat load and humidity factors when setting up your operation. Indoors with supplemental HID lighting, heat is usually the enemy. HID lights produce a great deal of heat which must be removed by air conditioners or vents and fans. The fan usually "pulls" hot / humid air out of the area and draws in cool drier air from another area. Air conditioners draw in the hot & humid air within the area and return cooler dryer air back to the growing area.

The next two pages show a couple of examples for how to set-up your growing area.

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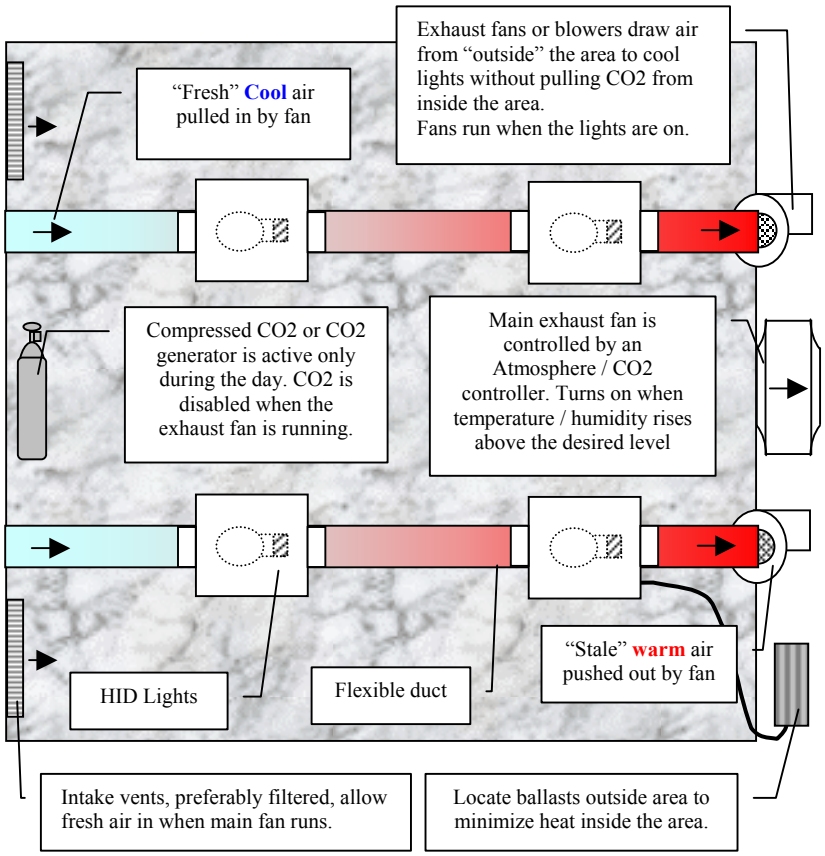
Application examples

No two set-ups are exactly alike so it is difficult to detail the perfect setup for everyone. However, your first experience setting up an indoor garden can be quite successful if you understand the basics which apply to all indoor growing areas. The next couple of pages describes and details the basic concepts and techniques which have been successfully used over the years. This in no way means there aren't other "hybrid" set-ups which work equal or better.

Air-cooled lights / Main exhaust fan



This type of setup works well in cool geographical areas.

The air-cooled lights example on this page takes advantage of the cooler air available in cooler climates. Cool dry air is pulled into the area while the warm humid air is exhausted out of the area. By "pulling" air into the area, static pressure inside the air is kep to a slight vaccum so that the only air exiting the area goes directly through the fan ONLY.

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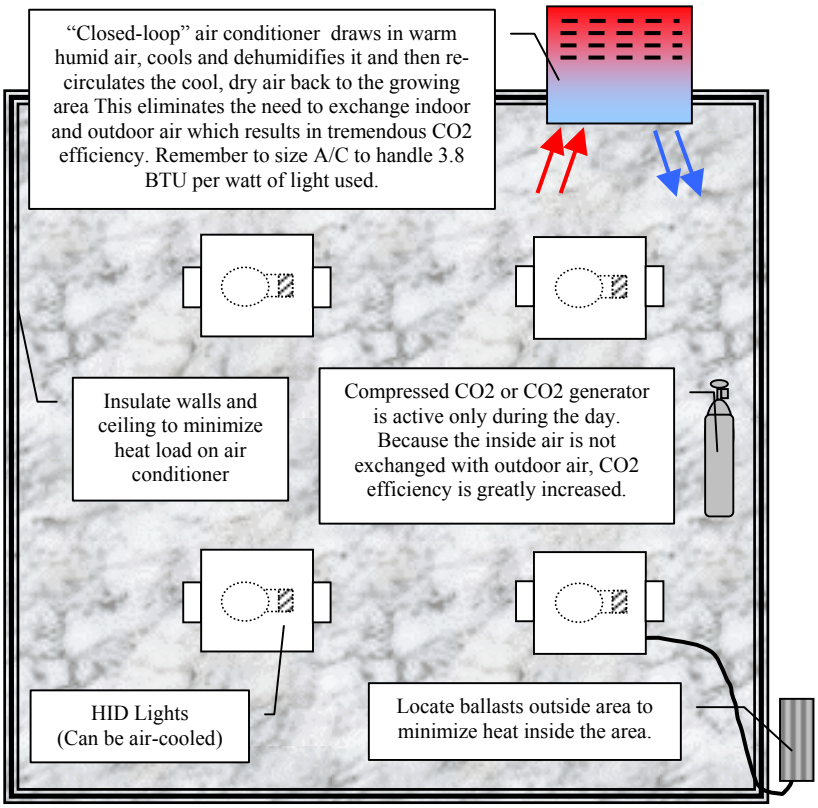
SENTINEL

Closed-loop Air conditioning / No exhaust fan



This type of setup works well in warm to hot geographical areas.

The air-cooled lights example on the prior page takes advantage of the cooler air available in cooler climates. But when it gets too hot for outdoor air to be used to cool your area, an A/C unit might be the only and best solution to handling heat and controlling humidity levels. The advantages come at a cost however as it is always more expensive to operate an A/C than fans. The advantages of using an A/C are numerous. Much lower costs associated with using CO2, less chance of an insect invasion because of less access points and generally less maintenance.

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