CSA Newsletter

Canadian Society of Agronomy **September 2010**

PRESIDENT'S MESSAGE

Dear Colleagues,

First and foremost I would like to thank you for entrusting me with the presidency of the Canadian Society of Agronomy for the ensuing term. I am proud to be a member of the Society, especially a society whose members strive to produce more and better quality food, while maintaining sustainability for this as well as the generations to come; not a small task for some 180 members! I would also like to express my and the Society's thanks to Shabtai Bittman for his able guidance of the Society over the past year and to all the members of the executive and the many committees, who tirelessly worked to ensure an efficient operation and communication with all members.

The challenging weather we have been encountering this year is a reminder of the challenges that we are facing in our profession. As we move forward, the Society executive has discussed the opportunities we have in designing a "made in Canada" version of the Grand Challenge for Agronomy. Recent events, such the much publicized takeover of the PotashCorp by BHP Billiton is only a small indication on how important food production is about to become as the world's population is expanding. In the meantime, production challenges remain great, in spite of some political powers considering production agriculture and investment in relevant research as an outdated concept.

Over the years, I had the privilege to make over 630 extension presentations, including 85 in the last three years, almost exclusively on production agriculture and agronomy. If you think that all production agriculture problems are solved, think again! Anywhere between "new" technologies, some so new that they are not even tested to prove that they work, to new crop cultivars with a new set of nutrient demands to molecular genetics (yes, they are part of agronomy) and the ever-growing environmental stresses, the contribution of our profession is constantly needed and needed more.

We had a very successful conference this past June in Saskatoon together with our sister Society of Soil Science. Fifty eight society members participated in the conference and I had the opportunity to meet with some of you. I am hoping that over the next year we will have the chance to meet again. At this year's annual meetings we honoured the best paper in the Canadian Journal of Plant Science by Chen et al. (89:1065-1074) and organized a very successful statistics webinar that was attended by over over 90 people (thanks Yantai!). A short summary of this year's best paper in layman language will shortly appear in the Top Crop Manager magazine.

As both farmers and those of our colleagues that are involved in field research are harvesting or are about to harvest their crops, let us gather or thoughts and take the time to contemplate as what went right and what might have gone wrong with this year's conference and how we can make annual conferences more attractive to a wider segment of our Society membership. The executive is open for suggestions on this as well as any other issues.

Have a great fall!
Rigas Karamanos

Chosen as Best 2009 Agronomy Paper in CJPS

Dong Chen, Michael Peel, Kenneth Olson, Bart Weimer and Daryll DeWald.
Differential ruminal degradation of alfalfa proteins. CJPS 89:1065-1074.

