Annual Report
2008-2009

Submitted by
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Department of Bioresource Engineering
Macdonald Campus of McGill University

Publications are from January 1, 2008 to December 31, 2008
All Other Information is from June 1, 2008 to May 31, 2009

SECTION I – DESCRIPTION OF THE UNIT

Bioresource Engineering

Bioresource Engineering is the unique branch of engineering that includes Biological Engineering and Bioengineering where professional engineering practice intersects with biological sciences. Bioresource Engineers design, improve and manage biologically-based systems to operate in efficient and sustainable way for the well being of the environment and society. Whereas our interests were previously largely confined to agricultural systems, our discipline now encompasses the design, construction, remediation, and management of all manner of biosystems, addressing a much wider spectrum of system types and scales than before.

Bioresource Engineering encompasses a number of sub-disciplines, as listed below. It should be noted that the department's involvement in each sub-discipline includes research oriented to the development of knowledge and methods for engineering, as well as the teaching of programs at both undergraduate and graduate levels. The department also teaches courses at the technologist level as part of contractual obligations with other units inside McGill (e.g., the FMT program).

Sub-disciplines in Bioresource Engineering

a) Soil and Water Management - the design and development of systems for soil and water management, including irrigation, drainage, soil conservation, remediation, and reclamation
b) Food and Biotechnology - included in this are areas such as food, bioprocess, and fermentation for the production of food, nutraceuticals, pharmaceuticals, bio-fuels, etc.
c) Larger Environment - includes ecosystem design, management at the watershed scale, agricultural pollution control, bio-fuel generation, and remote sensing
d) Materials Processing - includes post-harvest food and feed engineering, as well as the handling of agricultural materials, and composting.
e) Automation and Control - application of control and computer technologies to biosystems; this includes mechatronics, robotics, and computer-based intelligence
f) Structures - buildings and associated systems for the production and processing of plants, animals and animal products, as well as the storage of biomaterials.
g) Machinery - the design and development of machinery, equipment, and power units for the mechanization of the production and handling of both food and feed.

The Purpose and General Objectives for the Department

The primary purpose and general objectives for the Department of Bioresource Engineering are:

a) To provide an excellent engineering education to our undergraduate, graduate, and postdoctoral students, so that they may continue to serve as leading professionals in the province of Quebec, in the rest of Canada, and elsewhere in the world;
b) To provide an ideal setting for our academic staff to fully develop to their potential, in terms of their research and professional accomplishment;
c) To make it possible for both our staff and students to do outstanding research, and to engage in other academic activities in strategic areas of bioresource engineering;
d) To stimulate curiosity in all those whose lives are intertwined with the department's, and to encourage them to widen their view to the greatest possible extent;
e) To provide leadership in the bioresource engineering profession so that it will remain a viable and vital part of the provincial, national, and international mosaic; and
f) To contribute to the health and welfare of our planet by helping to maintain the diversity of the biosphere and thus ensure its longevity.

SECTION II – THE PAST YEAR'S ACTIVITIES

Over the past year, our staff and students have engaged in teaching and learning, research, various types of professional work, administrative tasks, international travel, and extracurricular activities. Our undergraduate enrollment has been increasing significantly over the last few years, and this trend has continued with over 112 students in B.Eng. program in 2008-09. Similarly, our graduate student population has also been experiencing a very healthy renewal and stayed relatively steady at just over 67. Our new IWRM (International Water Resources Management) program had eight students during its first year of full operation (2007-08) and the number has grown to 17 in 2008-09. In addition to the three new professors that joined the department in 2007-08, a fourth professor has joined us in 2008-09. Additionally, a fifth professor has also been chosen and he has accepted our offer of employment; he is expected to join us by summer of 2010. At the end of May 2008, Robert Kok stepped down as the Chair of the department; Shiv Prasher took over the Chair as of June 1, 2008.

The Department and its Programs

♪ The new undergraduate program in Bioresource Engineering appears to be maturing; our enrollment has increased steadily and now tops 112. There are about 34 students per year entering U1 and about 6 entering the program at the U0 level (freshman program). It is anticipated that the undergraduate student body will continue to increase steadily, especially through increased freshman enrollment. The goal for total undergraduate enrollment remains 150 students. It should be possible to attain this goal in about five years.

♪ A number of minor adjustments to the Bioresource Engineering program are still outstanding at this time. As new staff is hired and other faculty programs are updated this will probably continue to be so.

♪ During the year the department was again very active in recruiting for the B.Eng. (Bioresource) program at both the U1 and U0 (freshman) levels. A recruiter was hired for the whole year and he marketed the B.Eng. program through personal visits to career and guidance counselors at CEGEPS and high schools throughout Quebec. The departmental website (http://www.mcgill.ca/bioeng/) and printed recruitment materials have also been updated.

♪ In the fall of 2008, one student graduated with the B.Eng. (Bioresource), and in the spring of 2009 another nineteen graduated, bringing the total to twenty for the 2008-2009 year.

♪ The new graduate program in Integrated Water Resources Management (IWRM) officially started in September 2006, with Professor Bonnell as the program director. The first cohort in 2006 consisted of three students; the second cohort in 2007 consisted of eight. Through an active recruitment campaign, the total enrollment in this program has increased to 17 in the 2008-2009 year. Dr. Jan Adamowski is the new program director and he is supported by a professional associate, Mr. Robert Oxley, to make this program even more successful.

