

# Controlled Environment Systems Research Facility

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## 2007 Station Report to the NCR-101 Committee

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### 1. New Facilities and Equipment

Dissolved ozone sensor (ATI); Ozone generator (Clearwater Tech); Ozone off-gas preparation system (INUSA); Ozone off-gas destruct system (Clearwater Tech); Hach Colourimeter, Plant Tissue Fibre Analyzer (ANKOM 200), Humidity and temperature sensor (Vaisala HMP42).

### 2. Unique Plant Responses.

- 1). Root zone high dissolved oxygen (DO) level (e.g. 40 mg l<sup>-1</sup>) can have negative effects on plant root growth (e.g. tomato, miniature roses, Huang Qing) in hydroponic system.
- 2). Root zone DO level above normal (~ 8.5) to 30 ppm may enhance plant growth and prevent or reduce roots from *pythium* spp. infection.
- 3) Direct foliar application of dissolved ozone does not impact growth at levels below 0.8 mg/l (as realized at the canopy level) for selected crops. This opens the door for foliar pathogen control using aqueous ozone.

### 3. Accomplishment Summaries.

We are a big group and it is too much to summarize all of our accomplishment here. But one thing we would like to report is the Tomatosphere project. Tomatosphere, an educational outreach project involving more than 6000 classrooms in Canada (and the United States and several other countries), was awarded the 2006 Alouette Award by the Canadian Aeronautics and Space Institute. The award was presented to Tomatosphere to recognize its outstanding contribution to advancement in Canadian space technology, application and science.

### 4. Impact Statements.

The Tomatosphere project uses the excitement of space exploration as a medium for teaching students about science, space and agriculture and the role being played by Canada as a world leader in the support of long-term space flight.

### 5. Published Written Works.

#### Book Chapters

Zheng, Y., Jones, M.P.A., Dixon, M and Saxena, P.K. 2007. Conventional and emerging cultivation strategies for medicinal *Echinacea* production. In: *Advances in Medicinal Plant Research*. S.N. Acharya and J.E. Thomas (ed.) (Inpress).

#### Refereed Journal Articles

Zheng, Y., Wang, L. and Dixon, M. 2007. A Threshold for Elevated Root Zone Oxygen for Tomato. *Scientia Horticulturae* (Inpress).

Zheng, Y., Dixon, M. and Saxena, P.S. 2006. Growing Environment and Nutrient Availability Affect the Content of Some Phenolic Compounds in *Echinacea purpurea* and *Echinacea angustifolia*. *Planta Medica* 72:1407-1414.

Zheng, Y., Dixon, M. and Saxena, P. 2006. Greenhouse Production of *Echinacea purpurea* (L.) and *E. angustifolia* Using Different Growing media,  $\text{NO}_3^-/\text{NH}_4^+$  ratios and Watering Regimes. *Can. J. Plant Sci.* 86: 809-815.

#### Symposium Proceedings

Stutte, G., N.C. Yorio, J.T. Richards, S. Edney, M. Sisko, R. Wheeler, M. Stasiak, and M. Dixon. 2006. Effects of hypobaric pressure conditions on the growth and development of radish. *Habitation 2006*. Orlando, Florida. Feb 5-8, 2006. Vol 10 No 3/4, HLS123

Dixon, M., C.A. Wehkamp, and M. Stasiak. 2005. Physiological responses of lettuce (*Lactuca sativa*) to reduced atmospheric pressure. *SAE Technical Paper Series*. 2005-01-3074.

#### Popular Articles

Zheng Y., Zhang, P. and Dixon, M. 2007. Eco-system unites substrate with NFT. *Fruit and Veg Tech*. V 7 No 1.

Richard, S., Zheng, Y., Dixon, M. 2006. To recycle or not to recycle? *Greenhouse Canada* December issue, 2006. 20-25.

#### **6. Scientific and Outreach Oral Presentations.**

Zheng, Y., Wang, L., Cayanan, D., Zhang, P., Graham, T., Liu, W., Chong, C., Llewellyn, J and Dixon, M. 2007. Irrigation water disinfection – Cu, Cl and  $\text{O}_3$ . *Landscape Ontario Growers Short Course*, Royal Botanic Garden, On. Feb. 7 (Invited talk).

Cayanan, D.F., Zheng, Y., Chong, C., Graham, T., Zhang, P., Llewellyn, J. and Dixon, M. 2007. The Application of Chlorination Technology in Nursery and Greenhouse Productions. *Flowers Canada (On) Research Symposium*, Niagara Horticultural College, Ontario, January 22, 2007.

Martinez, S., Zheng, Y., Wang, L., Liu W. and Dixon, M. 2007. Improving Productivity and Pathogen Resistance of Ornamental Crops by Nutrient Solution Oxygenation. *Flowers Canada (On) Research Symposium*, Niagara Horticultural College, Ontario, January 22, 2007.

Thomas Graham, Michael Dixon, Youbin Zheng, Weizong Liu, Ping Zhang, Aaron Cena, Laura Greenway, Dave Greenway. 2007. Aqueous Ozone in Nursery and Greenhouse Production Systems. *Ozone V*, University of California, Fresno, California. April 2-3, 2007.

Thomas Graham, Michael Dixon, Stacey Robinson, Jamie Lawson, Ping Zhang, Aaron Cena, Steve Hagens, John Brouwers, Laura Greenway, Dave Greenway. 2007. From Lab Bench to Commercial Trials: Ozone in the Floriculture Industry. *Ozone V*, University of California, Fresno, California. April 2-3, 2007.

Dixon, M., C. Wehkamp and M. Stasiak. 2005. Physiological Responses of Lettuce (*Lactuca sativa*) to Reduced Atmospheric Pressure. 2005-01-3074. 35th Conference on International Conference on Environmental Systems, Rome, Italy, July 11-14, 2005.

Dixon, M. 2006. Controlled Environment Systems Research Facility. *OCE-ETech*, Guelph, ON.

Dixon, M. 2006. Promising  $\text{CO}_2$  Absorption Technology identified in contract on Phase Management for Advanced Life Support Processes. The Netherlands.

Dixon, M. 2006. Tomatosphere. Cool Primary School, Cool, California.

Dixon, M. 2006. Controlled Environment Systems Research Facility; Collaborations and Technology Transfer. *Going Global*, Spain.

Dixon, M. 2006. Biological Life Support for Human Space Exploration. Guelph, ON.