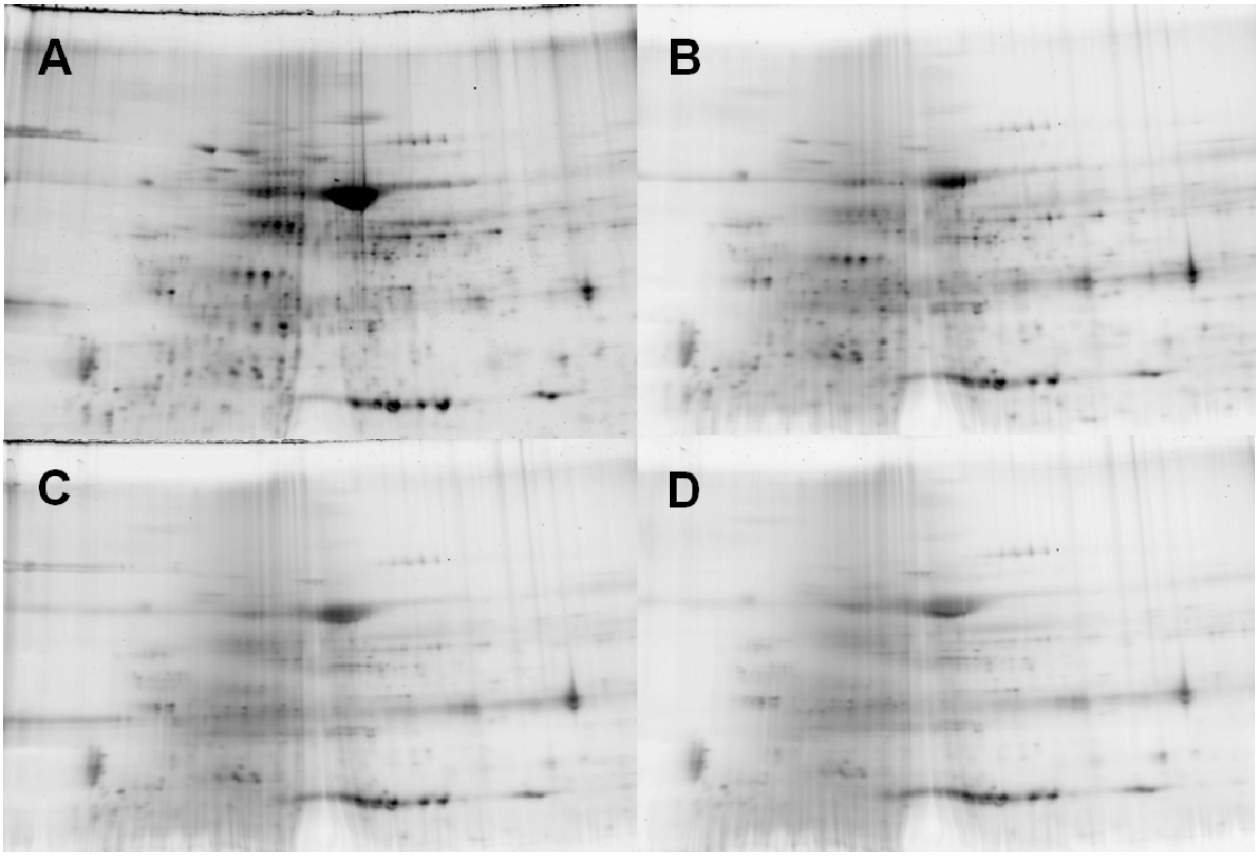
Increasing Alfalfa Rumen Bypass Protein

The efficiency of forage protein utilization by livestock depends on how much of it is microbially degraded in the rumen before it gets into the other chambers of the stomach. Bypass proteins make it past microbial digestion into the other chambers of the stomach. Alfalfa has one of the highest crude protein contents among forage crops but it is rapidly and extensively degraded by rumen microorganisms. This decreases the amount of total protein available for livestock nutrition and increases the risk of bloat caused by the excessive build-up of gas in the rumen. To breed an alfalfa variety with increased bypass proteins requires two things: genetic variation for reduced microbial digestion and the capacity to consistently identify these lines. Alfalfa total protein is comprised of several different types of proteins. While the variation among alfalfa varieties for rumen bypass of total protein has been studied, there is very little information on the microbial degradation of specific types of alfalfa proteins. If we can find certain types of proteins that are degraded to a lesser extent than others, it may be possible to select for varieties with higher concentrations of these proteins, thereby increasing total bypass protein and reducing the risk of bloat.

To examine differential protein digestion, three distinct varieties of alfalfa, grown from single plants, were subjected to fermentation in the rumen of a cannulated steer for 0, 45 and 120 minutes. A cannulated steer is an experimental animal that has been surgically fitted with a porthole-like device allowing samples to be inserted and retrieved from the rumen. After digestion, total protein was extracted from the fermented alfalfa residues and the individual proteins were separated using two-dimensional gel electrophoresis. The individual proteins were labeled with different fluorescence dyes for identification and quantification. The degradation times were labeled separately and the gels were digitally scanned and processed to determine amounts of the different proteins. Individual proteins were identified by removing the spots from the gels, determining their amino acid sequences and comparing them to amino acid sequences from known proteins.

