Organic Agriculture Centre of Canada

2008 ANNUAL REPORT

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INTRODUCTION

OACC is growing in its role of facilitating a national network of organic researchers and associated practitioners. We enjoy serving and collaborating with the stakeholders of organic agriculture. The sector is growing rapidly, and the level of interest from researchers, government and industry have grown accordingly.

In 2008, with input from staff, the OACC Advisory Board developed a new Vision "*Sustainable and science-based organic agricultural systems, supporting healthy Canadian communities*". This Vision along with our motto "*Linking Organic Knowledge*" guides our efforts. We welcome your ideas about how we can meet our Vision more effectively.

Facilitating national and regional collaboration in research, extension and education is among our top responsibilities. Over 600 farmers across Canada responded to our survey about research priorities and further analysis with regard to criteria is underway.

Increasingly, we are challenged to provide data supporting the benefits of organic agriculture. This requires systems-level research with multidisciplinary collaboration, and of course, funding. We strive to provide valid research results to address the expected benefits of organic systems.

Sponsors of OACC, featured on page 57, are crucial to our work and we very much appreciate the support of industry supporters and granting agencies.

Let me also say how much I appreciate the excellent work of our staff and students at OACC. They work on a contract basis as funds permit and act as if they are making a difference. They do! It was restorative for me to take a sabbatical, with full confidence that OACC was in good hands. Andy Hammermeister, in particular, deserves thanks for leading during this time.

The OACC website, www.oacc.info, continues to grow as the dynamic archive for information related to organic research and education in Canada. Each month an **e-zine** is sent to Friends of OACC. It highlights the most recent up-dates on the OACC website. If you wish to subscribe, please contact oacc@nsac.ca and we will add your name, or that of a friend or colleague, to our mailing list.

For a complete overview of OACC see: www.oacc.info/About%20Us/au_welcome.asp

Ralph C. Martin, Founding Director, OACC

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ORGANIC SEED TREATMENTS IN BARLEY PRODUCTION

Final Research Report E2009-33

BACKGROUND

Reduced crop establishment is a growing concern on organic farms, which can lead to higher weed pressure as well as reduced yields and farm income. Poor establishment can result from the use of lower-quality seed, slow or hindered crop seed germination, or inappropriate soil management practices that lead to elevated weed or disease pressures. These occurrences can affect both the quality of harvest and weed seed presence years into the future.

A variety of organic-approved seed treatments are commercially available, claiming to offer developmental advantages to germinating crop seeds and young plants and to promote healthier and higher-yielding crops. In such cases, treated crop seeds may grow faster and with fewer limitations, gaining an advantage over competing weeds and pathogens. The treatments may reduce disease-causing organisms, or facilitate growth-supporting factors such as beneficial microbes and their promoting plant interactions. Such strengthened or accelerated crop growth will likely improve establishment earlier in the season.

OACC technicians Paula Schofield and Lloyd Rector, sowing barley plots (D. Kerr)

Seed treatments may be loosely-categorized by function as antimicrobial, biostimulatory or nutrient-enriching, although some may play multiple roles due to their complex biological formulations or activities. In general, seed treatments function by either stimulating the germination process itself or by providing the germinating seed with a micro-environment that is beneficial for growth (fewer pathogens, with more nutrients available). Historically, seed treatments have usually taken the form of fungicides. Today, however, legume inoculants have become commonplace and more seed treatments are being sought and discovered with the goal of promoting healthy soil ecology.

The objective of this research was to evaluate seven types of organic commercial seed treatments in terms of their effects on seedling vigour, crop establishment and yield in barley.

WHAT WAS DONE

The selected OMRI-approved seed treatments included: ASL™ TP (Acadian Seaplants Ltd.), Biodynamic Preparation 504 (Josephine Porter Institute), HeadsUp® (HeadsUp® Plant Protectants, Inc.), MycoApply® (Mycorrhizal Applications, Inc.), NanoGro™ (Agro Nanotechnology Corp.), and SuperBio® SoilBuilder (Advanced Microbial Solutions, LLC).

Treated common no.1 barley seed was subjected to two different vigour tests in a growth chamber to assess seed treatment effects relative to an untreated control. Cold tests evaluated the percentage germination under simulated cold-seedbed conditions and seedling growth tests measured average shoot length after seven days' germination.

The same treated barley seed was also sown in field-plot experiments at three sites in late May of 2007. At each site, plots were sown in four replicates at a rate of 350 seeds m^{-2}, with pre-and post-emergent tine weeding. Within the first few weeks, early growth of the barley plots was assessed in terms of crop establishment and seedling vigour (height, dry mass). At maturity, grain was harvested, dried and cleaned. Grain data recorded included yield, test-weight and 1000-kernel weight.

WHAT HAPPENED

Both the cold test and seedling growth test were repeated and each trial used two different samples of barley seed. In the two cold test trials, ASL™ TP and HeadsUp® occasionally appeared to reduce the germination rate of certain seed samples relative to the untreated control. In the seedling growth test one trial indicated no differences among any of the treatments while the other trial indicated that ASL™ TP could reduce the average shoot length of seedlings.

Cold test samples, during incubation at 10°C (D. Kerr)

ASL™ TP was also shown to decrease germination. The ASL™ TP seaplant extract was used at full strength during these lab experiments; since then, a dilution has been recommended to avoid inhibition effects due to seed toxicity.

In the field-plot experiments, crop establishment was only affected at one site by MycoApply® which resulted in a reduction of establishment relative to the untreated control. Altering or influencing the microbial population around a seed could have favourable or un-favourable consequences, depending on the activity of introduced microbes as well as their interaction with other organisms in the surrounding soil.

Neither of the two seedling vigour indices – dry mass nor seedling height – was affected by any of the seed treatments relative to the control, at any of the three sites. Such observations of seedling vigour can offer early indications of future crop performance, but there are other growth factors that will not show up at this developmental stage. The same results were observed for harvested grain yield, test weight and 1000-kernel weight as none of the seed treatments had any effect on them relative to the control. It should be noted that the relatively late spring planting could have compromised potential seed treatment effects otherwise seen under early-spring planting conditions.

Seedling growth test samples, following incubation for 7 days (D. Kerr)

Any such differences were not observed in the cold test, however, where they would have been expected to show up if they existed. While the lack of significant effects at three different sites is compelling, it is worth noting that unfavourable growing conditions such as soilborne disease pressure can vary from year to year, and under low-stress conditions treated seed may fare no better than untreated seed. Ideally, seed treatment evaluations would be conducted over at least two seasons.

Table 1. Descriptions of selected seed treatments

Treatment Name	Category	Active Ingredient(s)	Disease Control
ASL™ TP	Biostimulant; non-biological	Seaplant extract of (*Ascophyllum nodosum* L. Le Jolis)	Unspecified, unknown
Biodynamic Prep. 504	Biostimulant; non-biological	Composted stinging nettle (*Urtica dioica* L.)	Unspecified, unknown
HeadsUp®	Systemic acquired resistance agent; non-biological	Plant biochemical extract from quinoa (*Chenopodium quinoa* Willd)	Broad-spectrum, unspecified
MycoApply®	Disease control; biological	Beneficial microbes (*Glomus* spp., *Trichoderma* spp.)	Unspecified, unknown
NanoGro™	Biostimulant; plant immune system booster	Sugar pellets treated with ethanol and trace nutrients	Broad-spectrum, unspecified
SuperBio® SoilBuilder	Nutrient-enhancer; biological	Beneficial microbes and byproducts (*Bacillus* spp., *Cyanobacteria*, *Actinomycetes*)	Unspecified, unknown

Young barley seedlings at the two-leaf stage (D. Kerr)

Variability among identically-treated seed, following seedling growth test incubation (D.Kerr)

THE BOTTOM LINE…

Results were inconsistent among lab experiments, and no seed treatment could be declared as offering a clear advantage over untreated seed in terms of improved performance - based on cold germination and seedling growth tests. Field tests further supported this, as none of the seed treatments evaluated increased crop establishment, in-field vigour, yield, test-weight, or 1000-kernel weight.

Many seed treatments are likely species- or environment-specific, in that they may only offer beneficial effects to certain crops or under certain growth conditions. While the seven seed treatments selected for this study did not offer any advantage to treated barley seed in the lab and field trials described here, they may be beneficial for other crops or in other situations. On the whole, organic seed treatments may still have important roles to play in organic cropping systems and should be investigated on an individual basis and using different crop species for proper evaluation.

FUNDING

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Graduate student Donald Kerr, explaining his barley seed treatment plots during OACC's Field Day (K. Seckar)

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Mark Bernard (Barnyard Organics, Freetown PE)

OACC Technicians, including Lloyd Rector, Shelly Juurlink, Paula Schofield, Serge LaRochelle, and Katya Seckar

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BREEDING SPRING WHEAT FOR ORGANIC AGRICULTURE

Final Research Report W2009-52

INTRODUCTION

Interest in crop breeding and agronomic research for organic production is growing in Canada and the United States. The selection of cultivars for low-input and/or organic environments has not been a priority of past breeding programs. Banziger and Cooper (2001) suggested that cultivars developed through formal crop breeding have not been adopted for low-input conditions because few programs have focused on low-input conditions.

Trials conducted under conventional management have questionable applicability to organic agriculture. Several studies have reported differences in the performance of wheat cultivars in organic and conventional management systems with some cultivars better suited to organic management in northern North America (Carr et al. 2006; Mason et al. 2007; Nass et al. 2003).

Murphy et al. (2007) reported selecting for yield under organic management resulted in genotypic ranks different from conventional management. Przystalski et al. (2008) suggested that selection of cultivars should be conducted under conditions which closely match commercial organic farms and should include traits important to organic farmers.
The objective of the study was to determine if selection results would differ between the two management systems.

WHAT WAS DONE?

A population was created from a cross between the Canadian spring wheat cultivar AC Barrie and the CIMMYT spring wheat cultivar Attila. AC Barrie was the most commonly grown spring wheat cultivar on the Canadian Prairies in the 1990s. Attila is an awned semi-dwarf bread wheat cultivar widely grown in Southeast Asia. The population consisted of 79, F4 derived F6 genotypes.

The experimental study was conducted from 2005 to 2007 at the University of Alberta Edmonton Research Station (ERS). The conventionally managed site was less than 1 km from the organically managed site. In keeping with the station's crop rotation, different areas of each site were used in subsequent years. Plots were seeded with 250 seeds m^{-2} in a randomized complete block design within management system.

Data recorded for each plot included early season vigour, plant height, number of spikes m^{-2}, grain yield, kernels $spike^{-1}$, harvest index, grain protein, weed biomass, days from seeding to anthesis, and physiological maturity.

Breeding lines grown under conventional management (cr. T. Reid)

WHAT HAPPENED?

On average, AC Barrie and Attila yielded less grain with greater protein content under organic than under conventional management (Table 1). In the organic system AC Barrie had 28% greater yield, was 17 cm taller, and had 5% greater protein content than Attila.

Table 1: Least square means of AC Barrie and Attila and the population derived from a cross between the two, grown under organic and conventional management in Edmonton, AB Canada from 2005 to 2007, for 17 agronomic traits.

Variable	AC Barrie		Attila		Diff Between Parents		Population Mean		SE of Diff
	Conv[a]	Org	Conv	Org	Conv	Org	Conv	Org	
Grain Yield (t ha^{-1})	4.54*	2.68*	4.83**	2.09**	-0.29	0.59*	3.88*	1.85*	0.67
Spikes m^{-2}	536	322	414	336	122*	-14	454	343	83
Plant Height (cm)	86	84	71	67	15*	17**	76	74	7.2
Kernels $spike^{-1}$	31	28	39**	32**	-8**	-4	40	32	3.0
Harvest Index (%)	45	45	49	42	-4	3	47	42	2.3
Grain Protein (%)	14.1**	15.2**	12.8**	14.4**	1.3**	0.8**	13.0	14.8	0.58
Weed Biomass (g)	0	10	1**	20**	-1	-10	1*	13*	3.5
Early Season Vigour	4	4	3	3	1	1*	3	3	0.1
Days to Anthesis	59	53	58	53	1	0	59	53	3.3
Days to Maturity	90	90	95	90	-5	0	94	92	3.5
Grain Fill Duration	32*	37*	37	37	-5*	0	35	39	3.9

*,** Significant at P = 0.05 and P = 0.01 respectively.
[a] Conv: Conventionally managed system; Org: Organically managed system.

In the conventional system AC Barrie had 30% more spikes m^{-2}, was 15 cm taller and had a 10% greater protein content than Attila.

When the population was grown in conventionally managed trials it yielded, on average, double the amount of grain with less recorded weed biomass than organic trials (Table 1). No other traits differed statistically between the systems.

Direct selection in each management system (10% selection intensity) resulted in 50% or fewer lines selected in common for four traits including: grain yield, grain protein, spikes m^{-2}, and grain fill duration (Table 2). If the top yielding 8 lines (10 %) of the population were selected from each management system (based on our results) 3 lines would be in common. Selecting the top 12 (15%) and 16 (20%) lines based on yield resulted in 7 and 8 lines in common, respectively. This suggests that selecting in the two management systems would result in large differences between systems for lines retained for further yield trials in a breeding program. The difference in the relative ranking of lines between systems was also large for other agronomically important traits (Table 2; Figure 1).

Breeding lines grown under organic management (cr. T. Reid)

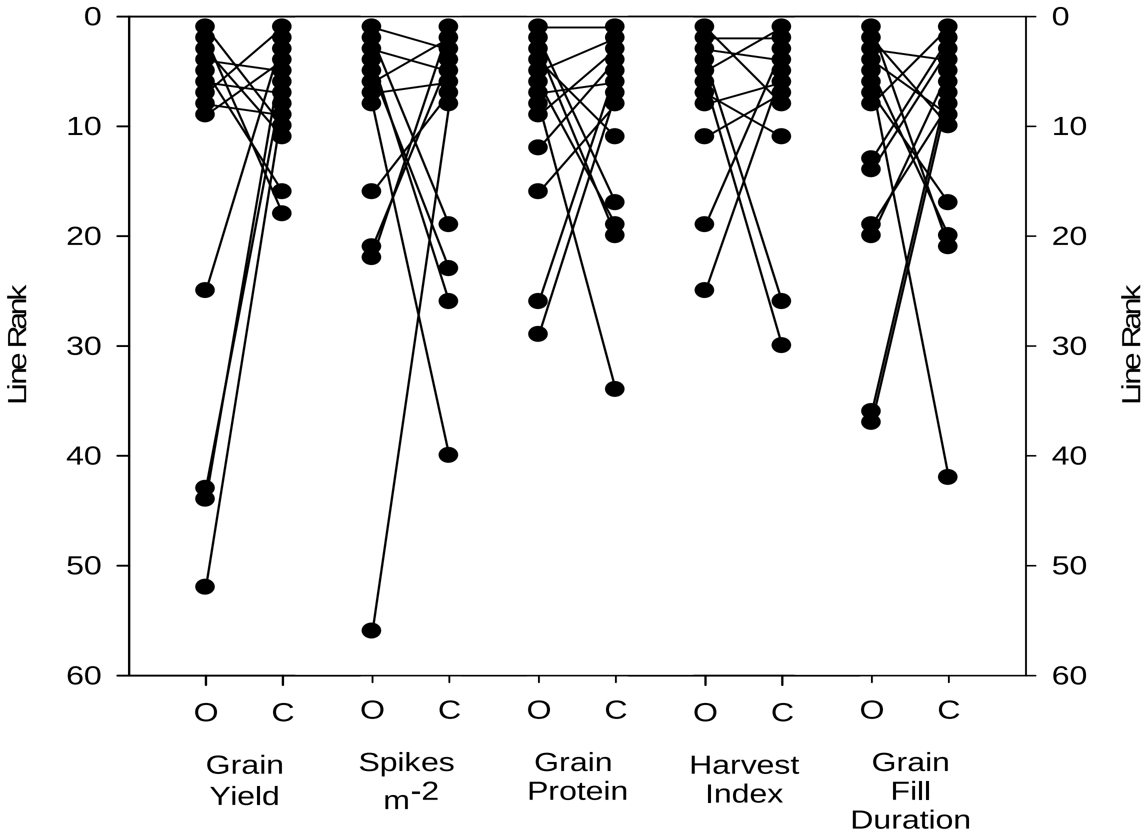

Figure 1: Genotypic ranks changes observed in the top 10% lines ranked under each management system (O: Organic; C: Conventional) for five traits measured in both systems. Rank was assigned according to the desired direction of selection (e.g. rank one for grain yield was the highest yielding)

Table 2: The number of lines in common at three selection intensities, for 14 agronomic traits in a population derived from a cross between AC Barrie and Attila grown under organic and conventional management in Edmonton, AB Canada from 2005 to 2007.

