



NCR-101 Committee on Controlled Environment Technology and Use

2000 Station Report
Controlled Environment Systems
University of Guelph
Guelph, Ontario, Canada

Michael Dixon
Bernie Grodzinski

<http://www.uoguelph.ca/~salsa>

New facilities

Construction of the new Controlled Environment Research Facility (CERF) located within the Bovey Building complex at the University of Guelph is currently underway. When completed in late this summer, the 900 m² (8600 ft²) facility will house nine new hypobaric plant growth chambers, as well as microbiological, analytical, calibration, foliar analysis, and system control laboratories. This facility will be the new home of over 30 CERF faculty, technicians, and students.

Sensors and instruments

After four years of microwave powered lighting enjoyment, our two Sealed Environment Chambers (SEC2) have been refitted with a combination of high pressure sodium and metal halide lamps. The inner canopy lighting system remains microwave powered as there is no real alternative to the current configuration. Temperature control problems encountered with the hydroponic solution tanks, also in SEC2, has necessitated the addition of in-tank nutrient cooling and monitoring systems.

Workshops / colloquia / symposia

A *Hypobaric Chamber Workshop*, hosted by The University of Guelph and co-sponsored by the Canadian Space Agency (CSA) and the Centre for Research in Earth and Space Technology (CRESTech), was held in Guelph on November 6 - 8, 1999. Over thirty-five invited speakers and guests convened to assist in design and engineering aspects of the nine hypobaric plant growth chambers, part of the new Controlled Environment Research Facility. After initial presentations from invited speakers from CSA, the European Space Agency (ESA), NASA, and a number University and industrial partners, the workshop was separated into three main working groups: Structure, Controls and Data Acquisition for Gases, and Controls and Data Acquisition for Liquids. A number of revelations came out of this workshop, including the decision to make the chambers rectangular rather than cylindrical! A schematic of the proposed hypobaric system is shown in the accompanying figure.

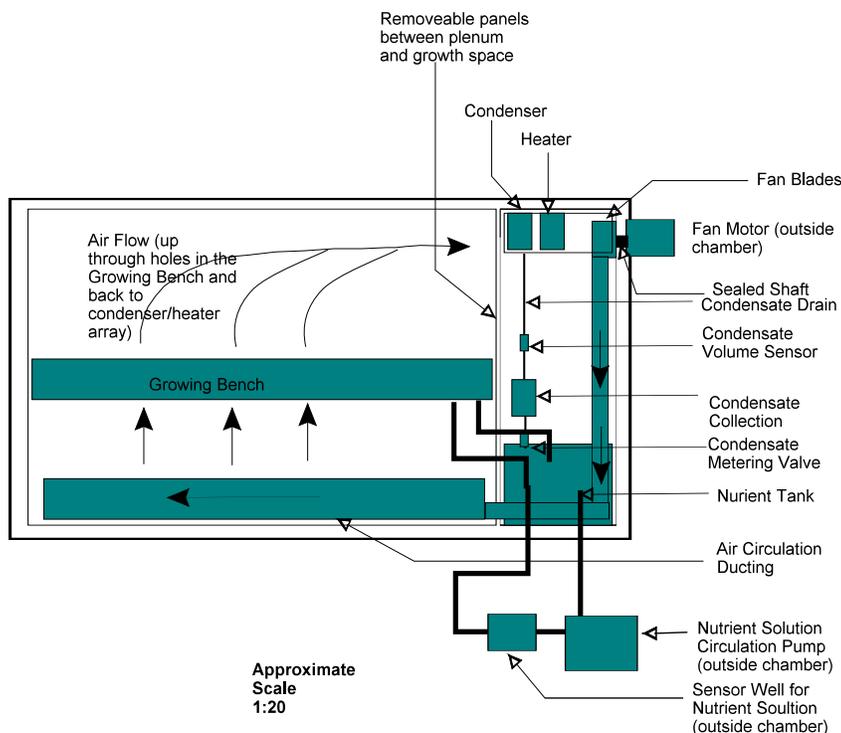
Core Projects

Research continues in the areas of:

- Efficient energy supply for dense plant canopies
- Assessment of ESA-MELISSA candidate crop readiness
- Indoor air quality
- Closed circuit nutrient recycling for greenhouse crops
- The influence of ion accumulation on crop production
- The rhizofiltration of sodium from hydroponic solution
- Evaluation of ozonation technology as a hydroponic remediation tool
- Early detection of plant responses to Pythium infection
- Individual ion control strategies in recirculating systems
- Assessment of transgenic lettuce

Publications

- Stasiak, M., R. Côté, B. Grodzinski and M. Dixon. **1999**. Light piping to the inner canopy enhances plant growth and increases O₂, CO₂, H₂O and ethylene gas exchange rates. Society of Automotive Engineers, Inc. 1999-01-2103
- Darlington, A.B, and M.Dixon. **1999**. Acetone removal kinetics by an indoor biofilter. Society of Automotive Engineers, Inc. 1999-01-2069
- Côté, R. and B. Grodzinski. **1999**. Improving Light Interception by Selecting Morphological Leaf Phenotypes: A Case Study Using a Semi-Leafless Pea Mutant. Society of Automotive Engineers, Inc. 1999-01-2102
- Edwards, D.R. and M.A. Dixon. **1999**. Plant growth and nutrient flux in a closed loop nutrient system using top irrigation for potted Asiatic lily, poinsettia and chrysanthemum. J. Amer. Soc. Hort. Sci. (Submitted)
- Gordon, R., M.A. Dixon, A. Madani and D.M. Brown. **1999**. Potato water use as affected by soil water status, vapour pressure deficit and irradiance. Canadian Journal of Soil Science, (In Press).
- Gordon, R., D.M. Brown and M.A. Dixon, **1998**. Field assessment of potato sap flow as affected by soil water status, humidity and irradiance. Canadian Journal of Soil Science, (In Press).
- Cloutier, G., J. Tsujita, L. Krick, M. Dixon. **1999**. Current research in the design of higher plant components of advanced life support systems: candidate crop technology readiness and systems sizing, European Space Agency (ESA-ESTEC) Workshop on Advanced Life Support and MELISSA Annual General Meeting, Noordwijk, The Netherlands.



Design schematic of the new hypobaric plant growth chambers to be constructed for the Controlled Environment Research Facility at the University of Guelph