Twenty six major proteins ranging from stable to highly digestible were successfully characterized from the alfalfa varieties. These proteins represented 36% of the total protein detected. After 45 min of rumen digestion 9 of these proteins still had greater than 75% of their total mass remaining, 12 had 50% or less remaining, and six were intermediate. After 120 min of rumen digestion four proteins still had greater than 80% of their mass remaining, 7 were between 80 and 50%, and 16 had less than 50% remaining. After both 45 and 120 minutes of rumen digestion there were three proteins showing differences among the three alfalfa varieties, while most of the other proteins showed similar rates of digestion. After 120 minutes there were significant differences in protein digestion rates among the three varieties for 10 out of 26 of the identified proteins.

Our experiment shows that we could improve the value of alfalfa as a dietary protein source by selecting varieties with a higher percentage of the proteins that are digested more slowly, or escape rumen digestion altogether. This will result in a greater concentration of the bypass proteins. These improvements would lead to more metabolizable protein for the animals and reduce the chances of bloat from excessive rumen gas production. Since more of the nitrogen containing protein will be digested by the animals there will be less environmental contamination from animal wastes. To take advantage of this research a rapid, reliable rumen digestion procedure needs to be refined so that large numbers of varieties can be tested. We also need to determine what the affects of changing protein types and concentrations are on the plant's agronomic performance. Finally, animal feeding trials will need to be done to show that the new alfalfa varieties result in greater metabolizable protein and less risk of bloat.



Differential degradation of proteins observed using two-dimensional gel electrophoresis. A=unwashed forage sample, B=time zero washed but undigested, C=45 min of digestion, =120 min of digestion.

CSA Annual Conference Feedback

What did you think of the conference?

The weather was good. Apart from construction, the campus seemed nice. Any comments about the conference itself?

Every year, volunteers from CSA face the major challenge of setting up our conference. These things have a sizeable budget, with potential for a loss that CSA would need to absorb. And scientists are particular about their conferences. Let us know what you thought was good and not good in Saskatoon. Send your messages to Steve Sheppard at sheppards@ecomatters.com.

Next year is in Halifax, we are meeting with Plant Canada. The local CSA team has been working on this 2011 conference for over a year already, and the plans look very good.

Venues for 2012 and 2013 are less well defined. Ideas and volunteers welcome.

Thanks!

Steve Sheppard

CSA Student Award Winners
CSA Conference, June 20-24, 2010
University of Saskatchewan