	Lines selected in common		
Trait	10%[a] (8)[b]	15% (12)	20% (16)
Grain Yield	3	7	8
Spikes m^{-2}	4	7	10
Plant Height	7	9	14
Kernel $Spike^{-1}$	6	12	13
Harvest Index	5	7	12
Grain Protein	3	6	13
Weed Biomass	7	10	12
Early Season Vigour	7	9	12
Days to Anthesis	6	11	14
Days to Maturity	7	11	6
Grain Fill Duration	2	4	10

[a] Selection intensity applied within each system
[b] Maximum number of lines selected from the population of 79 lines at the given selection intensity (10, 15, 20 %)

The Bottom Line

Selection in conventionally managed land for the purposes of developing cultivars for organic production does not result in the same genotypes being selected for each system for all traits. Based on the results of this study, we believe the selection of spring wheat cultivars for organic production systems should be done on organically managed land.

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Graduate Student Todd Reid, standing in the middle of one of his breeding experiment locations at the University of Alberta, Edmonton Research Station (cr. M. Iqbal)

Credits

Todd Reid (graduate student, University of Alberta), Dean Spaner (University of Alberta) Brenda Frick (Organic Agriculture Centre of Canada) Margaret Savard (OACC, Ed.) and Kristin Fielding (OACC, Format)

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MANAGEMENT PRACTICES AND CROP ROTATION FOR CONTROL OF EUROPEAN WIREWORMS IN CANADA

Interim Research Report E2009-24

BACKGROUND

Significant losses in crop yield, quality, and marketability have been attributed to wireworms, a pest of growing concern and widening distribution across Canada. While the Atlantic provinces harbour native wireworm species, three species introduced to North America from European ship ballast cause the lion's share of damage. These three species, *Agriotes lineatus*, *A. obscurus*, and *A. sputator*, have a short lived adult phase, commonly known as click beetles, that seldom cause substantial crop damage. The destructive larvae of these species persist in the soil for several years, feeding on the roots of host plants and causing significant reductions in the yield and quality of economically important crops.

Larval wireworm feeding on a carrot (J. MacKenzie)

WHAT WAS DONE

In 2008, the Organic Agriculture Centre of Canada continued working toward the development of cultural management strategies targeted at the larval wireworm and adult click beetle. Damage to crops as a result of wireworm feeding may be mitigated by deterring egg laying in crop fields or reducing viability of eggs and young wireworms, developing methods to deter feeding on cash crops, and using unattractive or ill-suited plants in a crop rotation.

Crop Rotation for Wireworm Control: Rotational crops may be used to create an inhospitable soil environment for wireworms.
A 3-year crop rotation trial was established at the Brookside NS research site in 2007, with the second year of cover crops planted in 2008. The trial includes crops which may have a detrimental effect on wireworm populations, such as glucosinolate-releasing brown mustard, quick growing and often tilled buckwheat, flax with possibly poor nutritional quality for the wireworm, deep rooted and soil drying alfalfa, and a control of barley underseeded to clover. In 2009, these plots will be planted with carrots or potatoes for evaluation of crop damage.

Wireworm populations in the plots seeded with the various crops were monitored throughout the 2007 and 2008 growing seasons. No significant differences in wireworm abundance due to the crop planted have been detected. There is, however, an emerging trend towards high wireworm populations the barley underseeded to clover plots and lower levels in the flax and brown mustard plots.

Installing traps for wireworm monitoring in an alfalfa plot of the crop rotation trial (J. MacKenzie)

Development of a Push-Pull-Immobilize Strategy: Evaluations are being made of a push-pull-immobilize strategy, based on pushing wireworms away from a cash crop using feeding deterrents, pulling wireworms from the cash crop using attractive bait crops, and immobilizing wireworms through the use of harmful seed or soil treatments.

Push Strategy: The push strategy aims to create a crop that is not attractive to wireworm. Plant-derived feeding deterrents, which may be applied as seed treatments or to growing plants, are currently being evaluated. Alternatively, less attractive varieties or cultivars of a given cash crop could be employed. However, an evaluation of four carrot varieties, including a commonly used processing variety, Chantenay, Scarlet Nantes, and Yaya revealed no significant differences in the relative attractiveness of these varieties.

Pull Strategy*:* In order to serve as an effective bait, a crop must be more attractive to wireworms than the cash crop it is protecting.

Potential bait crops, including wheat, red-skinned potato, corn and dandelion have been evaluated in the lab, with results suggest that germinating wheat is more attractive to wireworms than carrot, and may thus serve as an effective trap crop (Figure 1). Red-skinned potato, dandelion, and corn did not prove to be sufficiently attractive to wireworms to merit use as trap crops in carrot production.

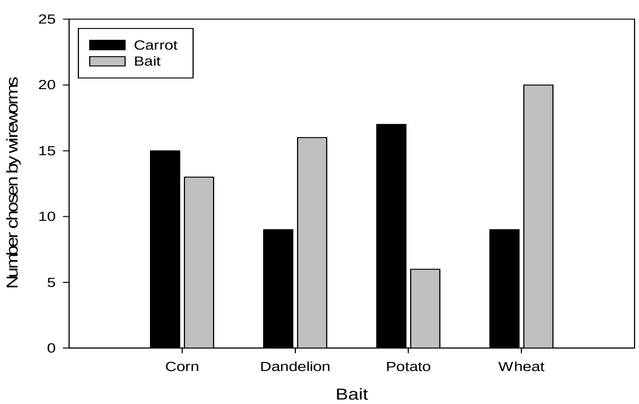

Figure 1. Number of wireworms choosing carrots or various baits in a laboratory trial of the 'pull' strategy.

The effectiveness of the wheat pull strategy was tested in a field trial in 2008. Wheat was densely seeded between carrot rows in August and September in an effort to lure the wireworms away from the maturing carrots until harvest. Results to date are inconclusive, with no significant reductions in wireworm damage in carrot rows adjacent to wheat rows but a trend toward such a reduction.

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Wheat planted between carrot rows before harvest as an in-field test of the "pull" strategy (J. MacKenzie)

Immobilize Strategy: The potential for organic soil amendments, such as diatomaceous earth, neem oil, and wood ash, to immobilize or control wireworms is currently under evaluation in laboratory conditions.

THE BOTTOM LINE

Wireworms are a damaging crop pest with few management techniques currently available for organic producers. Research is currently underway to evaluate the use of crop rotation and a push-pull-immobilize strategy for wireworm management.

CREDITS

By: Joanna MacKenzie and Andy Hammermeister (Organic Agriculture Centre of Canada)

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OILSEED PUMPKIN PRODUCTION: VARIETY AND FERTILITY TRIALS

Interim Research Report E2009-38

BACKGROUND

Oilseed (hull-less) pumpkins have been produced for generations in Eastern Europe, but are a novel crop for North American producers. Oilseed pumpkins produce seeds lacking the outer tough, white hull prevalent in more commonly grown pumpkin varieties, making these seeds desirable for oil pressing and for snack products. These hull-less seeds are largely composed of rich, dark green oil that boasts a range of health benefits attributed to the high content of Omega 6 and 9 fatty acids, zinc, and Vitamin E. Health conscious consumers or processors seeking this crop are likely to support organic production. In 2008, the OACC continued trials to examine the feasibility of producing this crop using organic management practices in the Maritimes.

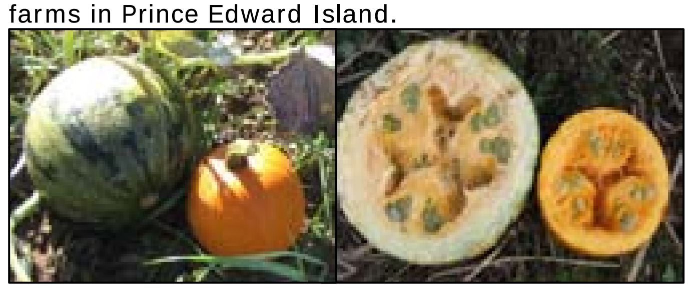
RESEARCH OBJECTIVES

- Improve understanding of agronomy and production potential for oilseed pumpkin as a novel crop for producers.
- Evaluate best organic management practices for fertility and planting timing for oilseed pumpkin.
- Assess oilseed pumpkin oil yield and quality for comparison to industry standards.

WHAT WAS DONE

In 2007, oilseed pumpkin trials were established to develop fertility, weed and pest management strategies for the Styrian oilseed pumpkin (cv. *Gleisdorfer olkurbis)* imported from Austria (see Bulletin 2008-38). However, the length of the growing season required for the Styrian crop resulted in some pumpkins that failed to reach maturity, even in late October. In an effort to overcome these maturity issues, 2008 trials examined other varieties of oilseed pumpkins with shorter maturation periods, and also examined the feasibility of planting earlier in the season. In addition, fertility as supplied through green manures and animal manure sources were examined.

A factorial trial was established at the Brookside Organic Research Site in Truro, NS to examine the performance of two locally available oilseed pumpkin varieties, Kakai and Snackjack. The factors of the experiment included planting timing (early = May 30, late = June 11), green manure preceding the pumpkin plant (timothy or red clover) and pelletized poultry manure (0 or 80 kg N ha^{-1}). Each factor combination was replicated three times. Demonstration trials were also established on two farms in Prince Edward Island.



Kakai and Snackjack oilseed pumpkins approaching maturity (left) and split open for harvest (J. MacKenzie)

The timothy and clover stands preceding the pumpkin plots had been in place for two years and were incorporated three weeks before the first pumpkin planting. One week before planting, pelletized poultry manure was applied by hand and incorporated in a 0.61 m (2') band along the crop row. Seeds were planted with a handheld corn jab-type planter at a depth of 3.8 cm (1.5"), with 1.2 m (4') between plant rows and 30 cm (1') between plants within a row. Cucumber beetles arrived in the plots at the beginning of July, hence plots were sprayed with Surround on five occasions until the beetle pressure subsided.

Pumpkin vine establishment was monitored throughout June and into July. Early planted seeds were observed to have very poor germination, with many rotting seeds found in the soil upon further examination thought to be largely attributed to cold soil temperatures. Late planted seeds exhibited higher germination (roughly 50%), but establishment was such that plants were transplanted within and between plots on July 10 to achieve the desired plant density of 2.7 plants m^{-2}. Pumpkins were harvested on October 30, with pumpkins split open in the field and the seeds removed. Seeds were then washed to remove residual flesh and dried at 50°C for four days.

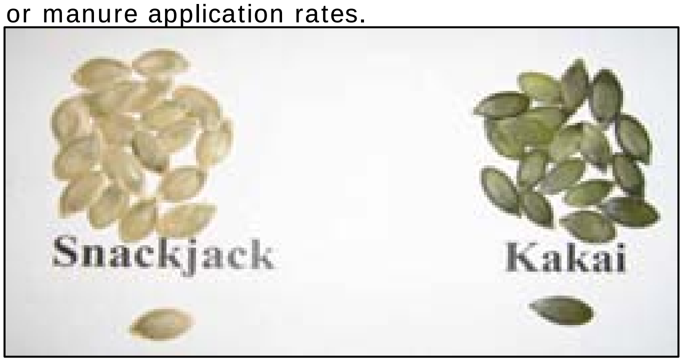
PRELIMINARY RESULTS

Table 1. Mean yield and yield components of oilseed pumpkin, illustrating the effects of variety and green manure plowdown. All means presented are significantly different ($p<0.05$).

	Pumpkins per Plant	Weight per Pumpkin (kg)	Seed per Pumpkin (g)	Seed Weight (g 1000 seeds^{-1})	Seed Yield (g m^{-2})	Oil Content (%)	Oil Yield (g m^{-2})
VARIETY							
Kakai	0.91	3.22	41.73	152.8	86.35	49.80	42.97
Snackjack	1.34	0.91	32.64	117.6	124.75	47.31	58.94
GREEN MANURE							
Timothy	ns	1.76	31.25	124.63	85.59	ns	41.69
Clover	ns	2.36	43.11	145.77	125.52	ns	60.22
Standard Error	*0.096*	*0.16*	*2.42*	*3.53*	*10.18*	*0.26*	*4.99*

Due to poor germination and crop establishment of the early planted plots, analysis of yield and oil content will focus on the late planted plots. Unfortunately, the trial and demonstration plots were plagued by poor germination, even when soil temperatures warmed to 15°C at the late planting date. Observations in the field suggest that planting depth and packing may impact crop establishment. Such factors should be examined, along with possible seed treatments that may promote germination.

Statistical analysis revealed that the main factors influencing the various pumpkin yield components were the pumpkin variety and the green manure plowdown that preceded the pumpkin crop. Results, as presented in Table 1, indicate that Kakai pumpkins were significantly larger than the Snackjack pumpkins and produced a significantly higher weight of seeds per plant with a higher average seed weight and oil content. However, the Snackjack plants more than compensated for these deficiencies, producing more pumpkins per plant that resulted in a higher overall seed and oil yield. For all characteristics examined, there were no significant interactions between variety, plowdown, or manure application rates.



Snackjack and Kakai seeds. Note the complete absence of hulls on the Kakai and reduction of hulls on the Snackjack seeds (J. MacKenzie)

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Poultry manure applications had little impact on pumpkin performance, with applications significantly increasing only pumpkin seed yield ($p < 0.05$). This may be attributed to the dilution of the nitrogen application, which was calibrated based only on the narrow band applied and not the entire plot area.

Further analysis of the fatty acid profile of the pumpkin seed oil reveals a high composition of Omega 6 and 9 fatty acids in both varieties, with linoleic acid (60-64%) and oleic (16-20%) dominant contributors in both varieties, as is common in oilseed pumpkins. These characteristics suggest that either variety could serve a snack or oil seed market. It should, however, be noted that the reduced hull present in the Snackjack variety may reduce its appeal in these markets.