♪ In the Fall of 2008, two M.Sc. and four PhD students graduated and then in the Spring of 2009 thirteen M.Sc. and 3 PhD students graduated, bring the total to twenty-two graduate degrees for the 2008-2009 year.

Academic Staff - Developments

♪ It is most noteworthy that in the department we have three James McGill professors (Professors Madramootoo, Prasher, and Raghavan) and one Dawson scholar (Prof. Ngadi). This makes us the most decorated department per capita in the entire University.

♪ Professor Chandra Madramootoo remains Dean of the Faculty of Agricultural and Environmental Sciences, reappointed on August 15, 2005.

♪ Dr. Bonnell is retiring as of August 31, 2009. Among others, he was the Director of both the Integrated Water Resources Management graduate program and the B.Eng. undergraduate program. He was also the Academic Advisor of the undergraduate program.

♪ Dr. Jan Adamowski has joined the department as of June 1 2009, and he is the new Director of the IWRM program.

♪ Dr. Clark is the new Academic Advisor for the undergraduate program, and Dr. McKyes is the Associate Academic Advisor.

♪ Dr. Valérie Orsat is the new Director of the B.Eng. undergraduate program and Dr. McKyes is the Associate Director.

♪ The three new academics, hired in 2007, i.e. Drs. Lefsrud, Clark, and Orsat, are settling in very well. Dr. Lefsrud will be working on bio-fuels; Dr. Orsat will be mainly working on nutraceutical extraction; and Dr. Clark will be working in the area of ecological engineering.

♪ Dr. Joyce Boye, a research scientist with Agriculture and Agri-Food Canada, joined the department as Adjunct Professor during the year. Her appointment runs until May 31, 2012.

♪ Dr. Young Choi, a research scientist with Biotechnology Research Institute, has been appointed as Adjunct Professor for three years from June 1, 2009 until May 31, 2012.

♪ Dr. Aleksandra Drizo of University of Vermont has been appointed as Adjunct professor for three years. Her appointment runs until May 31, 2012.

♪ Dr. Boris Tartkovsky, a research scientist with Biotechnology Research Institute, has been appointed as Adjunct Professor for three years. His appointment will run until May 31, 2012.

♪ Dr. Clément Vigneault was re-appointed as Adjunct Professor until May 31, 2011.

♪ Dr. Philippe Savoie was re-appointed as Adjunct Professor term until May 31, 2012.

♪ Dr. Jose Martinez, a research scientist at CEMAGREF, France, has been appointed as Adjunct Professor for one year until May 31, 2010.

♪ Dr. Ning Wang's appointment as Adjunct Professor was extended to May 31, 2010.

♪ Dr. Murray Clamen of the International Joint Commission has been appointed as Visiting Professor to March 31, 2010.

♪ As of June 1, 2009, our complement of adjunct professors was as follows:

- Dr. Joyce Boye appointed until May 31, 2012
- Dr. Young Choi appointed until May 31, 2012
- Dr. Aleksandra Drizo appointed until May 31, 2012.
- Dr. Boris Tartkovsky appointed until May 31, 20
- Dr. Clément Vigneault re-appointed until May 31, 2011
- Dr. Philippe Savoie re-appointed until May 31, 2011
- Dr. Jose Martinez appointed until May 31, 2010
- Dr. Serge Guiot appointed until May 31, 2011
- Dr. Sam Gameda appointed until May 31, 2010
- Dr. Ning Wang re-appointed until January 31, 2010

International Activities

Most of the professors in the department are involved in international activities. In this regard, Professor Barrington is part of a CIDA-funded project in Ethiopia where she is evaluating waste management research opportunities. Professor Bonnell continued working on a soil conservation research project in Iran. Professors Kok, Ngadi, and Raghavan are working on a rice processing project in Benin and Nigeria. Professor Madramootoo is the Project Director of CARIWIN, Caribbean Water Initiative project, funded by CIDA/AUCC, and Professor McKyes is also working with him on CARIWIN project in Barbados, Grenada, and Jamaica. Professor Raghavan has just completed a very large, CIDA-funded Tier 1 project entitled "Consolidation of Food Security in South India". In addition to the rice processing project in Benin and Nigeria, he is also assisting in the CIDA-funded Ethiopia project, primarily dealing with post-harvest food and feed processing academic curriculum development.

Staff Awards

- ♪ Professor Chandra Madramootoo was elected the President of International Commission on Irrigation and Drainage (ICID).
- ♪ Professor Robert Kok was elected as Fellow of the Canadian Society for Bioengineering (CSBE/SCGAB) for his outstanding and extraordinary qualifications and experience in the field of biological engineering.
- ♪ Professor Chandra Madramootoo was the winner of the N.D. Gulhathi Memorial Lecture Award of ICID.
- ♪ Professor Michael Ngadi was awarded the John Clark Award by CSBE/SCGAB for his outstanding work in teaching and research in Food Engineering.
- ♪ Professor Valerie Orsat was awarded the Young Engineer of the Year Award by CSBE/SCGAB for outstanding contributions to agricultural and food engineering.
- ♪ Professor Suzelle Barrington received the Canadian National Geographic Award for the Eco Quartier Composting Centre.
- ♪ Professor Robert Kok completed his one-year term as the President of the CSBE/SCGAB.
- ♪ Professor Shiv Prasher has become the President-Elect of the CSBE/SCGAB, to become the President in 2010.
- ♪ Professor Vijaya Raghavan received the Lifetime Achievement Award, in recognition of outstanding and sustained contributions to global drying research and development by the Drying Technology Journal at the 2008 International Drying Symposium.