ORAL PRESENTATIONS

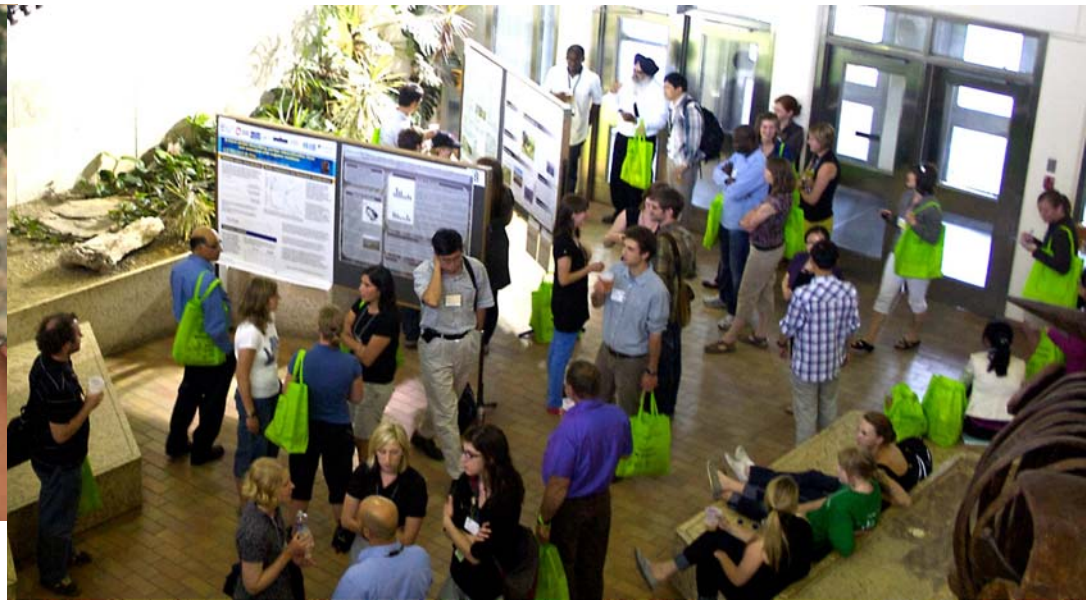
1st Place
Jeff Nimmo
NSAC

2nd Place
Rohit Dhandra
University of Saskatchewan

3rd Place
Laura Wiebe
University of Manitoba

NOTE: No poster prizes were awarded this year.

President's Award
(recognizing volunteer work at the conference)
Melissa Arcand



Conference participants enjoying poster session.

SPOTLIGHT: University of Manitoba Students

In the next few issues, we will be highlighting students from different universities.

Caroline Halde, MSc, agr.
Ph.D. candidate in Plant Science
University of Manitoba
Winnipeg, MB, Canada
umhalde@cc.umanitoba.ca

Education

MSc in Agriculture – Nova Scotia Agricultural College and Dalhousie University, NS - 2009
Certificate in Community-Driven Development – SOPAR and Bala Vikasa, A.P., India - 2009
BSc in Agronomy (Soil and Environmental Sciences) – Université Laval, QC – 2007
DEC in Science, Literature and Arts – College André-Grasset, QC – 2003

My M.Sc. work was on soil compaction and plant diversity in pastures, and I was supervised by Dr. Ralph C. Martin, founding director of the Organic Agriculture Centre of Canada.

Current Research

My Ph.D. project is on soil microbiology, crop residue decomposition and soil carbon dynamics in tilled and no-till grain production systems under organic management in the Prairies. I am also looking at the possibilities of implementing continuous no-till in organic grain production in the Prairies... quite a challenge! I want my Ph.D. project to be useful for farmers, as well as bringing new knowledge to the scientific community. My Ph.D. supervisor is Dr. Martin H. Entz.

Future Plans

My areas of interest in research are very broad: soil physics, forages and pastures, field cropping systems and agronomy. I really have a passion for research in organic agriculture. I also have an interest in politics, scientific journalism, and environmental advocacy.
I enjoy travelling. My trips to Latin America, South America, Europe and Asia definitely taught me that farmers all around the world share a common passion for the land, natural resources and livelihood, and I truly enjoy learning from them. I am currently involved in an international development project jointly coordinated by the Agricultural Institute of Canada and the Canadian Society of Agronomy aiming to help the development of organic agriculture in Nepal. I have a strong interest in international development.
I like challenges. I may end up working abroad as an agrologist, or as an academia in Canada, or go back farming on our organic farm in Quebec where I grew up. As long as I learn something new everyday and I feel that I am making a contribution to agriculture, I will be happy.

Laura Wiebe
M.Sc. Candidate in Plant Sciences (2009-2011)
University of Manitoba
Winnipeg, MB, Canada
laura_wiebe@umanitoba.ca

Education:
B.Sc. in Botany, University of Manitoba, Winnipeg, Manitoba 2008

Current Research:
I am looking at the nitrogen economy of organically selected wheat genotypes. Previous studies have indicated that direct selection for the intended growing environment is beneficial in wheat breeding. Organic production systems have different sources of nitrogen (N) than conventional agriculture. My masters research project is looking at the nitrogen economy of 15 organically selected advanced breeding lines compared with 5 common conventional varieties. We hypothesized that wheat genotypes that were selected under slow release organic N sources such as green manures will have superior soil N capture abilities compared with wheat genotypes selected under conditions of highly soluble N. Preliminary results from 2009 have indicated that some of the organic lines have a higher N uptake. The organically selected lines on average had higher grain nitrogen and over all yield values than the conventional varieties.

Future Plans
I am planning on completing my masters by the summer of 2011. I look forward to continuing my agricultural education either through a Ph.D. or work experience. I enjoy interacting with producers and hope to have involvement with extension programs in the future.