THE BOTTOM LINE

Oilseed pumpkin is an interesting new crop, not without its challenges, for Maritime organic farmers. Legume green manures may serve as an ideal fertility source for this high value crop.

CREDITS

Joanna Mackenzie (OACC), Andy Hammermeister, (OACC) Margaret Savard (OACC, Ed)

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SOIL PHOSPHORUS AND NITROGEN FIXATION ON ORGANIC DAIRY FARMS IN ONTARIO AND NOVA SCOTIA

Interim Research Report E2009-40

BACKGROUND

A recent survey noted that many fields within organic dairy farms in Ontario were low in soil-test phosphorus. Phosphorus is a key nutrient that supports plant growth and legume N fixation.

This project investigates the relationship between soil P levels on forage yield and nitrogen fixation on organic dairy farms in Ontario and Nova Scotia. It also explores the use of organic amendments to improve P supply and the role of soil microbial factors in crop P uptake.

WHAT WAS DONE: YEAR 1 (2008)

Soil samples were collected during the first harvest. Forage samples were taken before each cut from 28 fields (280 sampling points), mainly in Ontario. Due to very rainy weather in 2008, some actual harvest dates were up to several weeks later than sampling dates. In addition, many fields were harvested only twice rather than the usual 3 cuts.

Samples were sorted and the yield contribution was determined for each type of plant. The research team uses natural nitrogen isotopes (^{15}N:^{14}N) to determine the amount of N fixation by the legumes, as well as other common forage analyses.

The first results for 2008 are outlined in Table 1.

- In the Ontario fields, legumes (mostly alfalfa) contributed between 26% and 85% of yield, while in Nova Scotia legumes (mostly clover) contributed between 1% and 70% of yield. The average legume contribution is given in Table 1.
- Generally, a decline in legume content mirrored a decline in yield and amount of N fixed. Legumes contributed the majority of the nitrogen harvested (Table 1). This underlines the importance of legumes to nitrogen and protein production in forages.
- Average N fixation was about 90 kg/ha. This is likely an underestimate since the first cut was sampled too early and the fall regrowth was not sampled.

Table 1: 2008 interim field data, averages

	ON ave.	NS ave.
% legume	62%	31%
Soil test P (ppm)	8.8	-
# cuts	2.2	1.9
Forage yield, DM kg/ha	5736	6169
Forage crude protein	20.2%	-
N fixation, kg/ha	90	-
Legume N harvested, kg/ha	137	-
Grass/weed N harvested, kg/ha	49	-

Figure 2. Soybeans grown with increasing P supply, from 0 (at left) to 135ppm added P (at right)

- Soil-test P in ON fields (Olsen-P) varied from below 4ppm to about 16ppm.
- As shown in Figure 1, there was no clear relationship between soil-test P and forage yields. Similarly, a trend between N fixation and soil-test P was not observed.
- Figure 1 suggests that some fields with low soil P have excellent yields while others have low yields. This relationship may be explained as other analyses are completed.

Effects of P on Crop Performance

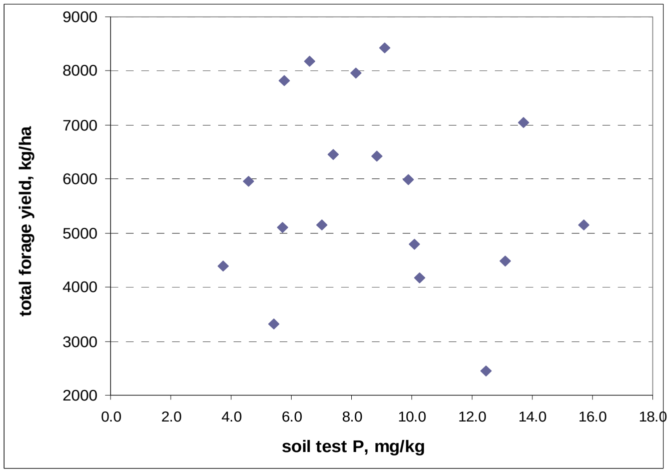

Figure 1. Plot of Forage yield vs. soil P

Controlled Environment Experiments:

- Soybean was grown in pots in two low-P soils from organic dairy farms. Soluble P was applied in various rates.
- The visible differences in soybean growth among P rates (Figure 2) suggest that P was a limiting factor in growth.
- Data from this trial is being analyzed.
- A similar trial will be conducted with alfalfa.
- A pot-trial will follow that examines the P-supplying power of organic amendments.

Soil Biology:

- Experiments examining the role of soil biology on crop P uptake are in the planning phase.
- Studies will be included of mycorrhizae fungi.
- Mycorrhizae grow on crop roots, sending out many kilometres of tiny threads that help plants absorb soil phosphorus.

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THE BOTTOM LINE

- Preliminary results reinforce the importance of legumes in organic forage crop productivity.
- Effects of soil P on forage productivity are not apparent from early data, but may emerge as more detailed analyses are completed.
- Further analyses and experiments are being conducted in 2009 and 2010.

CREDITS

Derek Lynch, NSAC/OACC; Paul Voroney, University of Guelph, Michael Main, NSAC/OACC; Amanda Ward, NSAC; Kim Schneider, University of Guelph; Shelly Juurlink, Organic Meadow; Ivan O'Halloran, University of Guelph, Ridgetown.

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MULCH TYPES AFFECT GROUND BEETLE (CARABIDAE) ABUNDANCE AND SPECIES COMPOSITION IN HIGHBUSH BLUEBERRIES

Interim Research Report E2009-44

BACKGROUND

The importance of ground beetles (Coleoptera: Carabidae) as biological control agents in healthy, diverse agroecosystems is becoming readily apparent (Kromp, 1999). Many ground beetles are significant predators of common pests in all types of crops. Sensitivity of ground beetles to human practices in agroecosystems, such as pesticide use and cultivation, may limit biological control effectiveness. However, increased natural habitat and food sources through well-managed hedgerows and shelterbelts as well as raised earth 'beetle banks' can enhance ground beetle diversity and abundance (Holland and Luff 2000).

Highbush blueberries (*Vaccinium corymbosum* L.) benefit from thick mulching; pine needles are effective at inhibiting weed growth and other composts increase moisture retention and fertility. It is unknown how various mulches and composts affect ground beetle diversity and abundance.

RESEARCH OBJECTIVE

Will ground beetles be affected by different mulches and composts in an organic highbush blueberry field?

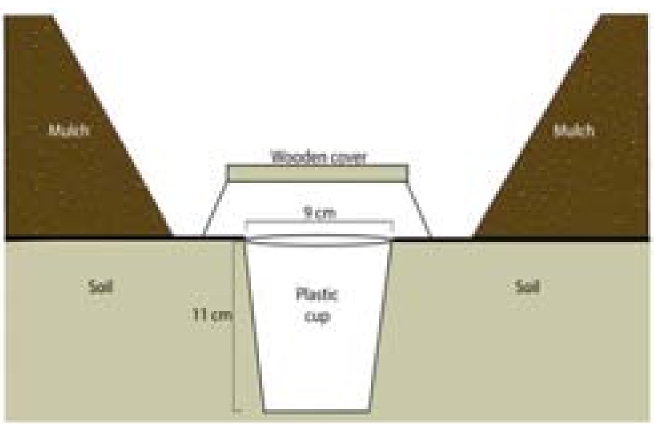

Figure 1: Placement of a plastic cup and wooden cover as a 'pitfall trap' in 20 cm thick mulch. Mulch angle not greater than 45°.

METHODS

On June 14, 2007 mulches were thickly applied by-hand (20 cm depth) in small plots (4.5 x 1.5 m) to a single row in an organic highbush blueberry field in the Annapolis Valley, near Kentville, NS. Plots were arranged in a randomized complete block design with four replications; each plot was at least 10 m apart with 25 m between replications. Mulches were pine needles (uncomposted, from Sherwood Forest Campground, Coldbrook NS), Bowater (composted biosolids from Liverpool, NS), farm (composted sawdust and horse manure from Nova Agri Inc.). There was an unmulched plot for comparison purposes.

'Pitfall traps' were plastic cups (9 cm top diameter x 11 cm height) sunk into ground with rims flush to soil surface. Cups were partially filled with water, salt (preservative), and dish-soap (surfactant). In mulches, mulch was removed around the cup (Fig.1). Traps had wooden covers and in 2008 were protected from rodents and birds with hardware cloth cages. Traps captured beetles for five, one-week periods from July to September in 2007 and 2008. Captured beetles were saved and identified to species (final species count yet to be determined for 2008).

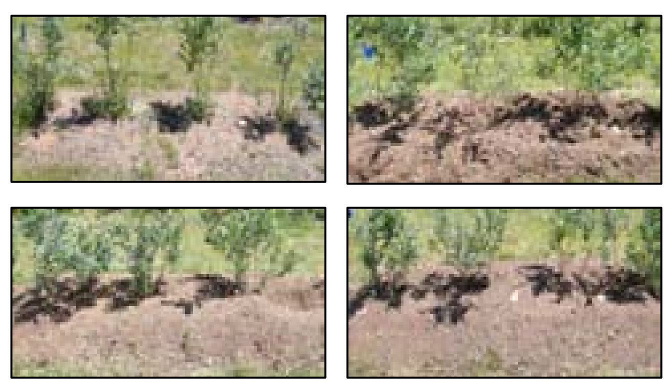

Figure 2: Clockwise from top-left: unmulched Control, Pine needle mulch, Bowater compost mulch, and Farm compost mulch.

Results and Conclusions

In 2007, 486 beetles encompassing 31 species, were captured, while 701 beetles were captured in 2008. *Pterostichus melanarius* (Illiger) made up 35.8% of the total in 2007 and 45.3% of the total in 2008 of all beetle captures. *Harpalus pensylvanicus* (DeGeer) was 25.7% of the total in 2007 and 17.7% of the total in 2008 of all beetle captures.

Pine Needles significantly reduced captures of all Carabidae in 2007 compared to control plots. Yet, in 2008 fewer captures were not significant compared to control plots.

Bowater mulch significantly reduced captures of all Carabidae in 2007, but not in 2008 when compared to control plots. Captures of *H. pensylvanicus* were significantly increased in Bowater mulch compared to control, pine needle, and farm mulched plots in 2008.

Farm mulch did not significantly alter captures of all Carabidae in 2007 or 2008 compared to controls, but captures were significantly greater in both years compared to pine needle mulch.

P. melanarius captures were significantly greater in farm mulch compared to all other mulches in 2008 and compared to Bowater mulch in 2007.

Bottom Line...

Small mulch plots indicate that ground beetles avoid pine needles and may prefer Bowater biosolids or composted manure/sawdust compared to unmulched plots. Such a preference may be especially true for *Pterostichus melanarius* and *Harpalus pensylvanicus*, the two most abundant species in this study.

Credits

Justin Renkema (PhD student) Derek Lynch (NSAC) Margaret Savard (OACC Ed.)

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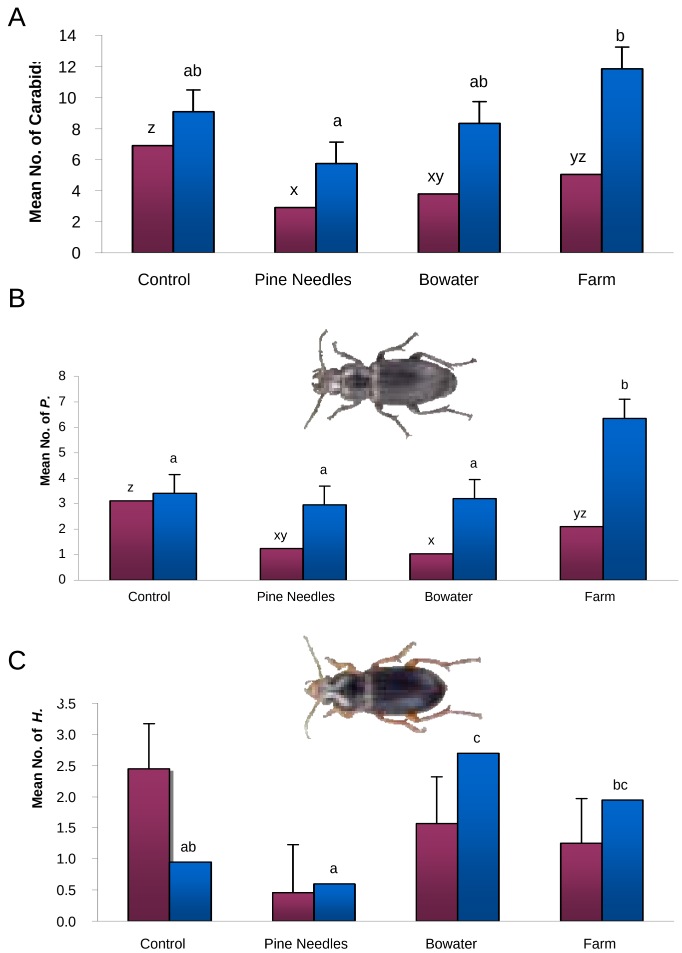

Figure 3: Number of captures for A.) all Carabidae, B.) *Pterostichus melanarius* (Illiger), and C.) *Harpalus pensylvanicus* (DeGeer) in pitfall traps placed in small mulch plots during five, one week periods in July-September 2007 (purple) and 2008 (blue) at an organic highbush blueberry field near Kentville, NS. Mulches were uncomposted pine needles, composted Bowater biosolids, composted farm sawdust/horse manure mulch, and an unmulched control. Significant differences between captures of beetles in mulches for each year are indicated by different letters above mean.

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SUSTAINABLE ORGANIC VEGETABLE SYSTEMS: EVALUATING GREEN MANURE AND BIOWASTE COMPOSTS

Interim Research Report E2009 - 51

ORGANIC VEGETABLE PRODUCTION

Organic production systems rely largely on soil fertility for nutrient supply. Soil fertility in these systems can be maintained by management practices such as organic amendments (i.e. manure, compost), green manure, and rotating high and low nutrient-demanding crops. Market demand continues to increase for local and organic vegetables. At the same time, compost production in Canada has increased by more than 100% in six years, from 980 thousand tonnes in 2000 to more than 2.0 million tonnes in 2006 (Statistics Canada, 2006). Combining these trends provides a unique opportunity to develop a sustainable high-value organic vegetable production system that uses both green manures in the rotation and biowaste composts to improve soil fertility.

The sustainability of a cropping system is linked with productivity, quality, economics and environmental impacts. Limited information is available on productivity, soil nutrient availability and environmental impacts within organic cropping systems. This project was established to test the effects of biowaste composts combined with green manure on crop productivity, nutrient availability, soil quality and greenhouse gas emission in a 5-year high-value organic vegetable (potatoes, beans, and carrots) rotation.

