Controlled Environment Systems - University of Guelph
Department of Plant Agriculture
University of Guelph
Guelph, Ontario, Canada
http://www.ces.uoguelph.ca

2002 Station Report to the NCR-101 Committee for Controlled Environment Technology and Use

Michael Dixon Ph.D., Director (mdixon@ces.uoguelph.ca)
Bernie Grodzinski, Ph.D., Co-Director (bgrodzinski@ces.uoguelph.ca)

New facilities

The opening ceremony for the newly completed 900 m^2 (8600 ft^2) Controlled Environment Systems Research Facility located at the University of Guelph (UoG) was held on May 14, 2000. Currently, there are more than 60 researchers, students, technicians and support staff involved in the activities of this facility. The first prototype variable pressure hypobaric plant growth chamber (HPGC) is now online and in the final phase of testing. A project titled analysis of plant water relations under variable pressures is currently being conducted in this HPGC. Nine additional smaller cylindrical hypobaric chambers (~1 m^3) are currently under final modification and will be installed in the new facility in the middle of April 02.

Sensors and instruments

Recent acquisitions include 9 CO_2/O_2 in-line analysers, 2 UV/VIS Spectro-photometers, Nikon microscope system, Spectrofluorometer, 2 cryogenic (–80 °C) storages, 2 ultra centrifuges, 6 incubator shakers, biological safety cabinet, HPLC, microplate fluorometer/luminometer, humidity/temperature sensors, ^{14}C leaf monitoring system, Li-Cor 6400R, spectroradiometer, autoclave, CAB steriliser, etc

Current Projects

- Development of an integrated control system for nutrient management in controlled environment systems
- Application of copper ion for diseases and green algae control in greenhouse industry
- A survey on the current statues of nutrient and water recirculation in Ontario's greenhouses
- Using ozone for diseases control in nutrient solution recirculation systems and as a disinfection method for growth media
- Application of a low nutrient strategy to solve salt accumulation problem in sub-irrigation system
- Modelling nutrient uptake dynamics in higher plant chamber
- Analysis of plant water relations under variable pressures
- Applications for modular biofiltration in the mining industry
- Modular biofilter beta testing
- Higher plants in indoor air biofilters
- Indoor biofiltration of ammonia and ethylene
- Biofilter applicability to diesel removal
- Biofilter efficiency at low VOC concentrations
- Carbon monoxide removal by botanical systems
- Tomatosphere II-- an educational outreach science project - http:// www.tomatosphere.org
- Protection of plants from infection in closed-cycle, hydroponic systems through transformation and antibody production
- Integrated control systems for root and aerial environments of greenhouse crops: management of allelochemicals and micro-organisms in closed-cycle hydroponic systems
- Genetic and physiological analyses of low light tolerance in natural ecotypes and selected greenhouse ornamentals
- Integrated biological and physical remediation technologies for recirculating hydroponic systems
- Improved plant productivity in closed environments: selection for enhanced photosynthesis and carbon partitioning in plants growing in dense plant canopies
- Production of high-flavoured native and commercial *Alliums* and extracts in closed environment systems

- Effects of environmental factors and antibiotics on bacterial membranes when grown in simulated microgravity

Workshops/colloquia/symposia

Advanced Life Support: Project and Technology Opportunities Workshop*,* co-hosted by UoG and the Centre for Research in Earth and Space Technology (CRESTech), co-sponsored by the Canadian Space Agency (CSA), CRESTech and European Space Agency (ESA), was held in Guelph on May 15, 01. Scientists and administrators from NASA, ESA, CSA, Japan and some Canadian universities, and people from related industries participated this workshop to exchange information and explore the opportunities in the Advanced Life Support field. ***European Space Agency, Annual General Meeting***, was hosted by UoG on May 16, 01. Scientists from Europe and UoG attended this meeting to exchange information on Advanced Life Support research.