Student Awards

♪ *Quebec Awards*

Several teams competed in the Conseil pour le developpement de l'agriculture du Quebec (CDAQ) sponsored poster competition. First-place winners were: Chloe Boucher-Ravenhorst, Marc-Andre Isabelle, and Carrie Rosevear; Second-place winners were: Mike Brodeur, Phil Brunet, and Robert Boutin.

♪ *American Society of Agricultural and Biological Engineers*

First place in the Gunlogson Environmental Design Competition – Marie Manchester, Amy Mclintock and Jenna Senecal-Smith

♪ *Canadian Society for Bioengineering*

Undergraduate Design Project Award ($100 or $50 per student)

Pénéloppe Thériault and Thomas Fortin-Chevalier for a project entitled "Design of a continuous flow Bio-diesel Production Research Unit" (Advisors: Vijaya Raghavan and Valérie Orsat)

Undergraduate Thesis Award ($100 or $50 per student)

Meghan Bichsel, Mark Burnham and Philippe Glaude for a paper entitled "Design of food waste anaerobic digester" (Advisors: Vijaya Raghavan and Mark Lefsrud)

Graduate Thesis Award (Ph.D.) ($200)

Jun Xue for a thesis entitled "Thermal and rheological properties of batter systems" (Advisor: Michael Ngadi)

♪ *North Atlantic Biological Engineering Conference*

Graduate Students

- First-place, oral presentation: Yaqiong Hu, Mark Eastman, Satyanarayan Dev
- Second-place, poster presentation: Simona Nemes

Undergraduate Students

First place in Student Design Category entitled "An Alternative Energy Source for the Raymond Greenhouse: Wood pellets by Louis-Martin Dion, David Molesworth, and Guillaume Proulx-Gobeil (Advisors: Mark Lefsrud and Vijaya Raghavan)

♪ *University Awards*

Many of our students received awards at the 2008-2009 Scholastic Awards Reception in October. Among these were the following: Kristian Swan received the Atlantic Provinces Entrance Scholarship; Audrey Yank received the Mary Emily Brown Entrance Scholarship; Tatjana Trebic received an Eliza M. Jones Entrance Award; nine of our students were on the Dean's Honour List; Stéphanie Dumais, Megan Fulleringer, Miriam Lebeau, Tatjana Trebic and Audrey Yank received McGill University Entrance Scholarships; Stépahnie Dumais and Sarah Lebel received Macdonald Medals; Caitlyn Chappell and Michael Mee received Eliza M. Jones Awards; Eric Baumann and Michael Mee received J.W. McConnell Awards/James McGill Awards; Diana Lalla received the Food and Nutrition Research Foundation Scholarship; Jonathan Martel-Gagnon received the James H. Cooper Memorial Scholarship; Louis-Martin Dion received the John Deere Scholarship; Sarah Lebel received the Mackenzie Family Scholarship and Eric Baumann received the Syngenta Crop Protection Canada Scholarship.

Research Associates/PDF's in the Department

- ♪ G. Dodds
- ♪ Y. Gariepy
- ♪ S. Kamra
- ♪ Y. Karimi (PDF)
- ♪ M. Kasaai
- ♪ M. Lautman
- ♪ L. Liu (PDF)
- ♪ Z. Li
- ♪ R. Patel
- ♪ M. Simpson

SECTION III – RESEARCH FUNDING

Project and research funding for the department comes from many different sources. During the past five fiscal years total income to the department was as follows:

Fiscal Year 2004-2005	$17,036,542
Fiscal Year 2004-2006	$14,000,136
Fiscal Year 2006-2007	$ 2,997,705
Fiscal Year 2007-2008	$ 4,202,020
Fiscal Year 2008-2009	$ 2,029,704

During the fiscal years 2004-2005 and 2005-2006 a number of staff members were very successful in attracting CFI funding so that the totals for these two years are much larger than usual. Funding details are presented in table format on the next two pages.

APPENDIX I: HONOURS, AWARDS AND PRIZES

Barrington, S.
- Canadian National Geographic Award for the Eco Quartier composting centre.
- Adjunct professor, Institut de recherche en biotechnologie de Monastir, Tunisie.
- Adjunct professor, l'École supérieure des ingénieurs de l'Équipement Rural de Jendouba, Tunisie.