METHODS

This project was established at the Nova Scotia Agricultural College experimental site in Truro, NS in 2006. Four crop rotation sequences include:

1- Oats/Red Clover (O/RC) - Red Clover-Potato (P)-Oats/Red Clover - Carrots (C)
2- Oats/Red Clover - Red Clover – Potato - Beans/Buckwheat (B/Buck) - Carrots
3- Carrots - Peas/Oats/Vetch (PeOV) – Potato - Oats/Red Clover - Beans/Buckwheat
4- Beans/Buckwheat - Peas/Oats/Vetch – Potato - Oats/Red Clover - Carrots

Each rotation plot was divided into four sub-plots including control, mineral fertilizer, municipal food waste compost (12 Mg ha^{-1} wet weight; DM=59%) and composted paper mill fibre (37 Mg ha^{-1} wet weight; DM=33%). In 2008, soil samples were collected from 0-15 cm and 15-30 cm depth from the potato phase prior to planting, at tuber initiation stage, at tuber bulking stage and after harvest, and analyzed for mineral N concentration. Potato tuber yield, size distribution and defects were measured at harvest. The N supply rate was measured within control plots for O/RC and C-PeOV rotations from planting to 30 days after planting using Plant Root Simulator probes that were placed in the soil. Indicators of soil quality including microbial biomass, particulate organic C and N, and acid phosphatase activity were determined in soil samples collected at the tuber initiation stage. Greenhouse gas data were collected from 8th May to 4th December, 2008.

PRELIMINARY RESULTS

Total potato tuber yields ranged from 32 to 40 Mg ha^{-1}. Crop sequence in the first three years of the study did not have any effect on total tuber yields. Greater total tuber yields were found in the fertilized treatment compared with composted paper mill fibre and control, while the yield in municipal food waste compost was comparable (Fig. 1). Tuber size distribution was also influenced by amendment application but not crop sequence. Lower percentage of small size (38-51 cm) tubers was measured in fertilized compared with composted paper mill fibre and control treatments. Canada #1 size tubers (51-89 cm) were not affected by rotation or organic amendment.

Tuber wireworm damage was reduced by 74% after C-PeOV and B/Buck-PeOV compared with the O/RC-RC rotation. Amendment application did not have any effect on wireworm damage. In contrast, hollow hearth, discoloured holes in the center of ***tubers***, was reduced by 50% when preceding crops were

O/RC-RC compared with C-PeOV and B/Buck-PeOV and by 38% in control compared with composted paper mill fibre and municipal food waste compost. Percentage of hollow heart in the fertilized treatment was intermediate.

Soil N supply measured by Plant Root Simulator (PRS) probes placed in the soil was 58% greater after O/RC-RC than after C-PeOV.

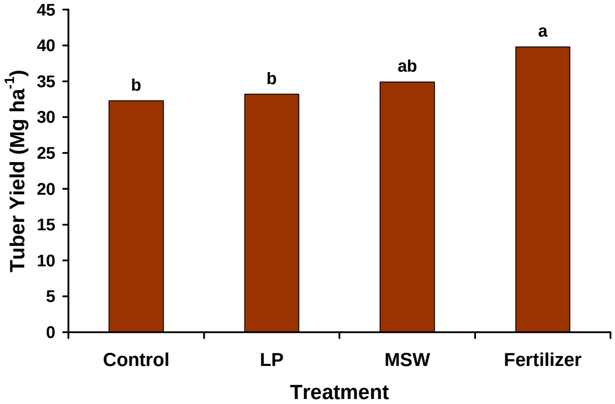

Fig. 1. Effect of control, mineral fertilizer, municipal food waste compost (MSW) and composted paper mill fibre (LP) on total potato tuber yield across all rotations.

The biologically active pool represents only a small fraction of total soil organic matter, but is often increased in organically managed soils, as revealed by microbial biomass measurements (Fließbach and Mäder, 1997). Soil microbial biomass carbon (MBC) was significantly higher in municipal food waste compost compared with composted paper mill fibre and fertilizer treatments (Fig 2). The MBC values were not affected by rotation sequences.

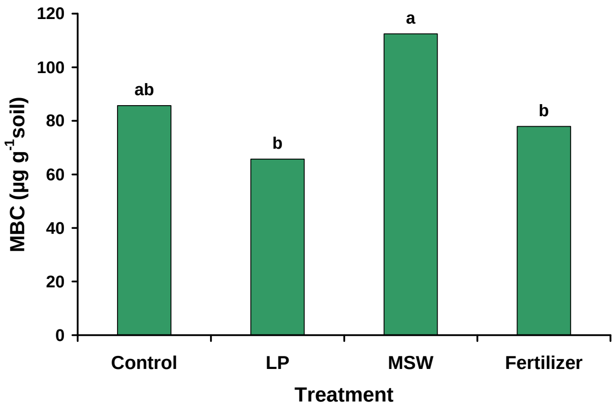

Fig. 2. Effect of control, mineral fertilizer, municipal food waste compost (MSW) and composted paper mill fibre (LP) on soil microbial biomass C (MBC) at tuber initiation stage across all rotations.

Soil acid phosphatase activity was significantly greater after O/RC-RC than after C/PeOV, whereas organic amendment did not have any effect on its activity.

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The Bottom Line...

Green manure and off-farm biowaste composts can be used successfully in organic production of high value vegetable crops. These practices can improve soil nutrient bioavailability, reduce N losses to the environment, and sustain soil quality and productivity, while assuring comparable yields as with conventional production.

Sustainable crop production can be achieved through an optimum combination of organic practices that include organic amendments and crop rotations.

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PRODUCTION OF NOVEL HIGH QUALITY HORTICULTURAL GROWING MEDIA

Interim Research Report E2009-53

INTRODUCTION

Paper mill biosolids (PMB) have been studied extensively as soil and growing media amendments for revegetation, field crops, vegetable production, and nursery container culture. Currently there is very little information available on composted PMB use in the greenhouse. Detailed research on the use of PMBs as a growing media in promoting plant growth and development in greenhouses is critical to developing improved production systems.

Soil-less media are used in horticulture for growing seedlings, plant propagation, vegetable production and the production of ornamental plants in pots. The most common media for these purposes is prepared with Sphagnum peat, due to its high physical and chemical stability and low degradation rate. The cost of high quality peat for horticultural use, together with the declining availability of peat in the near future due to environmental constraints, especially in countries without peat moss resources, make it necessary to look for alternative materials.

Table 1. Water-Holding Capacity (WHC) and Bulk Density (Db) for mixes. The letters following the measurement numbers indicate their relationship to other measurements in the table. Letters that are the same show that the measurement averages are not significantly different.

Treatment	WHC - % (m/m)		Bulk Density kgm^{-3}	
C-1	247.67	e	442.99	ab
C-2	168.37	e	580.99	a
C-3	345.93	de	327.73	bc
C-4	435.20	d	224.50	bc
C-5	213.57	e	487.89	ab
C-6	365.23	de	310.70	bc
C-7	622.73	c	206.51	bc
M-1	296.43	e	334.68	b
M-2	307.43	de	338.74	b
M-3	544.90	cd	225.01	bc
M-4	718.63	bc	168.85	c
M-5	279.63	e	292.73	bc
M-6	502.57	cd	228.65	bc
M-7	760.93	b	148.95	c
P-1	945.03	a	100.92	c
PR-1	884.90	ab	98.70	c

Figure 1: Clarendon Paper mill Compost

RESEARCH OBJECTIVES

The general objective of this research is to evaluate the suitability of composted pulp mill bio solids (PMB) and dehydrated PMB compost as peat replacement in the development of novel professional growing media for horticultural and export markets and to determine any limitation to their use. More specifically, the objectives are to:

1) Determine the effect of raw, dehydrated, screened and mixed with peat at 25%, 50% and 75% volume PMB on the physio-chemical and microbial properties.

2) Determine the effects on physio-chemical and microbial properties; and based on the results of objective 1: Selected growing media will be assessed for phytotoxicity (through germination assays) and performance (through vegetable transplant greenhouse trials).

Treatments

C-1 - Raw Clarendon
C-2 - Clarendon – DNS
C-3 - Clarendon – DNS. 50:50
C-4 - Clarendon – DNS. 75:25
C-5 - Clarendon – DS
C-6 - Clarendon – DS. 50: 50
C-7 - Clarendon – DS. 75:25
M-1 - Raw Miramachi
M-2 - Miramachi. DNS.
M-3 - Miramachi. DNS. 50:50
M-4 - Miramachi. DNS. 75: 25
M-5 - Miramachi. DS.
M-6 - Miramachi. DS. 50:50
M-7 – Miramachi. DS. 75:25
P-1 – Peat
PR-1 -Pro-Mix

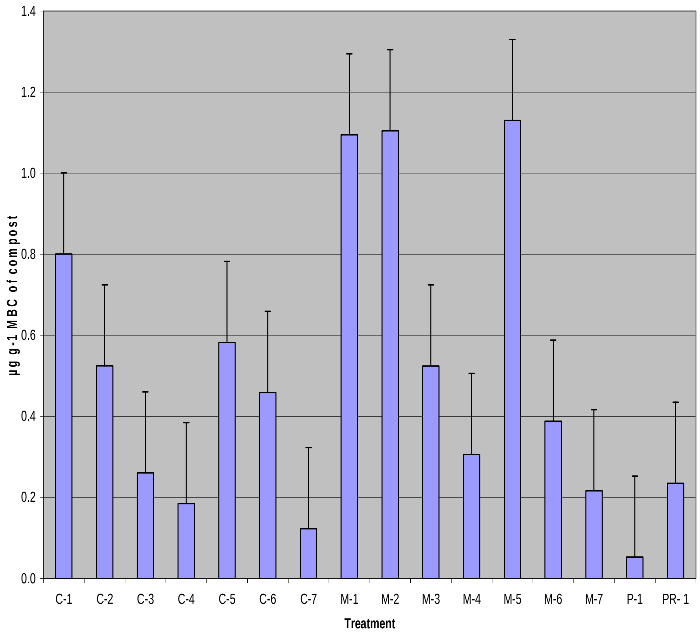

Figure 1: Microbial biomass-C as % of total c

Figure 2: Tomato seedlings grown under greenhouse conditions

PRELIMINARY RESULTS

PMB composts have a pH ranging from 7.2 to 7.6 and Electrical Conductivity ranging from 286 to 1010 $S \cdot m^{-1}$.There are no significant pH differences between the raw, dehydrated and dehydrated and screened compost. Both have reduced pH with the addition of peat. Screening of the compost and the addition of peat improves the bulk density (Table1). In most compost treatments, the addition of peat significantly increases the water holding capacity (Table 1) and decreases microbial content Figure 1).

BOTTOM LINE

Our long term goal is to expand the high value markets and lead to the development of high quality growing media for certified organic greenhouse production systems. Interim results suggest PMB compost when combined with peat may provide a quality growing media of benefit to organic production systems.

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Kristin Fielding (OACC, Format)

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MARITIME ORGANIC SPRING WHEAT CULTIVAR TRIAL (2007-2008)

Interim Research Report – E2009-54

INTRODUCTION

Achieving high grain yield and protein content can be a challenge for both organic and conventional producers of spring milling wheat in the Maritimes. A spring wheat cultivar specifically bred for organic agriculture has not yet been developed in Canada. Cultivar recommendations specific to organic production are also not available for the Maritime Provinces. At this time, organic producers select cultivars according to processor preferences. Additionally, wheat cultivars respond differently to the conditions present at different sites. Thus, across Canada, cultivar selection is a regional decision with recommendations often made by provincial governments. This is necessitated by Canada's wide geographic area and many different climate zones.

Some cultivars are known to yield similarly across a wide range of environments. Because of the variability, both within and between organic farms, these yield stable cultivars have been recommended for organic cereals production (Mason et al, 2008). They found that yield stable cultivars performed well under areas of high weed pressure and low fertility. This study investigated the production potential of different spring wheat cultivars under organic management conditions in the Maritime Provinces, and evaluated the yield stability of these cultivars.

WHAT WAS DONE

The experiment was conducted over two years (2007 and 2008) at three locations per year, one each in Nova Scotia (NS), New Brunswick (NB) and Prince Edward Island (PEI). The same location was used both years in PEI and NS; however, in NB a different specific site was used in each year. This provided a total of six site-years or environments.

AC Walton and AC Barrie, (two cultivars preferred by a local organic flour mill), AC Helena (a common cultivar used in conventional systems in the Maritimes), and Red Fife (a highly valued heritage wheat cultivar) were grown on each site in 2007. In 2008, the cultivar Acadia (an old cultivar with very limited seed availability that may not be commercially produced), was added to the trial. As well, in 2008 two batches of Red Fife were used: one from a prairie source and the other from a NB source. Due to the variable and long history of Red Fife in Canada, the two seed batches were treated as different cultivars. Thus in 2008 "New Brunswick Red Fife" and "Prairie Red Fife" were grown along with Acadia and the other cultivars grown in 2007. Unfortunately, the seed for Prairie Red Fife was not available in time for planting at the NS site in 2008.

An environmental index was calculated by taking the average yield of all the cultivars in each environment and subtracting the overall average yield of all the cultivars in all the locations. This provided the relative yield potential of each environment. A regression analysis of the yield of each cultivar against the environmental index is used as a measure of the stability of the cultivar.