Taryn Dickson
M. Sc. Candidate (2008-2010),
Department of Soil Science,
University of Manitoba,
Winnipeg, MB, Canada
umdicks3@cc.umanitoba.ca

Education

B. Sc. in Agroecology (2007), University of Manitoba, Canada

Current research

Growing season meteorological impacts on canola quality (Brassica napus) in Western Canada

Of the millions of tonnes of canola produced every year, the majority of it is exported. The ability to predict pre-harvest canola quality would allow more customers worldwide to purchase high quality Canadian canola with confidence.

Since previous research has identified growing season weather as a factor impacting canola quality, this project attempts to quantify individual weather parameter effects on canola quantity in order to create a predictive model. This model would require only meteorological data, seed variety and seeding date as inputs to determine oil content, oil-free protein, chlorophyll, glucosinolates content, and the fatty acid profile (including oleic, linoleic, linolenic, erucic and total saturated fatty acid content).

The canola samples used in this study are a selection of Canada Number 1, low erucic acid and low glucosinolate Brassica napus samples from the 2008 and 2009 Canadian Grain Commission (CGC) harvest surveys. All samples were from one of these top-ten varieties grown in western Canada: 1841, 5020, 5030, 34-65, 71-45RR and SP Banner. The canola quality data was aligned with weather data from the Environment Canada or Canadian Wheat Board weather station in closest proximity to each sample site. Daily high, low, and average temperatures, cumulative daily precipitation, and calculated evapotranspiration rates, heat stress and water stress were used for each sample over the span of various physiological development stages. The stages were defined by a P-day (physiological day) index that was based on findings by Wilson (MSc thesis, 2002) and adjusted according to data collected in a 2009 field study for this project. Correlations between the weather parameters and canola quality factors were investigated and are being used to develop a canola quality predictive model.

Future plans

Although I do have interests in agro-meteorology, where my current research lies, I am also interested in doing research in other areas of soil science, agronomy and even entomology, including nutrient management, green house gas emissions from croplands, and pesticide residues. I am also very interested in doing some agricultural research in developing countries which have different climates and challenges.

Luca Coppi

PhD Candidate in
Soil Science (2006-2010)

University of Manitoba
Winnipeg, MB, Canada

umcoppi@cc.umanitoba.ca

Education:

B.Sc. and M.Sc. in Tropical Agriculture and Crop Science (2004), University of Florence, Florence, Italy

Current research:

Potential for nutrient accumulation and leaching from liquid Ssine manure applied to a coarse soil pasture

Liquid swine manure is a by-product of the hog industry. It is a valuable organic fertilizer when spread over agricultural land but its disposal may become a concern due to the cost of transport and the relatively high content in nutrients such as P and N, which contribute to surface water eutrophication. Lately in Manitoba, concerns have been raised for the deterioration of water quality in Lake Winnipeg; agricultural non-point sources in the Red River valley contribute significantly to nutrient loading in the Red River basin and ultimately Lake Winnipeg. This graduate research was part of the La Broquerie Research Project, established in 2003 in 100 acres of land in South Eastern Manitoba to help improve the sustainability of livestock production systems. The site is divided into twelve paddocks where the effects of three manure treatments (single spring, split spring/fall and control) and two harvest treatments (grazing and haying) are studied in a factorial design. The objectives of the study were to monitor over time accumulation, transformation and movement of phosphorus and nitrogen in the soil, and to assess the leaching of nutrients to the shallow water table. Results have shown that manure applied at yearly nitrogen removal rates can cause accumulation of P in the topsoil up to environmental thresholds (60 ppm) in 5 years in single grazed systems. Manure application caused an increase in labile P forms in the top 30 cm of soil compared to the controls. Nutrient leaching of N was detected in highly trafficked areas around water troughs in grazed paddocks where animal congregate; P leaching in the same areas occurred when saturated conditions were caused by the rising water table at springmelt. Results of the research have shown that environmental nutrient management of land applied swine manure requires taking into account accumulation of P overtime, changes of P to more labile forms, and animal grazing behaviour.