Kok, R.
- Elected to the grade of Fellow of the Canadian Society for Bioengineering / La Société Canadienne de Génie Agroalimentaire et de Bioingénierie – July 2008

Lefsrud, M.
- BREE 314 won first (Chloé Boucher-Ravenhorst, Marc-André Isabelle, Carrie Rosevear) and second (Mike Brodeur, Phil Brunnet, Robert Boutin) place for a poster competition sponsored by MAPAQ within the Macdonald Campus. 2008
- Advised team (Pénéloppe Thériault and Thomas Fortin-Chevalier) on final design project that won 1st place at CSBE undergraduate design competition. 2008

Madramootoo, C.A.
- Winner of the N.D. Gulhathi Memorial Lecture Award, October 2008, ICID
- Elected President of the International Commission on Irrigation and Drainage, October 2008.

Ngadi, M.O.
- John Clark Award, The Canadian Society for Bioengineering (CSBE/SCGAB), July 15, 2008

Orsat, V.
- 2008 Young Engineer of the Year Award, Canadian Society for Bioengineering, July 15th, 2008.

Prasher, S.O.
- President-Elect, Canadian Society for Bio Engineering (2009-2010)

Raghavan, G.S.V.
- James McGill Professor, in recognition of outstanding professional and academic performance January 2009 – 2016 (Equivalent of Canada Research Chair – Tier 1)
- Lifetime Achievement Award, in recognition of outstanding and sustained contributions to global drying R&D. Presented by Drying Technology Journal at the International Drying Symposium (IDS) held in Hyderabad, India. 2008

APPENDIX II: PUBLICATIONS, CALENDAR YEAR 2008-01-01 TO 2008-12-31

Part A: Publications in REFEREED Journals

Barrington, S.

Kim, J-W, S. Barrington and J. Sheppard. 2008. Response surface optimization of medium components for citric acid production by Aspergillus niger NRRL 67 grown in peat moss. Journal of Bioresource Technology. 99 (2), 368- 377.

Adhikari, B., S. Barrington and J. Martinez. 2008. Characteristic of food waste and bulking agents for composting. Journal of Waste Management. 28, 795-904.

Kunjikutty, S., S.O. Prasher, R. Patel, S.F. Barrington and S Hyun-Kim. 2008. Simulation of nitrogen transport in soil under municipal wastewater application using LEACHN. Journal of American Water Resource Association. In Press, May 2007.

Ortega-Charleston, L., S. F. Barrington, S. R. Guiot. 2008. Thermophilic adaptation of a mesophilic anaerobic sludge for food waste treatment. Journal of Environmental Management. 88 (3), 517-525.

Lin, X.J. , S. Barrington, D. Choinière and S. Prasher. 2008. Effect of weather on windbreak odour dispersion. Journal of Wind Engineering and Industrial Aerodynamics. Accepted August 2007.

García Moreno, R., M.C. Díaz Álvarez , A. Tarquis Alonso, S. Barrington and A. Saa Requejo. 2008. Tillage and soil type effects on soil surface roughness at semiarid climatic conditions. Journal of Soil and Tillage Research. 98 (1), 35-44.

Morin, S., S. Barrington, J. Whalen and J. Martinez. 2008. A modified septic and seepage system for the treatment of dairy farm milk house wastewaters. Journal of Canadian Bioresource Engineering. 50, 6.7- 6.15.

Garcia Moreno, R., A. Saa Requejo, A.M. Tarquis Alonso, S. Barrington and M.C. Diaz Alvarez. 2008. Shadow analysis: a method for measuring soil surface roughness. Journal of Geoderma. 146 (1) 201-208.

Mainoo, N-O, J. Whalen, S. Barrington. 2008. Earthworm abundance related to soil physicochemical and microbial properties in Accra, Ghana. African Journal of Agricultural Research. 3 (3) 186-194.

Ortega-Charleston, L., C. Husser, S. F. Barrington, S. R. Guiot. 2008. Methane production test: a tool for evaluating anaerobic limiting-step degradation of food waste. Journal of Water, Science and Technology. 57.3; 419-422.

Adhikari, B., S. Barrington and J. Martinez. 2008. Effectiveness of three bulking agents in composting food waste. Journal of Waste Management. Journal of Waste Management. 29, 1997-203.

Adhiraki, B, S. Barrington and J Martinez. 2008. Urban food waste generation: challenges and opportunities. International Journal of Environment and Waste Management. Volume 3 (1/2), 4-21.

Bonnell, R.

Hossein S., R. Bonnell, F. Sharifi, G. Mehuys, M. Namdar and S. Ale-Ebrahim. 2007. Landform Classification from a digital elevation model and satellite imagery. Geomorphology 100, 453-464.

Clark, G.

Yu, S., O.G. Clark, J.J. Leonard. 2009. Influence of free air space on microbial kinetics in passively aerated compost. *Bioresource Technology*. Online DOI 10.1016/j.biortech.2008.06.051

Yu, S., O.G. Clark, and J.J. Leonard. 2008. Estimation of vertical air flow in passively aerated compost in a cylindrical bioreactor. *Canadian Biosystems Engineering* 50:6.29–6.35

Clark, O.G., J.J.R. Feddes, J.-C. Segura. 2008. Multiport averaging pitot tube to measure airflow rates from exhaust fans. *Canadian Biosystems Engineering* 50:5.1–5.7

The article above was translated and summarized as: Clark, O.G. *et al*. 2009. Tubo Pitot multipuerto promedio para medir las velocidades de flujo de aire de los ventiladores de tubos de escape. *Revista VIRTUALPRO* 85:15. Bogotá, Colombia: Editorial VIRTUALPRO. Online:http://www.revistavirtualpro.com/ediciones/instrumentacion_y_control_sensores-2009-02-01_15

Yu, S., O.G. Clark, J. Leonard. 2008. A statistical model for the analysis of nonlinear temperature time series from compost. *Bioresource Technology* 99:1886–1895

Kok, R.