Seeding in 2008 with the summer field crew (From L-R: E. Papineau, M. Bernard, L. Rector, A. Hammermeister (photo cr.), L. Poon, D. Kerr)

WHAT HAPPENED

In 2007, yield was highest at the NB site, with the PEI site showing the lowest yields. Overall in 2008, yield on all the sites was relatively low, with the highest yield coming from the PEI site (Figure 1). High rainfall early in the 2008 season resulted in increased weed pressure on all sites, with the PEI site having the lowest amount of weed competition

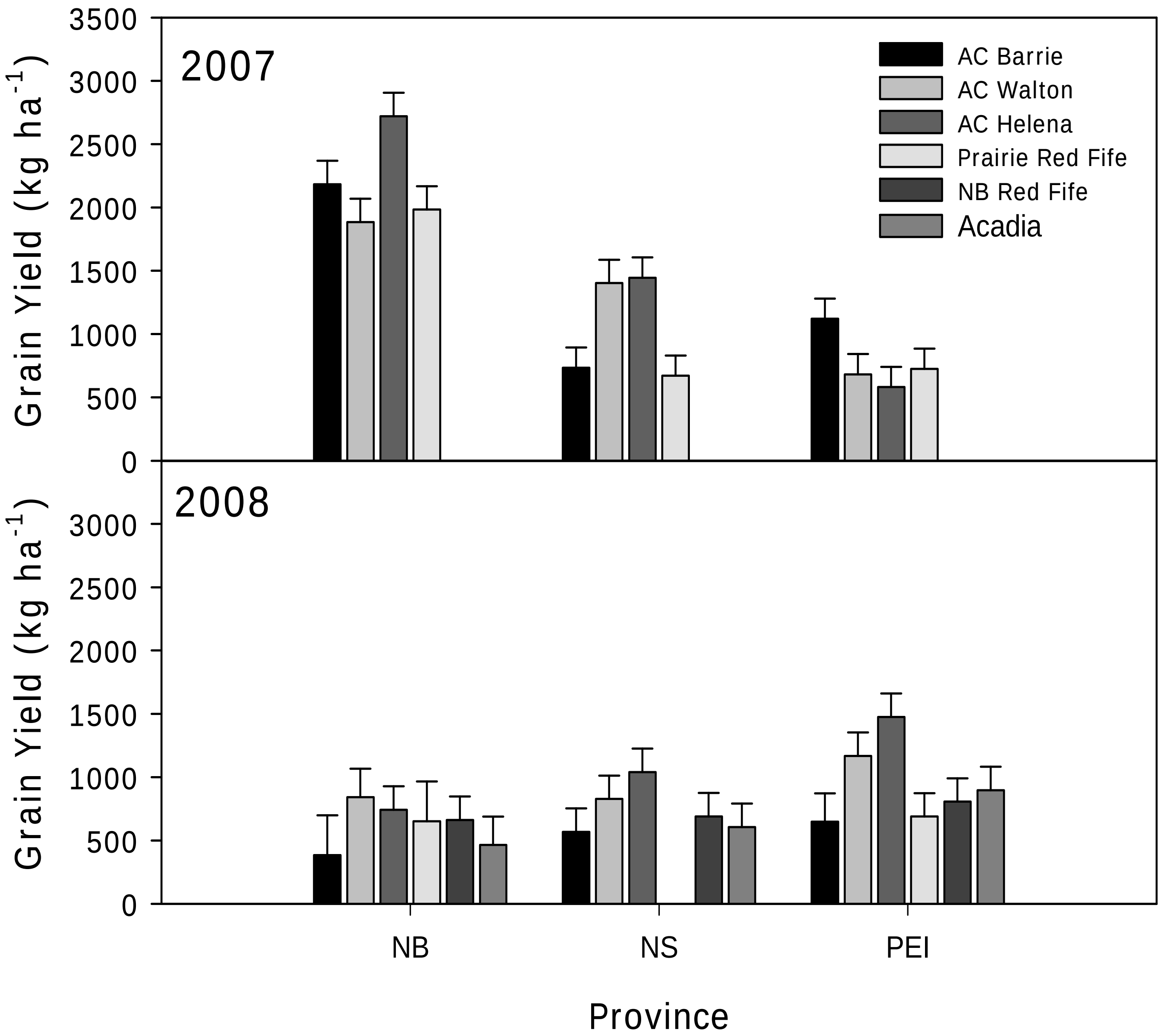

Figure 1: Grain yield recorded from a total of six cultivars grown in cultivar trials conducted on three organically managed sites each year in the Maritime Provinces in 2007 and 2008.

(data not shown). Evidence of cultivar differences were observed in each year, with AC Helena and AC Walton yielding the highest in all three sites, and AC Barrie with the lowest yield, with the exception of PEI in 2007. There was also evidence of cultivar by site interaction.

The interaction means the different cultivars responded differently depending on the site. Thus, in the Maritimes, cultivar selection could be considered even more regionalized than the prairies. This may be due to the widely varying soil types, elevations, and marine influences between the three provinces. Data has not been collected for the province of Newfoundland and Labrador. The average yield potential of each environment (site by year) was similar for all environments except for the New Brunswick location in 2007 ($P < 0.01$). The conditions present were arguably ideal for growing wheat organically in the Maritimes.

As a result, the site was dropped from the stability analysis to enable an investigation of the influence of typical Maritime growing conditions on the different wheat cultivars. An index of environmental effect was created by subtracting the average yield across all the cultivars and environments from the average yield of all the cultivars within each environment. The two Red Fife seed batches and AC Barrie were stable across environments while the remaining cultivars were responsive to favorable conditions (Figure 2). This also means that the responsive cultivars will yield below average if the conditions are not favorable.

Thus, stable AC Barrie was a good choice in the unfavorable field conditions in PEI in 2007, while responsive AC Helena was better able to capitalize on the ideal growing conditions in NB in 2007. It should also be noted that the two Red Fife seed lots did not yield differently ($P > 0.05$). Wheat is approximately 99% self-pollinated (Hucl, 1996). This makes wheat an inbred species and results in the near identical genetic makeup of individuals within a specific cultivar. Wheat breeders have to manually cross wheat parents by removing the male flower parts before the pollen is released. Pollen is then introduced from the donor cultivar to complete the cross. The breeders make selections on the resulting offspring, after many generations of self-pollination. This allows for the genetic makeup of the different sister lines to become consistent between generations. This pure line breeding is common in self pollinated crops, and once such a cultivar is released, the genetic make-up does not change regardless of where the seed is propagated.

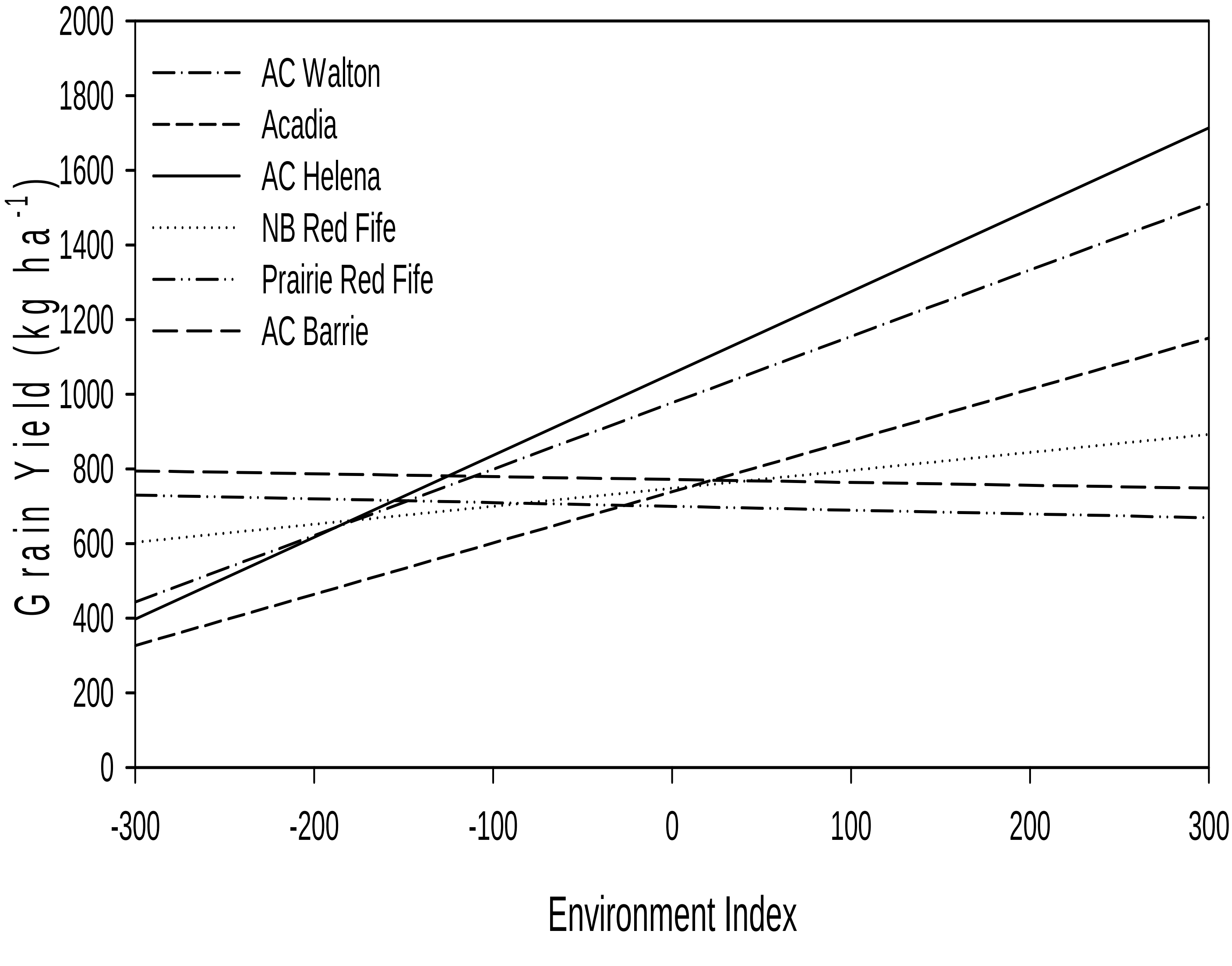

Figure 2: Estimates of yield stability for six spring wheat cultivars grown in five environments, each with similar growing conditions and yield potential.

BOTTOM LINE

Cultivar selection is ultimately the choice of the farmer. The results of this study may assist in the decision making process, but they should not be considered to be specific cultivar recommendations. Stable cultivars allow for a more predictable end result. A less yield stable cultivar could be considered a gamble but may provide a greater yield advantage in a better than average year. Nevertheless, our findings show that producing high quality milling wheat under organic agriculture is achievable in the Maritimes. This study was limited to cultivars of special interest to local processors. Many other wheat cultivars are available and may be tested if growers and processors express a need.

Dr. Andrew Hammermeister explaining cultivar differences. (cr L. Poon)

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ANIMAL WELFARE ON ORGANIC FARMS FACT SHEET SERIES

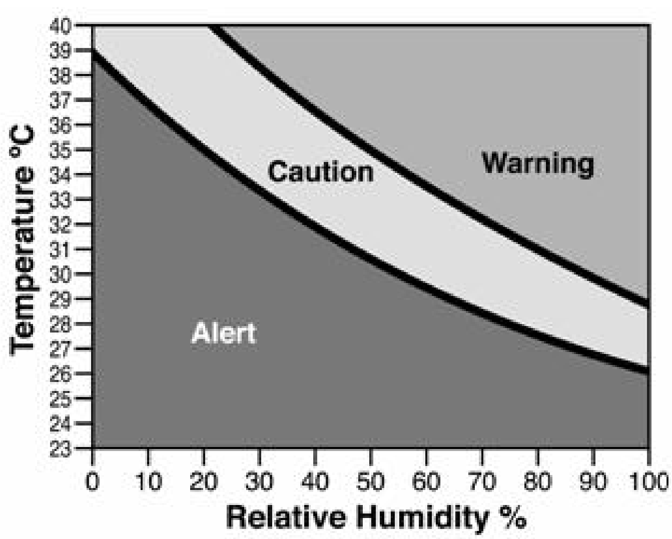
HEAT STRESS IN RUMINANTS

Produced in consultation with the ECOA Animal Welfare Task Force

THE PROBLEM

Heat stress can be a welfare issue for all types of livestock. In areas of Canada where high ambient temperatures occur during the summer months, the organic farmer must provide living conditions which give protection from excessive heat (see CAN/CGSB -32.310, 6.8.1).

Cattle can withstand low temperatures to -37°C but temperatures over 23°C (73°F) can cause stress when combined with high humidity, low air movement or direct sun. Stress starts to occur when the temperature humidity index is 68°F or above and becomes serious above 79/80°F. An abrupt increase in temperature when livestock have little time to adapt, or the first, very calm day during a heat wave is potentially lethal and can cause rapid dehydration in calves.



(Diagram from: Beat the Heat- Widowski 1998)

Heat stress can reduce productivity, cause reproductive problems such as reduced semen quality and lower birth weights, and compromise the immune system. Heat stress will reduce milk production in dairy cows: a 10% drop in yield at 27-32°C (80-90°F) and 50-90% humidity; and more than 25% drop at 32-38°C (90-100°F) with 50-90% humidity. The effect is more pronounced in higher producing cows.

Heat stress also lowers natural immunity making animals more vulnerable to disease in the following days and weeks. Problems with lameness occurring up to a few months after the event may also be attributed to heat stress.

Tolerance to heat varies:

- Holsteins are less tolerant than Jersey cows.
- Beef cattle with black hair suffer more from direct solar radiation than those with lighter hair.
- Lactating cattle are more susceptible than dry cows because of the additional metabolic heat generated during lactation.
- Heavier cattle over 1000lbs (455kg) are more susceptible than lighter ones.
- Sick or previously stressed animals are susceptible as are recently fresh cows.
- Cattle, alpacas and llamas are more prone to heat stress than sheep and goats (the comfort range of goats is 0-30°C (32-86°F).

SIGNS OF STRESS

When temperatures are high, monitor weather forecasts and look for signs of stress.

- Reduced feed intake (which is a natural response to reducing metabolic heat).
- Change in feeding patterns – more grazing at cooler times of the day.
- Cattle stand rather than lie down; sheep look for an area of cooler ground to lie on.
- Bunching or congregating in shade if it is available or around water when no shade is available.
- Rapid shallow breathing; open mouth breathing with panting at higher temperatures. Respiration rates increase with increasing temperatures from 14 to 34°C (57-93°F). If more than 20% of cows have respiratory rates exceeding 100 breaths per minute, action is needed to reduce stress.
- Sweating and increased saliva production.
- Lack of coordination and trembling.
- Increased water intake e.g. cows 10 gal/day at 20°C (68°F); 32gal at 35°C (95°F) and more for high producing cows. Requirements for beef cattle increase 150% between 21-32°C (70-90°F).
- Overheated sheep are prone to bloating.

TO REDUCE AND AVOID HEAT STRESS

Provide shade from direct sunlight; e.g. trees, temporary shade using portable shade cloth blocking 50% of radiation, or permanent structures. All cows should be able to use the shade at the same time and there should be enough space for animals to lie down. Research on beef cattle shows improved weight gains and feed conversion efficiency with 45 sq ft (4.18 sq m) of shade/animal.

Provide ample, cool, clean water in shade near loafing areas. Cows will not travel across 30 metres of open field when temperatures, humidity and radiant solar heat are extremely high. Provide at least 1 watering station per 20 cows, with a supply of 3-5 gal (11-19L)/minute and a minimum 3" (8cm) depth. Calves will consume 3-6 gals (11-23L)/day. Finishing steers will require up to 20gal (76L/head/day).

Cow showing signs of stress (photo cr.) A. Rogers, AgResearch New Zealand

Cattle on range should be readily able to access water. Add extra stock tanks if necessary. In normal conditions the recommended maximum distance cattle should travel to water:

- steep slopes (>15%): ¼- ½ mile (0.4-0.8 km)
- moderate slopes (8% to 15%): $^{3}/_{8}$-¾ mile (0.6-0.9km)
- flatter slopes (<8%): ¾-1 mile (0.9-1.6 km)

Other recommended practices:

- Increase air flow over the animals. Efficient use of fans will help alleviate heat stress when animals are housed. All vents should be fully open.
- Minimize time spent in holding pens before milking.
- For dairy cows in pasture-based systems the use of sprinklers while the cows wait for the afternoon milking reduces heat stress. Sprinklers also reduce irritation from insects.

- Avoid handling cattle during hot, humid weather. If it is necessary to carry out stressful events (e.g. castrating, vaccinating), do it in the early morning.

- Avoid transporting livestock in hot weather; move between 8pm and 8am and reduce loading density. Do not move animals from a relatively cool environment to a hot environment during the summer.

- Reduce biting fly populations (with improved sanitation, repellents and traps) which tend to cause cattle to bunch together.

- Provide access to high quality forage (e.g. first cut dry hay) in feed bunks in shaded areas even if cows are also on good quality pasture.

- If finishing cattle, shift daily feed delivery toward evening.

- Keep livestock in a good body condition – fatter animals have more problems.

- When using management intensive grazing, rotate through fields more quickly - taller grass is a cooler surface; rotate in evening rather than in the morning; graze paddocks that allow access to barn or trees during the heat of the day.