Future plans:

Thesis writing is ongoing, with planned graduation date by fall/winter season 2010 and 3 publications to be submitted to peer-reviewed journals. I'm currently screening job and postdoc opportunities. My long-term career plan is to work in the environmental industry especially in the field of monitoring and modeling of groundwater contamination from agricultural and other sources.

Jodi Larkin
M.Sc. candidate in Plant Science (2009-2011)
University of Manitoba
Winnipeg, MB, Canada
umlarki6@cc.umanitoba.ca

Education:
B.Sc. in Biochemistry, University of Winnipeg, Winnipeg, Manitoba

Current Research:
Innovative approaches to assessing seed quality in *Brassica*

Brassica napus is one of the most widely cultivated oilseed crops in the world. *Brassica* species produce Very Long Chain fatty acids; erucic acid is one of these. Erucic acid can lead to health problems in humans and animals; on the other hand, high erucic acid rapeseed (HEAR) oil has many industrial applications. Traditionally, erucic acid content in rapeseed is determined phenotypically by gas chromatography which requires mature seed. It is therefore helpful to utilize molecular markers in the seedling stage to accelerate the breeding effort. Sequence characterized amplified polymorphism (SCAR) markers and single nucleotide polymorphism (SNP) markers target insertions and deletions in a genome and are quite useful in marker assister selection (MAS) in plant breeding by making it is possible to select plants with desired traits at a much earlier stage and at a much lower cost. The purpose of this study is to determine the genotype of canola/rapeseed seedling samples using SCAR and SNP markers for marker assisted selection and to reduce the apparent error rate (of 10 to 50%) of the SCAR and SNP marker analysis for erucic acid of the *Bn-FAE1.1* gene in the A genome and the *Bn-FAE1.2* gene in the C genome.

The quality of rapeseed/canola oil is determined primarily by its fatty acid content, but chlorophyll content also affects the quality of the oil. Chlorophyll adds an undesirable green color to oil and also causes rancidity. It is also difficult to remove during routine processing. It is therefore desirable to have the lowest possible amount of chlorophyll in canola/rapeseed. Traditionally, chlorophyll levels have been determined by extraction from the seed with an organic solvent and measuring the absorbance on a spectrophotometer or by comparing the percentage of green seed to the overall sample color. Neither method is preferred as there are major disadvantages to both. As a result, there is a need to develop a less time consuming and more accurate method to determine chlorophyll levels in whole seeds. The purpose of this research is to develop a calibration equation for chlorophyll content using a FOSS 6500 NIR spectrophotometer.

The overall goal of assessing the quality in *Brassica* seed samples is to provide efficient screening techniques and evaluation methods for the development and registration of new *Brassica* oilseed cultivars.

Future plans:

I expect to successfully reduce the error rate of the SCAR and SNP marker analysis for erucic acid in *Brassica napus* and to develop a calibration equation for chlorophyll using a FOSS 6500. I plan to graduate in the summer of 2011, at which point I will be looking for a career in seed quality analysis/ plant breeding.

Siobhan Stewart
M.Sc.
Department of Soil Science

University of Manitoba
Winnipeg, MB, Canada
siobhanelainestewart@gmail.com

Education

B.Sc. in Agroecology, Faculty of Agriculture and Food Science, 2008 (University of Manitoba).

My undergraduate thesis was on the accumulation of nitrogen (N) and phosphorus around watertroughs in cattle pastures. J'ai aussi un diplôme de l'école secondaire d'immersion en français et peut communiquer assez bien.

Current Research

Hi! My name Siobhan Stewart and I am currently completing my M.Sc. in the Soil Ecology Laboratory (Soil Science Department) at the University of Manitoba. My M.Sc. thesis research is looking at nitrous oxide and carbon dioxide (CO_2) flux differences between a perennial forage mix (alfalfa-timothy grass) and a spring wheat-rapeseed annual rotation in the Red River Valley, Manitoba, using the micrometeorological flux gradient method. Environmental and soil mineral N concentrations variables were collected to relate the greenhouse gas fluxes to environmental and agronomic flux drivers. The perennial forage is being looked at a possible method for carbon sequestration-atmospheric CO_2 mitigation.

