SAFETY FIRST WHEN STIMULATING PLANT GROWTH

Despite being beneficial to the growth of salad, vegetables and fruit in a greenhouse environment, carbon dioxide is dangerous to humans at certain levels. Stephen B. Harrison, from sbh4, says the trick is getting the balance right, which is where calibration gas mixtures from Coregas can help

When growing fruits, salads and vegetables in greenhouse environments, elevated levels of carbon dioxide enhance plant growth. The growth rate and development of all plants can be improved by controlling carbon dioxide (CO_2) concentrations at levels of around 800 ppm. This is approximately twice as much as the natural concentration of CO_2 in natural ambient air. Higher CO_2 concentrations up to 2000 ppm have been used in greenhouses and hydroponics, but each incremental increase in CO_2 levels above 700 ppm has diminishing benefit to the plants. Despite these diminishing returns, some operators control the CO_2 levels at 1000 or 1200 ppm to fully exploit the potential of CO_2 addition.

At high levels, CO_2 can be toxic to humans and bugs. For humans, the short-term exposure limit is 3% and the long term 8-hour time-weighted average exposure limit is 0.5% (5000 ppm). For bugs such as white fly, exposure to a CO_2 concentration of 1% for one hour has been reported to be an effective fumigation technique.

As mentioned, optimised CO_2 levels in greenhouses raise productivity and crop yields considerably, up to 40% during the darkest time of the year. In addition, they also improve the quality of the crop. When the CO_2 level in the greenhouse is optimised, the plants will produce uniform fruit, salads and vegetables of the best quality. So CO_2 can maximise both the crop yield and the sales price for the harvest. This technique is applied to greenhouses using both hydroponic and conventional soil growing techniques.

For food producing and exporting countries, such as the Netherlands and New Zealand, the investment in these high yield processes has been intense in recent decades. TJ Croeser, sales manager at the industrial gases supplier Coregas in New Zealand comments as follows: "Dosing of carbon dioxide to the greenhouse can be from a CO_2 generator or from a carbon dioxide supply cylinder or tank. Greenhouse CO_2 generators are often simple LPG, or propane, burners, which produce CO_2 and heat from combustion of the LPG. However, enhanced flexibility and improved dosing control can be achieved by using carbon dioxide gas, which can be supplied by Coregas in New Zealand in bulk liquid tanks, gas cylinder packs or single cylinders."

Enhanced flexibility and improved dosing control can be achieved by using carbon dioxide gas supplied by Coregas in bulk liquid tanks, gas cylinder packs or single cylinders

ENVIRONMENTAL REQUIREMENTS

While elevated carbon dioxide levels in the greenhouse create more productive crop plants, plants go through several growth stages during their lives and each stage has its own environmental requirements, so it is essential to use CO_2 at the right times during the growth cycle for optimum results.

For example, seedlings need different light levels and fertiliser strengths than established plants. Similarly, extra CO_2 is more beneficial during some growth stages than others. Generally, dosing of CO_2 is most essential during periods of rapid growth, but researchers have also discovered how extra CO_2 early in the life of a plant can also bring benefits months later.

To control the CO_2 level in the greenhouse, an NDIR sensor is typically used. The target set point will generally be 800 ppm of CO_2. When the sensor detects a reduced CO_2 level in the greenhouse it will activate the CO_2 dosing system. When the required CO_2 level has been achieved, the measured value will rise and the control system will shut off the CO_2 supply.

To calibrate the CO_2 sensor, it might be possible to take it out of the greenhouse into clean pure air and run an auto calibration based on the normal CO_2 concentration in ambient air. However in professional units, where the CO_2 sensor is often fixed into the greenhouse control panel and has mains electrical power supply, this calibration in ambient air is not practical. A specialty gases calibration gas mixture cylinder containing a certified pre-mixed gas at 410 ppm of CO_2 in a balance of air or nitrogen can be presented to the NDIR CO_2 sensor to simulate an automated calibration in natural air. Alternatively, if the sensor is capable of being calibrated at user-defined levels, a certified calibration gas mixture at 800 ppm CO_2 in a balance of nitrogen can be used to calibrate the sensor close to its measured value.

As already discussed, CO_2 can be toxic to humans at a certain level. Croeser said: "Let's put the undisputed economic benefits of CO_2 dosing to one side for a moment and get down to brass tacks… there is nothing more important in that greenhouse than the CO_2 gas detector and alarm system. Every employee relies on it for their safety. Carbon dioxide is invisible and does not have a noticeable smell, so a dangerous concentration can't be detected by humans until it's too late. That's why we offer only the best quality NATA-certified calibration gas mixtures for CO_2 gas detector sensor calibration applications."

Coregas
www.coregas.com.au/

Optimised CO_2 levels in greenhouses can raise productivity and crop yields considerably, up to 40% during the darkest time of the year. In addition, they also improve the quality of the crop