Katayama N, Y. Ishikawa, M. Takaoki, M. Yamashita, S. Nakayama, K. Kiguchi, R. Kok, H. Wada, and J. Mitsuhashi. 2008. Entomophagy: A key to space agriculture. Advances in Space Research 41:701-705.

Lefsrud, M.

Lefsrud, M.G., D.A. Kopsell, C.E. Sams. 2008. Wavelengths from Adjustable Light- emitting Diodes affect Secondary Metabolites in Kale. HortScience 43(7):2243–2244

Lefsrud, M.G., D.A. Kopsell, J. Wills Jr., C. Sams, and A.J. Both. 2008. Dry Matter Content and Stability of Carotenoids in Kale and Spinach During Drying. HortScience 43(6):1731-1736.

Wilmes, P., A.F. Andersson, M.G. Lefsrud, N.C. VerBerkmoes, M. Wexler, M. Shah, P.L. Bond, R.L. Hettich, J.F. Banfield. 2008. Community proteogenomics highlights strain-variant protein expression within activated sludge performing enhanced biological phosphorus removal. ISME Journal 2:853–864.

Denef, V.J., N.C. VerBerkmoes, M. B. Shah, P. Abraham, M. Lefsrud, R.L. Hettich, and J.F. Banfield. 2008. Proteomics-inferred genome typing (PIGT) demonstrates inter-population recombination as a strategy for environmental adaptation. Environmental Microbiology 11(2):313-325.

Madramootoo, C.A.

Dayyani, S., C.A. Madramootoo, P. Enright, G. Simard, A. Gollamudi, S.O. Prasher and A. Madani. 2008. Field evaluation of Drainmod 5.1 under a cold climate: Simulation of daily midspan water table depths and drain outflows. Journal of the American Water Resources Association, 45(3):779-792

Webber, H. and C.A. Madramootoo. 2008. Soil water dynamics of alternate furrow and regulated deficit irrigation for two legume crops. Transactions of the ASABE, 51(4): 1341-1350.

Webber, H. and C.A. Madramootoo. 2008. Response of two legume crops to soil salinity in gypsiferous soils. Irrigation and Drainage (In Press, 2009; accepted – July 2008).

Webber, H., C.A. Madramootoo and D. Smith. 2008. Adapting CROPGRO for regions with saline soils. Irrigation Science (accepted – July 2008).

Ojha, C.S.P., K.S. Hari Prasad, V. Shankar and C.A. Madramootoo. 2008. Evaluation of a non-linear root water uptake model. Journal of Irrigation and Drainage (in press).

Doria, R. and C.A. Madramootoo. 2008. Estimation of irrigation needs for some crops in Southern Quebec using CROPWAT. Irrigation and Drainage (In Press, 2009; accepted December 2008).

Giroux, M., M. Duchemin, A.R. Michaud, I. Beaudin, C. Landry, P. Enright, C.A. Madramootoo et M.R. Laverdière. 2008. Relation entre les concentrations en phosphore particulaire et dissous dans les eaux de ruissellement et les teneurs en P total et assimilable des sols pour différentes cultures. Agrosolutions, 19(1) : 4-14.

Ngadi, M.O.

Dehghannya, J.,M. Ngadi, and C. Vigneault. 2008. Simultaneous aerodynamic and thermal analysis during cooling of stacked spheres inside ventilated packages. Chemical Engineering and Technology 31(11): 1651-1659.

Gachovska, T.K., A.A. Adedeji, M. Ngadi, and G.S.V. Raghavan. 2008. Drying characteristics of pulsed electric field-treated carrot. Drying Technology 26(10): 1244-1250.

Adedeji, A.A., T.K. Gachovska, M. Ngadi, and G.S.V. Raghavan. 2008. Effect of pretreatments on drying characteristics of okra. Drying Technology 26(10): 1251-1256.

Li, Y.S., M. Ngadi, and S. Oluka. 2008. Quality changes in mixtures of hydrogenated and non-hydrogenated oils during frying. Journal of the Science of Food and Agriculture 88(9): 1518-1523.

Gallardo-Reyes, E.D., A. Valdez-Fragoso, G.V, Nevarez-Moorillon, M. Ngadi, and E. Ortega-Rivas 2008. Comparative quality of orange juice - as treated by pulsed electric fields and ultra high temperature. Agro Food Industry Hi-tech 19(1): 35-36.

Orsat, V.

Changrue, V., V. Orsat and G.S.V. Raghavan. 2008. Osmotically dehydrated microwave-vacuum drying of strawberries. Journal of Food Processing and Preservation. 32:798-816.

Orsat, V., G.S.V. Raghavan and V. Sosle. 2008. Adapting drying technologies for agri-food market development in India. Drying Technology. 26(11): 1355-1361.