Selected Publications/Presentations

Cloutier, G.R., Dixon, M.A., Olabi, A., Hunter, J.B., 2001. Area requirements for biomass production units (BPUs) including current MELiSSA candidate crops, European Space Agency (ESA_ESTEC), MELiSSA Technical Note 46.2 ECT/FG/MMM/97.012.

Darlington, A.B., Dat, J., Dixon, M.A. 2001. The Biofiltration of indoor air: air flux and temperature influence the removal of Toluene, Ethylene and Xylene. Environmental Science & Technology, 35: 240-246.

Dixon, M. and Y. Zheng. 2001. Variable pressure plant growth chambers for advanced life support studies. International Meeting for Advanced Technology of Environment Control and Life Support. Rokkasho_mura, Japan

Leonardos and Grodzinski. 2001. Quantifying immediate C export from source leaves *in* Handbook of Plant and Crop Physiology, 2nd Edition, Chapter 19. pp 407-420. ed. M. Pessarklia, Marcel Decker, N.Y.

Leonardos,ED, L. Savitch,N. Huner, G. Oquist and Grodzinski,B. 2002. Photosynthesis and export in low temperature acclimated winter wheat.Plant Cell Env. Accepted

Leonardos, E.D. and B.Grodzinski, 2002. Afternoon and nighttime export patterns of ^{14}C-assimilates from source leaves of C_3, C_3-C_4 intermediate, and C_4 *Panicum* and *Flaveria* species. J Functional Biol.(accepted)

Mikula, C., Y. Zheng and M. Dixon. 2001. The Effect of ethrel on geranium stock plants. American Society of Horticulture Science, Sacramento, CA, USA.

Mikula, C., Y. Zheng and M. Dixon. 2001. Physiological effects of ethephon on zonal geraniums. Flowers Canada Ontario 3rd Annual General Meetings, Mississauga, ON.

Savitch, L.V., Leonardos,ED, Huner, G. Oquist and Grodzinski,B. 2002. Two different strategies for low temperature acclimation in plants. Plant Cell and Environment. *In press*

Shafia, A., Sutton, J.C**.**, Yu, H., Fletcher, R.A.. 2001. Influence of pre-inoculation light intensity on development and interaction of *Botrytis cinerea* and *Clonostachys rosea* in tomato leaves. Canadian Journal of Plant Pathology. 23: 346-357.

Sutton, J.C. 2001. The new pathology. FLORNAMENTECH Conference, Toronto, Ontario, 2001. Proceedings of FLORNAMENTECH Conference, Toronto, 2001. pp 25-26.

Sutton, J.C., Liu, W., Huang, R., and Owen-Going, N. 2002. Ability of *Clonostachys rosea* to established and suppress sporulation potential of *Botrytis cinerea* in deleafed stems of hydroponic greenhouse tomatoes. Biocontrol Science and Technology (Accepted).

Richard, S. J., Y. Zheng and M. Dixon. 2001. State of Recirculation System Technology in Ontario Greenhouses. Flowers Canada Ontario 3rd Annual General Meetings, Mississauga, ON

Waters, G., Y. Zheng, S. Richard and M. Dixon. 2001. Mindless control of Hydroponic Systems. Flowers Canada Ontario 3rd Annual General Meetings, Mississauga, ON.

Waters, G.R., Dixon, M.A., 2001. Chamber Design and Performance Measures for Estimating NCER, European Space Agency (ESA_ESTEC), MELiSSA Technical Note 53.1 ECT/FG/MMM/97.012.

Zheng, Y., S.J. Richard, L. Wang and M. Dixon. 2001. Chrysanthemum and Miniature Rose Response to Copper in Solution Culture. Plant Biology 2001. Providence. RI, USA.

Zheng, Y., S. J. Richard, Liu Weizhong, Linping Wang, John Sutton and M. Dixon. 2001. Can You Use Copper to Control *Pythium* and Green Algae Without Killing Your Plants? Flowers Canada Ontario 3rd Annual General Meetings, Mississauga, ON.