Higher dissolved oxygen great for productivity, health and vigor

by Robert Fieldhouse
(Guelph, October 13th, 2005)

Dissolving more oxygen into hydroponic solutions could boost greenhouse productivity and provide a whole host of other benefits too, say University of Guelph researchers.

Prof. Mike Dixon and Dr. Youbin Zheng, Department of Environmental Biology, are investigating the positive aspects of using an oxygen diffuser to increase oxygen levels in greenhouse hydroponic solutions used to grow roses, tomatoes, cucumbers and peppers.

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Dr. Youbin Zheng, Department of Environmental Biology, is studying if oxygen levels can be boosted in hydroponic solutions to help growers ward off harmful microbes and boost productivity.

Photo: Olivia Brown

Preliminary results suggest a higher dissolved oxygen level increase productivity, health and root vigor in greenhouse plants, and helps keep harmful microbes in check.

“These findings are really beneficial to the industry,” says Zheng. “If we can use oxygen to boost plant health, making them stronger and more resistant to disease, we've discovered a very helpful tool.”

Oxygen isn't as prevalent in warm water as in cool water, so oxygen levels tend to be low -- about two to four parts per million (ppm) -- at high greenhouse temperatures, compared to eight to nine ppm in cool water. Under hot weather in the greenhouse, the root zone is especially short on oxygen, says Zheng, because root respiration depletes oxygen in hydroponic solutions. Excessive watering can further depress oxygen levels because it makes growth media, such as rockwool or coconut fibre, less porous, blocking air. These factors all weaken plant disease defense systems, making them more susceptible to disease-causing microbes such as *Fusarium* and *Pythium* which cause root decay.

To prevent this problem, greenhouse growers typically bubble air into hydroponic solutions to bring oxygen levels up to about nine ppm. But sometimes this still

isn't enough.

Two years ago, the BC Greenhouse Growers' Association asked Dixon to investigate using even higher oxygen levels in hydroponic solutions. His literature review revealed that very little work had been done in this area suggesting the problem was largely ignored – until now.

Dixon and Zheng are using an oxygen diffuser recently developed and manufactured by Seair Diffusion Systems Inc., an Edmonton-based company with an interest in the greenhouse sector. The diffuser concentrates atmospheric oxygen, and dissolves it into hydroponic solutions. With this technology, oxygen levels can reach as high as 60 ppm in hydroponic solutions.

The research team is currently studying the effects of different oxygen levels, ranging from about nine ppm to 40 ppm.

So far, preliminary results are promising. But creating optimal supersaturated oxygen solutions requires extreme precision. Oxygen can be damaging at very high levels, says Dixon , so it's important to establish application methods for using this technology for different crops.

But if the methods can be worked out, Dixon says the oxygen diffusers are inexpensive and stand to emerge as an economical, environmentally friendly solution for growers looking to enhance their crops.

“Greenhouse growers are voracious technical consumers – they'll try anything,” says Dixon . “But by the same token, they're also very shrewd business people, and they won't waste money unnecessarily.”

Dixon and Zheng will continue their research and will further investigate oxygen's effect on plant growth, physiology and disease. For example, they will inoculate greenhouse plants with specific microbes to see how the plants cope with this challenge under different oxygen levels.

Other researchers involved in this project include technician Linping Wang, graduate student Johanna Valentine and undergraduate student Mark Mallany, Department of Environmental Biology.

This research is being conducted at greenhouses in Guelph and Leamington , Ontario . It is sponsored by Seair Diffusion Systems Inc., Flowers Canada Ontario and the Fred Miller Rose Research Fund.

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