- Use opaque calf hutches in preference to translucent hutches and space them to allow for adequate air flow. Provide supplemental shade for young calves.

- Shear in spring or early summer before temperatures rise to give the fleece a chance to regrow a bit. Protect recently shorn sheep from prolonged exposure to sun. Water consumption during heat stress is higher in shorn than in unshorn sheep and there is a greater reduction in roughage intake.

TREATING SUNSTROKE OR HEAT EXHAUSTION

Treatments to lower body temperature include cold water submersion, cold water enemas, ice applications, alcohol rubs and in the case of sheep or llamas, cold water applied to body parts with little wool (head and lower legs). Move to cool shaded area. Provide oral administration of fluids to dehydrated animals.

Homeopathic remedies can provide relief if sunstroke is indicated with very high temperature, rapid pulse, shallow breathing and a reluctance to move. Hansford & Pinkus in *The Herdsman's Introduction to Homeopathy* recommend the following: Use Aconite 30C – one every 15 minutes if worse for standing and shows anxiety. Belladonna 30C can be used alternately where the animal is excited and has dilated pupils; if recumbent and limbs tremor and jerk use Glonoine 30C. Dose every 15 minutes, gradually increasing time between doses until improvement is seen. Always stop with improvement.

Call the vet.

Shade is essential to the welfare of farm animals in areas where the typical summer temperature exceeds 23°C and the temperature humidity index exceeds 68. (photo cr. Neil Anderson)

SOURCES OF INFORMATION

Extension service fact sheets from a variety of sources: Ontario Ministry of Agriculture (OMAFRA), South Dakota State University Cooperative Extension Service, Virginia Cooperative Extension, University of Nebraska, Ohio State University, University of Arkansas, NRCS Texas, and miscellaneous industry newsletters.

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(photo cr. Mike Main)

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ANIMAL WELFARE ON ORGANIC FARMS FACT SHEET SERIES

IDENTIFYING LAMENESS IN DAIRY CATTLE

Produced in consultation with the ECOA Animal Welfare Task Force

THE PROBLEM

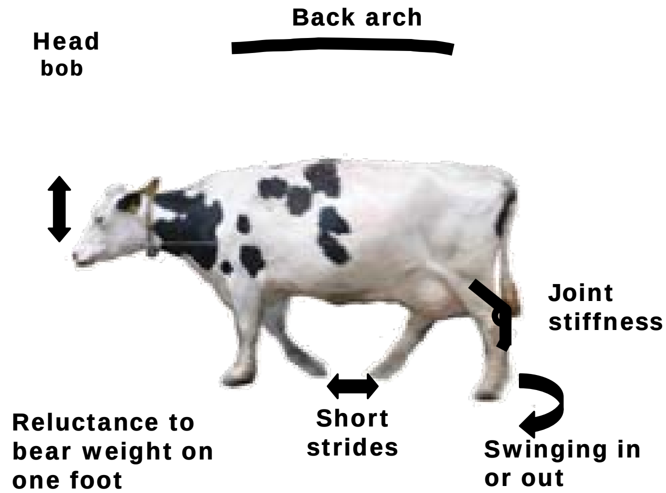
Lameness is considered a serious welfare problem for dairy cattle. Studies have shown that farmers have difficulty detecting animals in the early stages of lameness, and thus, the occurrence of lameness is often underestimated. Hoof problems are the typical cause of lameness, and these are often related to housing or other management factors. For instance, bare concrete floors cause excessive and uneven wear of the hoof, and diseases of the skin, such as dermatitis, are more common when cows have to walk on grooved or uneven concrete. Steep steps (more than 15cm), sloped walking surfaces, and wet, muddy flooring surfaces can also cause lameness. Lastly, any factor that contributes to cows standing longer on concrete and manure can increase their risk of lameness, such as uncomfortable lying surfaces due to insufficient bedding.

DETECTING LAMENESS

The reluctance to bear weight on one or more hooves is an obvious indicator of lameness, however, the signs are often more subtle.

Several scoring systems, designed to detect lameness early, have been developed based on observable changes in the way a dairy cow walks. These are usually based on a 5 point scoring system ranging from sound to severely lame. Indicators of lameness include: back arching, legs swinging in and out, short strides, jerky head bobbing, joint stiffness and reluctance to bear weight on one or more hooves. Observers assign a score to a cow after watching them walk on a level, non-slippery, hard surface from the side and from behind.

The following image shows examples of behaviours to monitor as a cow is standing or walking to assess whether she is lame or not:



1 = "Sound" – a cow that is not lame will walk with a smooth and fluid motion with a straight back, even weight bearing and no unevenness or awkwardness of gait.

2 = "Imperfect Locomotion" – a cow with slightly uneven gait, and slight stiffness in her joints. This score is not considered lame.

3 = "Mildly Lame" – a cow with an obviously arched back when walking, some swinging in and out with the hind limbs, or a slight limp in one limb.

ACTION: Keep an eye on these cows, as they are at risk for more severe lameness.

4 = "Moderately lame" – a cow that is moderately lame obviously favors one limb and walks with a limp. These cows also have an arched back when standing and walking, a jerky head bob, and stiff joints.

ACTION: it is advised that you have a professional hoof-trimmer see these cows immediately.

5 = "Severely lame" – cows that have extreme difficulty in rising and walking, extreme arched

position, very jerky head bob, joint stiffness and noticeable weight loss are very lame cows.
ACTION: it is advised that you have a hoof-trimmer or a veterinarian experienced in lameness see these cows immediately.

IDENTIFYING HOOF INJURIES

Regular hoof trimming provides an opportunity to check for hoof disorders which commonly cause lameness, such as:

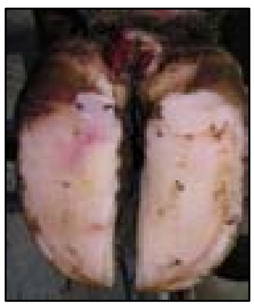
Less severe:

1) Elongated or cracked hoofs
2) Hemorrhaging or bruising of the sole
3) Heel erosion

Requires immediate treatment/attention:

1) Ulcer in the sole
2) Ulcer in the whiteline ("whiteline disease")
3) Foot rot, swelling to fetlock, foul odour, separation of claws
4) Digital dermatitis ("strawberry heel wart")

Whiteline disease



Digital Dermatitis

Sole Ulcer

Foot rot

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Anne Macey; Marina von Keyserlingk, Katy Proudfoot and Kiyomi Ito of the UBC Animal Welfare Program. Production of this bulletin was supported by the BC Organic Sector Development Fund.

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Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

MANAGING LAMENESS

Good record keeping of lameness and hoof injuries is critical! Recording the occurrence of lameness will help determine the extent of the problem in your herd and provide clues as to the underlying cause. A professional hoof-trimmer should see your cows at least once a year (for instance, when cows are dried off), and cases of lameness should be treated immediately. A lameness prevention program developed in consultation with your nutritionist, veterinarian and hoof trimmer is also highly advised. Examples of management practices that might cause lameness:

1) Overstocking at the feed bunk or lying stalls can increase the time that cows stand in manure.
2) Uncomfortable lying surfaces or inadequate bedding can increase standing time.
3) Improper foot-bathing can help diseases spread between cows in your herd.
4) Long, rocky pathways between pasture and the milking parlor can cause hoof injuries.
5) Concrete flooring is a known risk factor, particularly when cows are forced to stand for long periods of time (e.g. waiting to be milked).

RESOURCES

Rushen, J., de Passillé, A. M., von Keyserlingk, M., Weary, D. M. 2008. *The Welfare of Cattle.* Springer, Dordrecht, The Netherlands.

"Firm Steps: Identifying Lameness in Dairy Cattle", a CD-ROM aimed at producers, educators and veterinarians and produced by Alberta Agriculture and Food. $20 for 2 CDS from: www.agriculture.gov.ab.ca/publications

http://www.cattle-lameness.org.uk/index.php The Healthy Feet Project from the University of Bristol, UK, contains a wealth of practical information to assist producers in addressing lameness in dairy cows including videos clips showing different degrees of lameness and record keeping sheets for identifying hoof problems.

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FINANCIAL STATEMENT

OACC Financial Statement as of February 17, 2009 for 2008/09 Fiscal Year

	Total
Expenditures	
Research Coordination	273,582.12
Research Costs and Analysis	35,348.36
Information Dissemination	165,575.16
Translation	75,612.85
Travel	27,640.97
Financial Management	46,916.58
Total	**624,676.04**
Revenues	
Province of Nova Scotia	50,000.00
Province of New Brunswick	15,000.00
Province of Prince Edward Island	50,000.00
Province of Alberta	50,000.00
Canadian Wheat Board Market Development Initiative	19,000.00
Maritime Organic Grain Network sub-contracted from the Atlantic Canadian Organic Regional Network, funded by NS Agri-Futures, PEI Adapt Council and NB Agricultural Council	15,399.00
Government of Manitoba Agricultural Sustainability Initiative	30,500.00
Advancing Canadian Agriculture and Agri-Food	422,498.89
British Columbia Agri-Futures Fund, Organic Sector Development Program	20,325.70
Organic Meadow	2,500.00
Nature's Path	3,000.00
Homestead Organics	1,000.00
The Organic Grocer	1,500.00
Nova Spinal Care	200.00
Total	**680,923.59**

Notes:

1) Expenditures include actual and committed funds as of Feb. 17, 2009; fiscal year end is March 31.
2) Revenues may include donations intended for multiple years.
3) Specific research contracts held in whole or in part by OACC staff are not included in this statement. Other research costs are included on those contracts.
4) In-kind contributions (not shown here) are significant, especially those of the Nova Scotia Agricultural College.

FARMER AND INDUSTRY COLLABORATORS

OACC is fortunate to work with many dedicated organic farmers and researchers from all parts of Canada. Every effort has been made to acknowledge all of our collaborating partners in this report. If we have missed anyone in this listing, please accept our apologies and let us know so this may be corrected next year.

Farmers

Twenty-three farms in Ontario and ten farms in Québec are anonymously participating in OACC parasite research studies.

- Andres, Lawrence - ON
- Archibald, Greg - NS
- Ballam, Kris – NS
- Bernard, Mark - PE
- Blois, Lloyd & Shelly – NS
- Brouwer, Gerrit - AB
- Brynne, Abra - BC
- Cowan, Cal - SK
- Cushon, Ian - SK
- DeGroot, Martin - ON
- DeNuke, Peter & Carl - NS
- Dewavrin, Loïc - QC
- Dykstra, Mark - PE
- Funk, Dayton - SK
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- Harbers, Bert - NS
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- *Western Ag Innovation*s, *Gary Kruger*

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Goodyear, Norman - *Nova Scotia Agricultural College*
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Haley, Derek - *University of Alberta*
Hamel, Chantal - *Agriculture and Agri-Food Canada*
Hanlon-Smith, Claire - *Nova Scotia Department of Agriculture*
Harrison, Joan - *Organic Connections Board*
Harker, Neil - *Agriculture and Agri-Food Canada*
Hartley, Scott - *Saskatchewan Ministry of Agriculture*
Heit, Jason - *University of Saskatchewan*
Henning, John - *McGill University*
Henry, Roger - *Agriculture and Agri-Food Canada*
Hollinger, John - *Manitoba Agriculture, Food and Rural Initiatives*
Hucl, Pierre - *University of Saskatchewan*
Hrycan, William - *University of Saskatchewan*
Irving, Pamela - *Alberta Agriculture, Food and Rural Development*
Johnson, Dan L. - *University of Lethbridge*
Johnson, Eric - *Agriculture and Agri-Food Canada*
Kabakuk, Todd - *Pacific Agri-Food Canada*
Kehler, Connie - *Organic Connections Board*
Kelton, Dave - *University of Guelph*
King, Jane - *University of Alberta*
Klemmer, Craig - *Saskatchewan Ministry of Agriculture*
Knight, Diane - *University of Saskatchewan*
Kosteroski, Bryan - *Agriculture Council of Saskatchewan*
Kutcher, Randy - *Agriculture and Agri-Food Canada*
LaBelle, François - *University of Guelph (Alfred)*
Lachance, Simon - *University of Guelph (Alfred)*
Leach, Darwin - *Agriculture and Agri-Food Canada*
Leblanc, Maryse L.- *institute de recherché et de developpement en agroenvironnement*
Leboeuf, Anne - *Centre d'expertise en production ovine du Québec*
Leeson, Julia - *Agriculture and Agri-Food Canada*
Linsley, John - *Canada Saskatchewan Irrigation Diversification Centre*
Macey, Anne - *Organic Inspector*
MacKinnon, Susan - *Prince Edward Island Department of Agriculture*
MacRae, Rod - *MacRae Media Consultants*
Malhi, Sukhdev - *Agriculture and Agri-Food Canada*
Martin, Hugh - *Ontario Ministry of Agriculture and Food*
Matthews, Linda - *University of Saskatchewan*
McAvoy, Mike - *Saskatchewan Ministry of Agriculture*
McConkey, Brian - *Agriculture and Agri-Food Canada*
McLean, Nancy - *Nova Scotia Agricultural College*
McMahon, Beth - *Atlantic Canadian Organic Regional Network*
Meinert, Martin - *OCIA Research and Education*
Menzoes, Paula - *University of Guelph*
Miller, Debbie - *Organic Connections Board*
Mirza, Mohyuddin - *Alberta Agriculture and Rural Development*
Monreal, Marcia - *Agriculture and Agri-Food Canada*
Moolecki, Patrick - *Saskatchewan Ministry of Agriculture*
Morrison, Malcolm - *Agriculture and Agri-Food Canada*
Moyer, Jim - *Agriculture and Agri-Food Canada*
Neeser, Chris - *Alberta Agriculture and Rural Development*
Neilsen, G. H. - *Agriculture and Agri-Food Canada*
Newman, Stephanie - *OCIA Research and Education*
Noronha, Christine – *Agriculture and Agri-Food Canada*
Nurse, Rob – *Agriculture and Agri-Food Canada*
O'Donovan, John - *Agriculture and Agri-Food Canada*
O'Halloran, Ivan - *University of Guelph (Ridgetown)*
Olfert, Owen – *Agriculture and Agri-Food Canada*
Ouellette, Tim - *Tourism Saskatchewan*
Owen, Josée – *Agriculture and Agri-Food Canada*
Patriquin, David - *Dalhousie University*
Percival, David - *Nova Scotia Agricultural College*
Peregrine, Andrew - *University of Guelph*