Future Plans

I will be traveling Europe until Summer 2011, but will be looking for employment either in Canada or abroad for the fall. If the right Ph.D project arose, I would be more than willing to start my doctorate in late 2011 or early 2012.

Waraidzo Chiyoka
M.Sc. in Soil Science Student (2009-2011)
University of Manitoba, Winnipeg, MB, Canada
umchiyok@cc.umanitoba.ca

Education:

B.Sc. Honours in Applied Environmental Science (2006), University of Zimbabwe, Zimbabwe.

Current Research:

I am characterizing nutrient release and greenhouse emission from agricultural soils amended with anaerobically digested beef cattle-feedlot manure under controlled-environment conditions.
Anaerobically digested manure (ADM) is a nutrient-rich byproduct of biogas generation from livestock manure. The ADM is often separated into solid and liquid fractions that are applied to soil as a source of nutrients for crops. Currently, little is known about nutrient release and availability in, and nitrous oxide (N_2O) emission from ADM-amended soils. Physicochemical changes due to anaerobic digestion may result in a product (ADM) with different nutrient release patterns and lower N_2O emissions relative to raw manure. Two 10-wk long incubations and a growth-room bioassay of barley (5 crop cycles, each 6 wk long) were conducted using a Dark Brown Chernozem and a Black Chernozem to:

1. Determine nitrogen (N) and phosphorus (P) mineralization in the Chernozemic soils amended with ADM relative to those amended with raw manure
2. Quantify N2O emissions from soils amended with ADM vs. soils amended by raw manure
3. Determine N and P availability and uptake by plants in Chernozems amended with ADM vs. Raw manure-amended Chernozems

Results from these experiments will provide information on nutrient availability and N2O emission from ADM-amended soils, factors that will help in the formulation of decision making tools for use and management of ADM as a crop nutrient source. With the growing concern over N2O emissions from manure application, farmers may find it more appealing to apply ADM rather than raw manure, particularly if yields are maintained or improved.

Future plans:

I am currently looking for a PhD opportunity in the area of reclamation and remediation for a 2011 start. Prior to starting my M.Sc. program, I worked for a chromium mining and smelting company as part of the company's environmental management team. My undertaking a PhD in reclamation and remediation would enable me to make use of my experience and knowledge in soil nutrient dynamics and mining environmental management. Beyond that, I look forward to a consulting career in agro-environmental management.

Other Graduate Students Carrying Out Agronomy-Related Projects in the Plant Sciences Department at the University of Manitoba.