Changrue, V., V. Orsat, G.S.V. Raghavan and D. Lyew. 2008. Effect of osmotic dehydration on the dielectric properties of carrots and strawberries. Journal of Food Engineering, 88:280-286.

Sunjka, P.S., V. Orsat and G.S.V. Raghavan. 2008. Microwave/vacuum drying of cranberries. American Journal of Food Technology, Vol.3(2):100-108.

Prasher, S.O.

Jutras, P., S.O. Prasher, and G. Mehuys. 2009. Prediction of street tree morphological parameters using artificial neural networks. Accepted for publication in Agricultural Water Management. February 3, 2009.

Dayyani, S., C.A. Madramootoo, P. Enright, G. Simard, A. Gullamusi, S. O. Prasher, and A. Madani. 2009. Field evaluation of DRAINMOD 5.1 under a cold climate: simulation of daily midspan water table heights and drain outflows. Journal of the American Water Resources Association, Vol. 45(3):779-792.

Abdel-Nour, N., M. Ngadi, S.O. Prasher, and Y. Karimi. 2009. Combined maximum R^2 and partial least squats method for wavelength selection and analysis of spectroscopic data. International Journal of Poultry Science, Vol. 8(1):170-178.

Jutras, P., S.O. Prasher, and P. Dutilleul. 2009. Identification of Significant Street Tree Inventory Parameters Using Multivariate Statistical Analyses. Accepted for publication in Arboriculture and Urban Forestry. November 10, 2008.

Sharda, V.N., S.O. Prasher, R.M. Patel, P.R. Ojasvi, and C. Prakash. 2008. Performance of MARS models in predicting runoff in middle Himalayan micro-watersheds with limited data. Hydrological Sciences Journal, Vol. 53(6): 1165-1175.

Han, L., P. Dutilleul, S.O. Prasher, C. Beaulieu, and D.L. Smith. 2008. Assessment of Density Effects of the Common Scab-Inducing Pathogen on the Seed and Peripheral Organs of Potato during Growth Using Computed Tomography Scanning Data. Accepted for publication in the Transactions of the ASABE. November 24, 2008.

Han, L., P. Dutilleul, S.O. Prasher, C. Beaulieu, and D.L. Smith. 2008. Assessment of common scab-inducing pathogen effects on potato underground organs via computed tomography scanning. Phytopathology, Vol. 98: 1118-1125

Raghavan, G.S.V.

Adedeji, A., T. Gachovska, M. Ngadi and G. Raghavan. 2008. Effect of pretreatments on drying characteristics of okra. Drying Technology 26(10): 1251-1256.

*Ahmed, J., H. Ramaswamy and G. Raghavan. 2008. Dielectric properties of soybean protein isolate dispersions as a function of concentration, temperature and pH. LWT-Food Science and Technology 41(1): 71-81.

Ahmed, J., H. Ramaswamy and V. Raghavan. 2008. Dynamic viscoelastic, calorimetric and dielectric characteristics of wheat protein isolates. Journal of Cereal Science 47(3): 417-428.

Changrue, V., V. Orsat and G. Raghavan. 2008. Osmotically dehydrated microwave-vacuum drying of strawberries. Journal of Food Processing and Preservation 32(5): 798-816.

Changrue, V., V. Orsat, G.S.V. Raghavan and D. Lyew. 2008. Effect of osmotic dehydration on the dielectric properties of carrots and strawberries. Journal of Food Engineering, 88:280-286

*Dev, S., T. Padmini, A. Adedeji, Y. Gariepy and G. Raghavan. 2008. A comparative study on the effect of chemical, microwave, and pulsed electric pretreatments on convective drying and quality of raisins. Drying Technology 26(10): 1238-1243.

Hui, K., C. Vigneault, L. De Castro and G. Raghavan. 2008. Effect of different accessories on airflow pattern inside refrigerated semi-trailers transporting fresh produce. Applied Engineering in Agriculture 24(3): 337-343.

*Hui, K.P.C., C. Vigneault, S.A. Sotocinal, L.R. de Castro and G.S.V. Raghavan. 2008. Effects of loading and air bag bracing patterns on correlated relative air distribution inside refrigerated semi-trailers transporting fresh horticultural produce. Canadian Biosystems Engineering. 3.27-3.35

Joshi, N., Y. Gariepy and G. Raghavan. 2008. Comparative evaluation of different pretreatments on tomato slices dried in a cabinet air drier. International Journal of Food Engineering 4(7): 1261.

Kanchana, S., Raghavan, G.S.V, Sosle, V., Gariepy, Y. 2008. Quality assessment of dehydrated idli. Journal of Food Science & Technology, Mysore. 45(2):177-179

Kushalappa, A., A. Vikram and G. Raghavan. 2008. Metabolomics of headspace gas for diagnosing diseases of fruits and vegetables after harvest. Stewart Postharvest Review 4(2): 1-7.

Lu, J., P. Delaquis, C. Vigneault, M.T. Charles, G.S.V. Raghavan, V. Toussaint, and J.W. Austin. 2008. Multidisciplinary approach to postharvest heat treatment of fruits and vegetables. In: Recent Advances in Agriculture. Research Signpost, Kerala, India. Chapter 8, 00 189-210.