RESEARCH AND EXTENSION COLLABORATORS CONTINUED…

Perrault, Don - *Saskatchewan Ministry of Agriculture*
Peters, Rick - *Agriculture and Agri-Food Canada*
Phelps, Sherilynn - *Saskatchewan Ministry of Agriculture*
Papadopoulos, A.P. – *Agriculture and Agri-Food Canada*
Porter, Paul - *OCIA Research and Education*
Prange, Robert - *Agriculture and Agri-Food Canada*
Prithiviraj, Balakrishnan – *Nova Scotia Agricultural College*
Raggio, Gaston – *Organic Dairy Research Centre*
Recksiedler, Blaine - *Saskatchewan Ministry of Agriculture*
Reekie, Julia - *Agriculture and Agri-Food Canada*
Rempel, Sharon – *Victoria, BC*
Rifai, Nabil - *Nova Scotia Agricultural College*
Risula, Dale - *Saskatchewan Ministry of Agriculture*
Robinson, Darren - *University of Guelph (Ridgetown)*
Rushen, Jeff - *University of British Columbia*
Sarno, Liz - *OCIA Research and Education*
Sawatsky, Rick- *University of Saskatchewan*
Scharf, Forest - *Saskatchewan Ministry of Agriculture*
Schoneau, Jeff - *University of Saskatchewan*
Scoles, Graham- *University of Saskatchewan*
Scott, Jennifer – *GPI Atlantic*
Sharpe, Keri - *Alberta Agriculture and Rural Development*
Shirtliffe, Steve - *University of Saskatchewan*
Sim, Brian - *Saskatchewan Ministry of Agriculture*
Singh, Av - *Agrapoint (NS)*
Smith, Gary - *Organic Connections Board*
Smith, Susan - *British Columbia Ministry of Agriculture, Food and Fisheries*
Spaner, Dean - *University of Alberta*
Stumborg, Chantal - *Saskatchewan Ministry of Agriculture*
Sumner, Jennifer - *University of Guelph*
Sweetman, Glen - *Saskatchewan Ministry of Agriculture*
Tanino, Karen - *University of Saskatchewan*
Taylor, Arnold - *Organic Connections Board*
Thomas, Gordon - *Agriculture and Agri-Food Canada*
Thomson, Jill - *University of Saskatchewan*
Tremblay, Michel - *Saskatchewan Ministry of Agriculture*
Turkington, Kelly - *Agriculture and Agri-Food Canada*
Van Acker, Rene - *University of Guelph*
Van Leewen, John - *University of Prince Edward Island*
Van Straaten, Peter - *University of Guelph*
Vera, Cecil - *Agriculture and Agri-Food Canada*
Vernon, Bob - *Agriculture and Agri-Food Canada*
Villeneuve, Alain - *Université de Montréal*
von Brandon-Muenster, Brother Pius - *Organic Connections Board*
von Keyserlingk, Marina - *University of British Columbia*
Voroney, Paul - *University of Guelph*
Wahaab, Jazeem - *Canada Saskatchewan Irrigation Diversification Centre*
Walley, Fran - *University of Saskatchewan*
Warman, Phil - *Nova Scotia Agricultural College*
Waterer, Doug - *University of Saskatchewan*
Wilson, Mike - *Organic Connections Board*
Yiridoe, Emmanuel - *Nova Scotia Agricultural College*
Zebarth, Bernie - *Agriculture and Agri-Food Canada*
Zentner, Robert - *Agriculture and Agri-Food Canada*

EDUCATION

OACC web-based courses are available to farmers, students, and others involved in organic agriculture. Participants can register for the courses regardless of their location and participate in the course material during the hours most suitable to them. Many students have found the interactive approach to be enjoyable and educational. It can be a valuable experience to interact with the instructor and with classmates that have similar interests and questions while sitting comfortably at home.

The courses offered in 2008 are listed below, followed by the host institution.

- Composting and Compost Use (Nova Scotia Agricultural College (NSAC))
- Key Indicators of Sustainable Agriculture (University of British Columbia)
- Organic Crop Production on the Prairies (University of Manitoba)
- Organic Field Crop Management (NSAC)
- Organic Livestock Production (NSAC)
- Organic Marketing (University of Guelph)
- Organic Soil Fertilization (McGill University)
- Principles of Organic Horticulture (NSAC)
- Transition to Organic Agriculture (NSAC)
- Weed Control in Organic Agriculture (University of Saskatchewan)

Four web-based courses were offered in French, through Université Laval. These courses are roughly equivalent to the corresponding English courses offered at NSAC.

- Compostage et utilisation du compost en agriculture biologique
- Production biologique des cultures en champ
- Productions animales biologiques
- Transitions vers l'agriculture biologique

NSAC offers a “Certificate of Specialization in Organic Agriculture.” Any student who has successfully completed four of the eligible organic agriculture credit courses (including at least two courses from NSAC), and who has an overall average of at least 60% in these courses can apply to receive a Certificate of Specialization in Organic Agriculture.

For more information or to register for a course please visit the OACC website:

English: www.oacc.info/Courses/course_web.asp

French: www.oacc.info/Courses/courses_web_f.asp

Expert Committee on Organic Agriculture

The Expert Committee on Organic Agriculture (ECOA) has developed research priorities for each of 8 categories. The categories are 1) animals, 2) plants, 3) soils, 4) ecological systems, 5) health and food quality, 6) marketing 7) policy and 8) sustainable agriculture and rural communities. The priorities for 2008 build on those developed in 2005 through 2007 and are listed as succinct statements with some areas of concentration noted.

As a General Research Priority, ECOA recommends establishing funds and an application procedure to facilitate research in organic agriculture and food, to address the goals of carrying out research for the public good, including long term research, making research results publicly available and reducing requirements for matching funding from industry. ECOA also recommends investigating research accomplishments in other areas of the world that relate to the research needs of organic agriculture in Canada.

1) Animals

Design animal production systems that are most conducive to normal animal behaviour and animal health, while enhancing food safety.

Suggested areas of concentration are:

- animal welfare issues in dairy husbandry (includes animal health, housing, pasture nutrition, etc)
- parasite prevention and control in livestock (especially sheep)
- outdoor management systems with poultry in light of Avian flu
- optimally designed systems for organic swine (in light of parasites, environmental concerns and rodent management)
- grazing nutrition

2) Plants

Select and breed for plant varieties suitable for organic management especially in fruits and vegetables that are;

- adapted to diversified landscapes, regions, and changing climates
- disease and pest resistant/tolerant and competitive with weeds, improve food quality and yield adequately

Suggested areas of concentration are:

- weeds - ragweed, yellow mustard, Canada thistle, quackgrass, kochia
- insects - tarnish plant bug, carrot maggot, cucumber beetle, wireworm, apple maggot, cutworm
- diseases - apple scab, blight in potatoes, need to replace copper products

3) Soils

Develop integrated nutrient management systems (soils, crops, feeds, livestock, manures/composts) and evaluate sustainability of organic production.

Suggested areas of concentration are:

- elucidating soil biological activity and how to manage it beneficially
- assessing short and long term soil fertility issues (for example the availability and/or buildup of organic matter, phosphorus, nitrate, zinc, copper, calcium and sulphur)
- evaluating acceptable input substances on a regional basis

4) Ecological Systems

To assess and improve ecological goods and services (EG&S). To evaluate the interrelationships of ecological factors in organic farming systems.

Suggested areas of concentration are:

- assessing air quality (e.g. greenhouse gases)
- assessing water quality and water use efficiency
- assessing soil quality
- assessing biodiversity
- optimizing energy use efficiency and resources on organic farms

5) Health and Food Quality

Identify links between organic systems, healthy food and risk reduction. Identify links between food and human health.

Suggested areas of concentration are:

- evaluating the concentration of nutrients, antioxidants and other bio-constituents in food products
- assessing the relationships between the quality of soils, amendments, plants, animals and food
- assessing the impact of management on the quality of soils, amendments, plants, animals and food
- identify the impacts of organic food on human health

6) Marketing

Identify emerging consumer trends, serviced by imports, and the opportunities and barriers to investment and development in domestic production that could respond to emerging markets.

Suggested areas of concentration are:

- assessing the impact of a Canada Organic logo
- assessing the range and implementation of alternative marketing models including co-operatives, local marketing, other (e.g. fair trade)
- Canadian organic market research;
  - assessing the preference for Canadian or regional/local products and the relationship to price
  - characterizing the Canadian organic market (import, export, distribution channels)

7) Policy

a. Assess the impact of new Genetically Engineered (GE) crops (e.g. alfalfa) on organic systems, while considering regulatory and liability issues. Conduct research to inform policy makers on the issues surrounding GE crops related to their ecological, social and economic impacts on agriculture, including organic agriculture.

Suggested areas of concentration are:

- threshold levels
- pathways of contamination (ie: grain handling, seed, manure/compost, etc)
- effects on pollinators
- legislative models for dealing with liability issues
- strategies for developing GE free zones
- practical methods of detection and limiting contamination

b. Assess the impact of nano-technology on organic systems (prohibited in organic standards in EU based on precautionary principle).
c. Develop policy mechanisms for payment and/or recognition of ecological goods and services (EG&S) in organic production systems.
d. Research models of land use (e.g. no-development zones) on land values and availability of land for organic farming.
e. Research models for new entrants programs to organic agriculture.
f. Research alternative models of intellectual property ownership to ensure public access to genetic diversity of varieties in the organic sector.

8) Sustainable Agriculture and Sustainable Communities

Study, evaluate and make public policy recommendations for organic agriculture as a form of sustainable agriculture that is environmentally, socially and economically responsible, and supportive of rural and urban communities.

Suggested areas of concentration are:

- assessing how organic agriculture can strengthen the relationships between rural and urban communities
- assessing the impacts and feasibility of urban organic agriculture
- developing linkages with researchers into sustainable livelihoods in developing countries

WEBSITE REPORT: FEBRUARY 1ST 2008 TO FEBRUARY 1ST 2009

The OACC/CABC website continues to sustain an increasing demand for its pages, with a **10.6% increase in page views and a 12% increase in the number of visitors** to the site over the course of the last year.

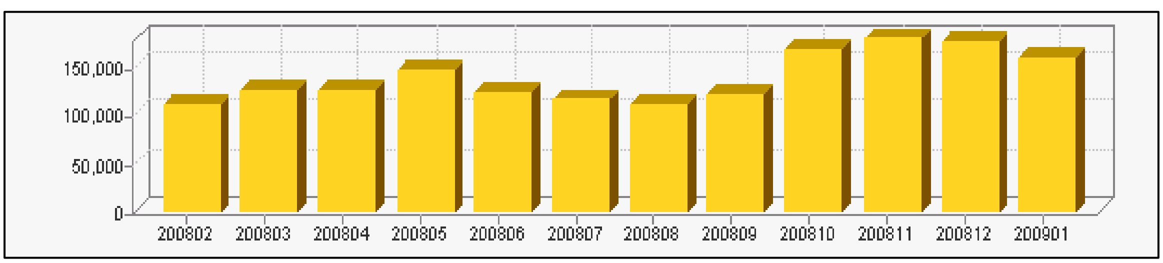
Highlights of the website in the last year include:

- Organic Friends E-Zine/Cyberbulletin Les amis du bio marked the beginning of its fifth year of publication in November 2008. Our mailing list consists of over 11,200 subscribers.
- There are currently a total of 10,908 files in the OACC/CABC website folder, including images, PDFs and web files, an increase of 23% over last year.
- OACC conducted a survey to ascertain our audience demographic and whether the website is meeting visitors' expectations. We found that:
    - 89% have high-speed internet access
    - Half are between 40 and 60 years of age
    - Equal number men and women using the website
    - Occupations include researchers, part-time farmers, government officials and full time farmers
    - Specific interests include field crops, food & health issues, vegetable production and livestock production
    - 97% rated the OACC/CABC website "good" or better
- OACC's website remains in the #1 position (out of **16,400,000** results) for Google searches for the key phrase, "organic agriculture".

Table 1. Summary of OACC Website Statistics for Feb 1'08 – Feb 1'09

Total hits all files	4,554,227
Total hits for page views	**1,648,010**
# Unique visitors	204,862
# Visits	540,455
% Visitors > once	16.2%
Average visits per visitor	2.64
Top visitor countries	Canada, France, USA, UK

Table 2. Hits for Pages for the Last 12 Months - Feb 1'08 – Feb 1'09



Respectfully submitted by Jane Morrigan, M.Sc., P.Ag., Website Coordinator
jmorrigan@nsac.ca

PEER-REVIEWED PUBLICATIONS AND THESES

Beavers, R. L., Hammermeister, A. M., **Frick, B.,** and **Martin, R.C.** 2008. Spring wheat yield response to variable seeding rates in organic farming systems. Canadian Journal of Plant Science 88 pp 43-52.

Boiteau, G., **Lynch, D.H.**, and **Martin, R.C**. 2008. Influence of fertilization on the Colorado potato beetle, Leptinotarsa decemlineata (Say), in organic potato production. Economic Entomology 37(2): 575-585.

Fahmy, S. H., **Sharifi, M.** and Hann, W. R. S. 2008. Pulp fibre residue amendment and supplemental irrigation effects on yield and nutrient uptake of three crops in a potato rotation. Journal of Plant Nutrition 31:716-730.

Liu. K., **Hammermeister, A. M.**, Entz, M. H., Astatkie, T., Warman, P. R., Patriquin, D. G. and **Martin, R. C.** 2009. Nitrogen availability during transition to organic potato production under contrasting farming systems. Canadian Journal of Soil Science *(submitted).*

Liu, K., **Hammermeister, A.M.**, Patriquin, D. and **Martin, R.C.** 2008. Assessing organic potato cropping systems at the end of the first cycle of four-year rotations using principal component analysis. Canadian Journal of Soil Science 88: 543–552.

Lowitt, K. 2008. A comparative case study of Nova Scotia farmers' markets: exploring connections among people, places and food. School for Resource and Environmental Studies, Dalhousie University.

Lynch, D.H., Zheng, Z., Zebarth, B.J. and **Martin, R.C.** 2008. Organic amendment effects on tuber yield, plant N uptake and soil mineral N under organic potato production. Renewable Agriculture and Food Systems 23(3):250-259.

Lynch, D.H., **Clegg, E.**, Owen, J. and Burton, D. 2008. Greenhouse gas emissions from organic crop management in humid region eastern Canada. Proceedings of ‘Organic Agriculture and Climate Change’, April 17-18th, Enita Clermont, Lempdes, France.

MacKenzie, J.L. and **Hammermeister A.M**. 2008. Novel organic approaches to the management of Agriotes spp. wireworms. Canadian Journal of Plant Science 88: 734.

Nelson, K.L. 2008. Assessment of changes in soil health throughout organic potato (*Solanum tuberosum* L.) rotation sequences and potential use of the bioindicator, *Folsomia candida*. M.Sc. Thesis, Dalhousie University, Halifax, NS. 118pp.

Sharifi, M., Zebarth, B.J., Burton D.L., Grant, C.A., Bittman, S., Drury, C.F., McConkey,B., and Ziadi, N. 2008. Response of soil potentially mineralizable N and indices of N availability to tillage system. Soil Science Society of America Journal 72:1124-1131.

Sharifi, M., Zebarth, B.J., Burton, D.L., Grant, C.A., and Porter, G.A. 2008. Organic amendment history and crop rotation effects on nitrogen mineralization potential in a potato cropping system. Agronomy Journal 100:1562-1572.

NON-REFEREED PUBLICATIONS

Martin, R.C. 2008. Nitrogen Fertilizer is a Double-Edged Sword. Truro Daily News. December 20th, 2008.

Martin, R.C. 2008. Is Environmental Degradation Too Depressing to Consider? Truro Daily News. October 25th, 2008.

Martin, R.C. 2008. Can We Afford 'Business as Usual' or Must We Adapt to Change? Truro Daily News. October 3rd, 2008.