Name	Degree	Supervisor
Amarasinghe, Chami	M.Sc.	Dr. D. Fernando
Asselin, Sean	M.Sc.	Dr. P.B.E. McVetty
Barcellos Rosa, Silvia	M.Sc.	Dr.A. Brûlé-Babel
Baron, Kevin	Ph.D.	Dr. C. Stasolla
Behla, Ravneet Singh	Ph.D.	Dr. G. Li
Cicek, Harun	M.Sc..	Dr. M. Entz
Clague, Chelsea	M.Sc	Dr. P.B.E. McVetty
Cuthbert, Richard	Ph.D.	Dr.A. Brûlé-Babel
Dakouri, Salam	Ph.D.	Dr.S. Cloutier
Deol, Kirandeep Kaur	M.Sc.	Dr. B. Ayelel/Dr. C. Stasolla
Derksen, Holly	M.Sc.	Dr. F. Daayf
Elahi, Nosheen Noor	Ph.D.	Dr. M. Tahir
ElBebany, Ahmed	Ph.D.	Dr. F. Daayf
Elhiti, Mohamed	Ph.D.	Dr. C. Stasolla
Gauthier, Victoria	M.Sc.	Dr. A. Brûlé-Babel
Guerrieri, Tyler	M.Sc.	Dr. A. Brûlé-Babel
Henriquez Naranjo, Maria Antonia	Ph.D.	Dr. F. Daayf
Hirani, Arvindkumar	Ph.D.	Dr. G. Li
Huang, Shuanglong	Ph.D.	Dr. G. Li
Javed, Nasir	Ph.D.	Dr. M.Tahir
Kazuk, Robert	M.Sc.	Dr. M.H. Entz
Koscielny, Chadwick	M.Sc.	Dr. R. Gulden
Kumar, Santosh	Ph.D.	Dr. R. Hill
Lewis, Derek	M.Sc.	Dr. M. Entz
Li, Ru	Ph.D	Dr.D. Fernando
Mohamed Soliman, Atta	Ph.D.	Dr. F. Daayf
Mukherjee, Shalini	M.Sc.	Dr. B. Ayelel/Dr. C. Stasolla
Prystenski, Jessica	M.Sc.	Dr. M. Tahir/Dr. C Stasolla
Sakthivel, Geethalakshmi	Ph.D.	Dr. B. Ayelel/Dr. C. Stasolla
Vaisman, Iris	M.Sc.	Dr. M.H. Entz
Waddell, Kristine	M.Sc.	Dr. R. Gulden
Watts, Roger	M.Sc.	Dr. M.Tahir

CSA EXECUTIVE

PRESIDENT
Rigas Karamanos
Viterra Inc.
10517 Barlow Trail
Calgary, AB T2C 4M5
Ph: 403-270-1120
Fax: 403-279-1127
rigas.karamanos@viterra.ca

EXECUTIVE DIRECTOR
Steve Sheppard
P.O. Box 637
Pinawa, MB R0E 1L0
Phone: (204) 753-2747
Fax: 204-753-8478
sheppards@ecomatters.com

PAST-PRESIDENT
Shabtai Bittman
Agriculture & Agri-Food Canada
Pacific Agri-Food Research Centre
Agassiz, BC V0M 1A0
Phone: (604) 796-2221
Shabtai.Bittman@AGR.GC.CA

PRESIDENT-ELECT
Malcolm Morrison
Agriculture and Agri-Food Canada
960 Carling Ave,
K.W. Neatby Building, Floor 2, Room 2008
Ottawa, Ontario K1A 0C6 Canada
Phone: 613-759-1556
Fax: 613-759-1701
Morrisonmj@agr.gc.ca

SECRETARY-TREASURER
Balakrishnan Prithiviraj (Raj)
Nova Scotia Agricultural College
58 River Road
Truro, NS, Canada B2N 5E3
bprithiviraj@nsac.ca
Phone: 9028936643
Fax: 9028956734

WESTERN DIRECTORS

Patricia Juskiw
Agriculture and Rural Development
5030 50th Street
Lacombe, AB, Canada T4L 1W8
Phone: (403) 782-8691
Fax: 403-782-5514
patricia.juskiw@gov.ab.ca

Perry Miller
Montana State University
Department of Land Resources & Environmental Sciences
PO Box 173120
Bozeman, MT, USA 59717-3120
Phone: 406-994-5431
Fax: 406-994-3933
pmiller@montana.edu

EASTERN DIRECTORS

Alek (Thin-Meiw) Choo
Agriculture & Agri-Food Canada
ECORC, CEF
Ottawa, ON, Canada K1A 0C6
Phone: 613-759-1307
Fax: 613-759-1701
ThinMeiw.Choo@AGR.GC.CA

Jaswinder Singh
Macdonald Campus, McGill University
Department of Plant Science
21111 Lakeshore Road
St Anne-de Bellevue, QC
H9X3V9, Canada
Phone: 514-398-7906
Fax: 514-398-7897
jaswinder.singh@mcgill.ca

Canadian Society of Agronomy

Steve Sheppard, Executive Director
P.O. Box 637, Pinawa, Manitoba, R0E 1L0
Ph: 204-753-2747 Fax: 204-753-8478
E-mail: sheppards@ecomatters.com
Website: www.agronomycanada.com