*Muthukumaran, A., C. Ratti and G.S.V. Raghavan. 2008. Foam-mat freeze drying of egg white and mathematical modeling part i optimization of egg white foam stability. Drying Technology 26(4): 508-512.

*Muthukumaran, A., C. Ratti and G.S.V. Raghavan. 2008. Foam-mat freeze drying of egg white—mathematical modeling part ii: Freeze drying and modeling. Drying Technology 26(4): 513-518.

Niamnuy, C., S. Devahastin, S. Soponronnarit and G. Vijaya Raghavan (2008). "Kinetics of astaxanthin degradation and color changes of dried shrimp during storage." Journal of Food Engineering 87(4): 591-600.

*Niamnuy, C., S. Devahastin, S. Soponronnarit and G. Vijaya Raghavan (2008). "Modeling coupled transport phenomena and mechanical deformation of shrimp during drying in a jet spouted bed dryer." Chemical Engineering Science 63(22): 5503-5512.

Orsat, V., G. Raghavan and V. Sosle (2008). "Adapting drying technologies for agri-food market development in India." Drying Technology 26(11): 1355-1361.

Shivhare, U., M. Gupta, S. Basu and G. Raghavan (2008). "Optimization of blanching process for carrots." Journal of Food Process Engineering. December 2008. DOI: 10.1111/j.1745-4530.2007.00234.

Sunjka, P., V. Orsat and G. Raghavan (2008). "Microwave/vacuum drying of cranberries (*vacccinium macrocarpon*)." American Journal of Food Technology 3(2): 100108.

APPENDIX II: PUBLICATIONS, CALENDAR YEAR 2008-01-01 to 2008-12-31

Part B: Publications in REFEREED Conference Proceedings

Barrington, S.

Finley, S., S. Barrington and D. Lyew. 2008. Risk assessment of using domestic greywater for the irrigation of food crop. Technical meeting. Canadian Association of Water Quality. Montreal, Canada.

King, S., S. Barrington, S. Guiot. 2008. In-storage- psychrophilic anaerobic digestion: a wastewater treatment strategy adapted to the needs of Canada's pork producers. Technical meeting, November 2008. Canadian Association of Water Quality. Montreal, Canada.

Whalen, J. and S. Barrington. 2008. The role of livestock in maintaining soil organic matter. SoilAce conference, Puerto de la Cruz, Tenerife.

Ngadi, M.O.

Adedeji A.A., Ngadi M.O. 2008. Microstructural characterization of deep-fried breaded products using x-micro-CT. In: Proceedings of the 10th nternational Congress on Engineering and Food (ICEF 10), April 2008, Viña del Mar, Chile (CD-ROM).

Dehghannya J., Ngadi M., Vigneault C. 2008. Simulation of airflow during forced-air precooling of bulk produce in vented package. In: Proceedings of the 10th International Congress on Engineering and Food (ICEF 10), April 2008, Viña del Mar, Chile (CD-ROM).

Raghavan, G.S.V.

Changrue, V., W. Phaphuangwittayakul, W. Sriboon and G.S.V. Raghavan. 2008. LPG gas vaporizing mathematical model for drying process. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 392-395.

Niamnuy, C., S. Devahastin, S. Soponronnarit and G.S.V. Raghavan. 2008. Modeling shrimp rying using heat/mass transfer and solid mechanics concepts.Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 501-507.

Dussadee, N., W. Phaphuangwittayakul, K. Sasujit, V. Changrue and G.S.V. Raghavan. 2008. Rice husk cyclonic combustor for longan batch dryer. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 709-713

Raghavan, G.S.V., Z. Li, N. Wang and Y. Gariepy. 2008. Control of microwave drying rocess through aroma monitoring. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 807-815.

Nordin, M.F.M., Y. Gariepy, W.R.W. Daud, G.S.V. Raghavan and M.Z.M. Talib. 2008. M Microwave and hot air drying for red pitaya (hylocereus undatus). Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P :858-863.

Suryawanshi, M.V., K.R. Naik, R. Poornima, N. Uppinal, V. Sosle and G.S.V. Raghavan. 2008. Low cost antibrowning treatments aids compatible drying for minimally processed potato products. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1021-1025.

Phaphuangwittayakul, W., V. Changrue, P. Siriplabpla and G.S.V. Raghavan. 2008. Simultaneous heating and cooling for Thai herb by heat pump technique. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1040-1043.

Sunjka, P., G.S.V. Raghavan and V. Orsat. 2008. Drying pretreatments: A review of methods and their influence on the process. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1283-1289.

Sugapriya, S., P.N. Anisha, K.R. Naik, V. Sosle and G.S.V. Raghavan. 2008. "Anardana" a dried byproduct from pomegranate aids in consolidation of food security. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1329-1332.

Naik, K.R., M.V. Suryawanshi, V. Sosle and G.S.V. Raghavan. 2008. Consolidation of food and income level through improvement in traditional potato storage structures – a success story. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1347-1351.

