NCERA-101: Committee on Controlled Environment Technology and Use
2009 Station Report
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Impact Nugget
We have been researching in 2 target areas with the first focusing on identifying biofuel potential of corn stover and greenhouse heating using wood pellets. The second focus area is using proteomics as a means to monitor organism growth. Research is continuing in LED for plant production.

Accomplishment Summaries
The Macdonald Campus of McGill University is researching into controlled environments with work on the impact of biofuel heating systems with a research focus on corn stover extraction and greenhouse heating using wood pellets with carbon dioxide utilization. An interesting result of the corn stover research is that by harvesting the corn stover in the spring moisture content is significantly reduced to <20% and biomass yield reaches the previous recommended level of no more than 50% field removal. The greenhouse heating research is in the early stages with the instillation of a gasifier furnace and gas monitoring equipment. Testing of the furnace and carbon dioxide enrichment is expecting in the coming year.

The research into using proteomics as a means to monitor organisms is progressing well with a number of papers identifying protein expression in microorganisms. This work is the foundation required to begin to use this technology for monitoring higher organisms including plants.

Impact statement
Biomass heating at McGill University has been trying to identify methods to use both the heat from the combustion process and also use the carbon dioxide. A major challenge of this work is the numerous gases that are produced during the combustion process (CO, ethylene, SOx, NOx, and particulates) and remove these gases before injection into the greenhouse. Through the use of a gasifier we can significantly reduce the particulate levels but filtering and scrubbing will still be required before the exhaust gas can be used for enrichment. This research can reduce the heating costs and carbon dioxide enrichment cost for a greenhouse, specifically in the Quebec and Northeast US region.

Published Works
Kopsell, D.A., M.G. Lefsrud, D.E. Kopsell. 2009. Pre-harvest cultural growing conditions can influence carotenoid phytochemical concentrations in vegetable crops. Acta Hort. 841:283-293.

Lizotte, P.-L., P. Savoie, M. Lefsrud and C. Ouellet-Plamondon. 2009. Corn stover fractions during an extended harvest period. ASABE Paper 095651. Reno, Nevada, June 20 - 23.

Goltsman, D. S. A., V.J.Denef, S.W.Singer, N.C.VerBerkmoes, M.Lefsrud, R.Mueller, G.J.Dick, C.Sun, K.Wheeler, A.Zemla, B.J. Baker, L. Hauser, M.Land, M.B.Shah, M.P. Thelen, R.L.Hettich, and J.F.Banfield. 2009. Community genomic and proteomic analysis of chemoautotrophic, iron-oxidizing "*Leptospirillum rubarum*" (Group II) and *Leptospirillum ferrodiazotrophum* (Group III) in acid mine drainage biofilms. Applied and Environmental Microbiology 75:1-17.

Denef, V.J., N.C. VerBerkmoes, M. B. Shah, P. Abraham, M. Lefsrud, R.L. Hettich, and J.F. Banfield. 2009. Proteomics-inferred genome typing (PIGT) demonstrates inter-population recombination as a strategy for environmental adaptation. Environmental Microbiology 11(2):313-325.

Oral Presentations

CBC Radio One, Radio Noon (Montreal), Topic: Next generation biofuels - McGill University Food for Thought Lecture Series. Sept 15, 2009.

Québec Greenhouse Forum, Syndicat des producteurs en serre du Québec (SPSQ). Saint-Hyacinthe, Quebec, October 29, 2009.

Next generation biofuels. McGill University Food for Thought Lecture Series. Sept 15, 2009.

Solid Biomass Utilization: Bridging the Gap. 2nd Green Crop Network Workshop:
Green Crops Today & Tomorrow Montreal, QC. July 17, 2009.

Using Proteomics to Understand Environmental Spatial and Temporal Uniformity in Plant Growth Environments. GreenSys, Quebec City, June 17, 2009.

Other relevant accomplishments and activities.

From the successful application of a number of grants we are continuing our research for the upcoming year in LED lighting of lettuce, proteomic expression and measurement of Arabidopsis, and continued research on wood pellet greenhouse heating.