Naik, K.R., M.V. Suryawanshi, R. Poornima, N. Uppinal, A.A. Patil, V. Sosle and G.S.V. Raghavan. 2008. Improved traditional storage structure-boon to the onion growers – A success story. Proceedings of the 16th International Drying Symposium. Hyderabad, India, 9-12 November 2008. P: 1546-1550.

APPENDIX II: PUBLICATIONS, CALENDAR YEAR 2008-01-01 to 2008-12-31

Part C: Other Publications

Barrington, S.

Barrington, S. 2008. Minimiser l'énergie de séchage des grains. Journée d'information sur le séchage des grains. MAPAQ, St Jean sur Richelieu, Québec.

Mohaver, A., S. Barrington, A. Trémier and J. Martinez. 2008. Microbial oxygen uptake during composting as influenced by compost material physical parameters. Ouvrage scientifique présenté à la réunion technique annuelle du Canadian Society of Bioresource Engineering.

Finley, S., S. Barrington et D. Lyew. Impact of using greywater for the irrigation of vegetable crops. Ouvrage scientifique présenté à la réunion technique annuelle du Canadian Society of Bioresource Engineering.

Schwalb, M., C. Rosevear and S. Barrington. 2008. Optimizing the capacity of a rotary composter. Technical meeting. Compost Council of Canada. Toronto, ON. Technical Report.

Cordeau, S. et S. Barrington. 2008. The performance of solar walls on the ventilation of two broiler barns – Fall 2007. Report presented to CDAQ, Longueuil, Quebec, Coop Fédérée and Natural Resource Canada, Ottawa, Canada.

Cordeau, S. et S. Barrington. 2008. The performance of solar walls on the ventilation of two broiler barns – Winter 2008. Report presented to CDAQ, Longueuil, Quebec, Coop Fédérée and Natural Resource Canada, Ottawa, Canada.

Lyew, D., Q. Yong and S. Barrington. 2008. Initial results of testing microbes to fix CO2 under high temperatures. Intellectum Research inc., Vancouver, Canada.

Barrington, S. 2008. In storage psychrophilic anaerobic digestion of manures. Progress report of November 2008 for GTI and NSERC.

Lyew, D., Q. Yong and S. Barrington. 2008. Progress report of Sep 08 on testing microbes to fix CO2 under high temperatures. Intellectum Research inc., Vancouver, Canada.

Lyew, D., Q. Yong and S. Barrington. 2008. Final report of December 08 on testing microbes to fix CO2 under high temperatures. Intellectum Research inc., Vancouver, Canada.

Bonnell, R.

Book Chapter: Marko Tosic, Robert B. Bonnell, Pierre Dutilleul and Hazel A. Oxenford 2009 Runoff Water Quality, Landuse and Environmental Impacts on the Bellairs Fringing Reef, Barbados. In: X. Yang (ed.), *Remote Sensing and Geospatial Technologies for Coastal Ecosystem Assessment and Management*, Springer-Verlag Berlin Heidelberg.

Lefsrud, M.

D'Amours. L., P. Savoie, F. Lavoie, and **M. Lefsrud**. 2008. Vertical partition of corn stover fractions prior to harvest. ASABE Conference Paper 083592. Providence, hodes Island, June 29-July 2.

Kopsell, D.A., **M.G. Lefsrud**. 2008. Pre-harvest manipulation of growing conditions can influence carotenoid concentrations in vegetable crops. ACS Paper #1184386 - 236th ACS National Meeting, Philadelphia, PA, August 17-21, 2008.

Orsat, V.

Orsat, V., and G.S.V. Raghavan. 2008. Dewatering for food waste. In: "Handbook of water and energy management in food processing". Edited by J. Klemes R. Smith and J-K Kim. Woodhead Publishing Ltd. June 2008. ISBN 978-1-84569-195-0. Chapter 21:612-626.

Sosle, V., V. Orsat and G.S.V. Raghavan. 2008. CIDA Tier 1 Final Project Report, "Consolidation of Food Security in South India" presented to CIDA (Canadian International Development Agency), February 2008.

APPENDIX III CONSULTING ACTIVITIES JAN. 1, 2008 – DEC. 31, 2008

Bonnell, R.

Days	Private/Public/Other	Details
10	Private	PLA Consultants
Total Days: 10		

Broughton, R.

Days	Private/Public/Other	Details
10	Private	McGill University
10	Public	CIDA/Agriculture and Agri-food Canada
Total Days: 20		

McKyes, E.

Days	Private/Public/Other	Details
3	Private	Qikiqaaluk Environmental Inc. water crossings in Baffin Island
4	Private	Mezztek Inc. mezzanines
3	Private	Ottmar Bochardt slope stability
Total Days: 10		

Ngadi, M.O.

Days	Private/Public/Other	Details
14	Private	International Air Transport Association (IATA). Total global production capacity for 2^{nd} (or 3^{rd}) generation biofuels
Total Days: 14		

Prasher, S.O.

Days	Private/Public/Other	Details
20	Public	City of Montreal – Consulted on modeling approaches to urban forestry using spectral and laser-based approaches
Total Days: 20		

Raghavan, G.S.V.

Days	Private/Public/Other	Details
15	Private	KHD Sustainable Innovations
10	Public	WARDA/McGill Rice Processing
7	Other	Food Industry (Chennai)
Total Days: 32		