Martin, R.C. 2008. It's Only a Matter of Reason to Make Room for Bicycles. Truro Daily News. August 30th, 2008.

Martin, R.C. 2008. Fixing the Roads We Have. Truro Daily News. July 23rd, 2008.

Martin, R.C. 2008. Sustainability and Local Entertainment. Truro Daily News. June 21st, 2008.

Martin, R.C. 2008. The Upside of High Gas Prices. Truro Daily News. May 31st, 2008.

Martin, R.C. 2008. All Together in the Same Boat. Truro Daily News. April 23rd, 2008.

Martin, R.C. 2008. Adjusting to Scarce Fuel and a Wobbly Climate. Truro Daily News. February 27th, 2008.

Organic Agriculture Centre of Canada. 2008. Final Results of the First Canadian Organic Farmer Survey of Research Needs. Nova Scotia Agricultural College, Truro NS, Canada. http://oacc.info/ResearchDatabase/res_strategies.asp (and five related provincial reports.)

Frick, B., **Beavers, R.**, **Hammermeister, A.M**, and **Thiessen, J.M**. 2008. Research NeedsAssessment of Saskatchewan Organic Farmers. University of Saskatchewan. Saskatoon, SK. www.oacc.info/Docs/Saskatchewan Research Needs Survey with cover.pdf

Bromm, J., **Frick, B**. and **Hammermeister, A.M.**, 2008. Saskatchewan Best Organic Management Practices: Farmers' Perspectives. University of Saskatchewan. Saskatoon, SK. www.oacc.info/Docs/BOMP Whole Dec 08.pdf

NEWSPAPER ARTICLES

Every month, organic research and innovation in Canada is highlighted in a newspaper article appearing in publications for both Eastern and Western Canada, including the Western Producer, Farm Focus and Ontario Farmer. These articles are posted at the OACC website one month after publication. Several articles have been posted as audio files, available for download as an mp3. To read or listen, visit http://www.oacc.info/NewspaperArticles/na_welcome.asp

- Agriculture in the age of declining fossil fuels (Tracy Salisbury and Brenda Frick, December 2008)
- Sustaining the community that sustains us (Tracy Salisbury and Brenda Frick, November 2008)
- Using multiple methods key to weed control success (Brenda Frick, October 2008)
- Producers and researchers share understanding at organic field days (Brenda Frick, September 2008)
- Keys to phosphorus management are cycling and recycling (Joanne Thiessen-Martens, August 2008)
- Where has all the phosphorus gone? (Joanne Thiessen Martens, July 2008)
- Crop rotation key to increasing nutrient content of grains (Joanne Thiessen Martens, June 2008)
- University of Alberta student wins international organic scholarship (Brenda Frick, May 2008)
- Organic pioneer Victor Chrapko honoured (Brenda Frick, April 2008)
- Organic pig production (Brenda Frick and Bert Dening, March 2008)
- Rolling toward organic no-till (Joanne Thiessen Martens and Martin Entz, February 2008)
- Reducing tillage with sweetclover green manure (Brenda Frick, February 2008)
- Building community to support agriculture (Brenda Frick, January 2008)
- Balance is the key (Desiree Jans, December 2008)
- Organic farmers and the social economy (Jennifer Sumner and Sophie Llewelyn, November 2008)
- Uncertain peril: genetic engineering and the future of seeds (Tanya Brouwers, October 2008)
- Challenges from the european wireworm (Joanna MacKenzie, September 2008)
- The anatomy of cereal seed: optimizing grain quality involves getting the right proportions within the seed (August 2008, Andy Hammermeister)
- Marketing grain 101 (Mark Bernard, July 2008)
- A snapshot of an organic community (Margaret Savard, June 2008)
- Environmental benefits of organic dairy (Shelly Juurlink, May 2008)
- Reducing pesticide risk in soybean production (Melanie Leclerc, April 2008)
- Are organic and hydroponics a good fit? (Rupert Jannasch, March 2008)
- Fueling organic soils with forages (Rupert Jannasch, February 2008)
- Linking organic knowledge (Andrew Hammermeister, January 2008)

INVITED TALKS

Hammermeister, A.M. 2008. Canadian Cancer Society Conference: Agricultural Pesticides and Cancer Risk: Exploring the Connection, Toronto, ON. November 12-13th, 2008.

Martin, R.C. 2008. OACC Symposium for Professionals. Webinar presentation from NSAC, Truro, NS. October and December, 2008.

Martin, R.C. 2008. Atlantic Canada Economics Association Meetings. Acadia University, Wolfville, NS. October, 2008.

Martin, R.C. 2008. Association of Science Teachers, Halifax West High School, Halifax, NS. October, 2008.

Martin, R.C. 2008. Annual Fall Membership Meeting, Farmers' Markets of Nova Scotia, St. Joseph's, Antigonish Co., NS. October, 2008.

Martin, R.C. 2008. Made in Nova Scotia Information Session (Environment). NSDA. Truro, NS. June, 2008.

Martin, R.C. 2008. Growing Opportunities Conference, NSDA. Dartmouth, NS. March, 2008.

Martin, R.C. 2008. Sustainability and Environmental Research Symposium. Dalhousie University, Halifax, NS. March, 2008.

Martin, R.C. 2008. Organic Connections Conference. Saskatoon, SK. November, 2008

Martin, R.C. 2008. Atlantic Pasture Advantage Conference - Current Pasture Research Initiatives Conference. NSAC, Truro, NS. October, 2008.

Lynch, D.H. 2008. Changing Landscapes: Organic Agriculture in a new Canadian Society. University of New Hampshire, USA. October 15th, 2008.

Lynch, D.H. 2008. Research to Support a New Brand. Annual meeting of Certified Organic Producers Cooperative. Charlottetown, PEI. February 12th, 2008.

Lynch, D.H. 2008. Research to Support a New Brand. Annual meeting of Certified Organic Association of British Columbia. March. 1st, 2008.

Lynch, D.H. 2008. Research to Support a New Brand. Eco Farm day, Cornwall, Ontario. February 18th, 2008.

Lynch, D.H. 2008. Nutrient Management for Organic Dairy Farms. Guelph Organic Conference, Guelph, Ontario. January 25th, 2008.

Lynch, D.H. 2008. Research in Organic Agriculture in Eastern Canada. Victoriaville, Quebec. March 11-12th, 2008.

INVITED TALKS CONTINUED…

Lynch, D.H. 2008. Greenhouse gas emissions from organic crop management in humid region eastern Canada. 'Organic Agriculture and Climate Change', Colloque international scientifique et professional. Enita Clermont, Lempdes, France. April 17-18th, 2008.

Lynch, D.H. 2008. Research to support a new brand. Organic Value Chain Roundtable. Memramcook, New Brunswick. March 5th -6th, 2008.

Lynch, D.H. 2008. Nutrient status of organic dairy farms. 4th Annual Conference on Organic Dairying and Dairy Research. Alfred Campus of University of Guelph, Alfred, Ontario. April 7-8th, 2008.

Lynch, D.H. 2008. Organic potato cropping in Atlantic Canada. University of Newcastle. Newcastle, UK. April 24th, 2008.

Renkema, J. 2008. Exploring organic management options for blueberry maggot in highbush blueberries. Atlantic Canada Organic Regional Network Annual Meeting. Organic Berry Network, March, 2008.

MEETINGS AND WORKSHOPS

The following list outlines events that were coordinated or attended by OACC staff members.

- 2008 Guelph Organic Conference: Natural Sciences Research Symposium. Guelph, ON. January, 2008.
- 2008 Joint Annual Meeting (SSSA, ASA, CSSA, GCAGS, HGS) Houston, Texas. October 5-9th, 2008.
- 27th Annual Organic Agriculture Conference, Guelph, ON.
- 4th Annual Conference on Organic Dairying and Dairy Research.
- ACORN Organic and Organic Grains Production Workshop, Memramcook, NB March, 2008.
- ACORN workshop - Building Soils for Better Crops.
- ACORN workshop - Cover Crops.
- Agricultural Institute of Canada Annual Meeting, Guelph ON.
- Atlantic Canada Economics Association Meetings. Acadia University, Wolfville, NS. October, 2008.
- Atlantic Agrology Conference, Moncton, NB.
- Atlantic Pasture Advantage Conference - Current Pasture Research Initiatives Conference. NSAC, Truro, NS. October, 2008.
- Canadian Society of Agronomy, 4th Atlantic Agronomy Workshop, Charlottetown, PEI.
- Canadian Society of Agronomy Conference. Montreal QC. July 14-15th, 2008.
- Canadian Cancer Society Conference: Agricultural Pesticides and Cancer Risk: Exploring the Connection. Toronto, ON. November 12-13th, 2008.
- Grant writing and project management. NSAC, Truro, NS.
- Growing Opportunities Conference. NSDA. Dartmouth, NS. March, 2008.
- Heritage Breeds and Heirloom Seeds Conference. Debert, NS. October 22nd and 23rd, 2008.
- Joint Annual Meeting of the Canadian Entomological Society and the Entomology Society of Ontario. Ottawa, ON.
- Made in Nova Scotia Information Session (Environment). NSDA. Truro, NS. June, 2008.
- Nova Scotia Federation of Agriculture Annual General Meeting. Truro, NS
- NS Food Security Gathering, December 08.
- Organic Agriculture Symposium: Fundamentals for Professionals October 28th and December 2nd, 2008.
- Organic Meadow Coop Annual Meeting, July 23, 2008, Guelph.
- Organic Connections. Saskatoon, SK. November 17-18th, 2008.
- Sustainability and Environmental Research Symposium. Dalhousie University, Halifax, NS. March, 2008.
- Understanding Organics. Auburn, NY. October 28-30th, 2008.

CONFERENCE PRESENTATIONS AND POSTERS

Beavers, R., **MacKenzie, J.L.**, and **Hammermeister, A.M.** 2008. Organic Oilseed Pumpkin as a Novel Maritime Crop. ACORN Conference, Memramcook, NB. March 5-8th, 2008.

Halde, C. and **Martin, R.C.** 2008. Plant diversity and soil compaction in a Nova Scotian pasture. Atlantic Pasture Advantage Conference - Current Pasture Research Initiatives Conference. NSAC, Truro, NS. October 24th, 2008.

Halde, C. and **Martin, R.C.** 2008. Plant diversity and soil compaction in a Nova Scotian pasture. Plants & Soils Montreal '08 CSA-CSHS-Northeastern Branch of ASA, CSSA and SSSA Joint Meeting, McGill University, Montreal, QC. July 13-16th, 2008.

Hammermeister, A.M., Bernard, M., and **MacKenzie, J.L.** 2008. Organic Soybean Production in Atlantic Canada. ACORN Conference, Memramcook, NB. March 5-8th, 2008.

Hammermeister, A.M. and **MacKenzie, J.L.** Wheat Variety and Fertility Trials. ACORN Conference, Memramcook, NB. March 5-8th, 2008.

Hammermeister, A.M., Bernard, M. and **MacKenzie, J.L.** 2008. Optimize Your Crop Establishment. ACORN Conference, Memramcook, NB. March 5-8th, 2008.

Hammermeister, A.M., Bernard, M., and **MacKenzie, J.L.** 2008. Soil Characteristics of Maritime Organic Grain Farms. ACORN Conference, Memramcook, NB. March 5-8th, 2008.

Kerr, D. 2008. The Exploration of Organic Seed Treatments and Their Effects on Barley Seed Vigour. Guelph Organic Conference: Natural Sciences Research Symposium. Guelph, ON. January, 2008.

Kerr, D. 2008. The Exploration of Organic Seed Treatments and Their Effects on Barley Seed Vigour. 2008 ACORN Conference. Memramcook, NB.

MacKenzie, J.L. and **Hammermeister, A.M.** 2008. Novel Organic Approaches to European Wireworm (Agriotes spp.) Management. Oral presentation at the Atlantic Agrology Workshop. Moncton, NB. November 6-7th, 2008.

MacKenzie, J.L. and **Hammermeister, A.M.** 2008. European Wireworms: Integrated and Organic Management Options. Oral presentation at the Joint Annual Meeting of the Canadian Entomological Society and the Entomology Society of Ontario. Ottawa, ON. October 19-23rd, 2008.

MacKenzie, J.L. and **Hammermeister, A.M.** 2008. Novel Approaches to the Management of Wireworm Agriotes spp. in Nova Scotia. Oral and Poster presentations at 27thAnnual Organic Agriculture Conference. University of Guelph. January 24-27th, 2008.

CONFERENCE PRESENTATIONS AND POSTERS CONTINUED…

MacKenzie, J.L. and **Hammermeister, A.M.** 2008. Novel Organic Approaches to the Management of Wireworms (Agriotes spp.). Fourth Atlantic Agronomy Workshop. Rodd Charlottetown Hotel, Charlottetown, PEI. January 15-16th, 2008.

MacKenzie, J.L. and **Hammermeister, A.M.** 2008. Novel Approaches to the Management of Wireworm Agriotes spp. in Nova Scotia. 27th Annual Organic Agriculture Conference. University of Guelph. January 24-27th, 2008.

Nelson, K.L. 2008. Soil health throughout an organic potato rotation. Joint Annual Meeting (SSSA, ASA, CSSA, GCAGS, HGS). Houston, Texas. October 5-9th, 2008.

Hammermeister, A.M. and **Nelson, K.L.** 2008. Ontario Organic Farmer Survey and Organic Research Prioritization Process. 2008 Guelph Organic Conference: Natural Sciences Research Symposium. Guelph, ON. January, 2008.

Sharifi, M., **Lynch, D.H., Hammermeister, A.M.** and Burton, D.L. 2008. Crop performance and soil quality under a sustainable organic cropping system in eastern Canada. Organic Connections. Grand Salon, TCU Place, Saskatoon, SK. November 16-18th, 2008.

Renkema, J. 2008. Activity-density of ground beetles (Carabidae) in small mulch plots in a highbush blueberry field. Organic Connections Conference, November 2008.

Renkema, J. 2008. Border application of GF-120 for control of blueberry maggot (*Rhagoletismendax* Curran) in highbush blueberries. Organic Agriculture Conference, Natural Sciences Symposium, January, 2008.

Ward, A. and **Main, M.** 2008. Phosphorus regulation of legume biological nitrogen fixation on Ontario organic dairy farms. Soil and Plants- Biofuels, bioproducts and ecological intensification. Montreal, QC. 2008.

Ward, A. and **Main, M.** 2008. Phosphorus regulation of legume biological nitrogen fixation on Ontario organic dairy farms. Organic Connections. Saskatchewan. 2008.

FIELD DAYS AND FARM TOURS

- Maritime Organic Grains Network and OACC New Brunswick Field Day, Good Food Farm.

- Maritime Organic Grains Network and OACC Prince Edward Island Field Day, Barnyard Organics.

- Maritime Organic Grains Network and OACC Nova Scotia Field Day, NSAC.

- NSAC Open House 2008; Field Trip to Organic Cropping System (C206) and Brookside Organic Research Site, NS.

- Organic Cropping System Field Trip (C206) for visitors from the Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) in Ethiopia.

Committees and Professional Activities

Ralph Martin:

- Member, Expert Committee on Organic Agriculture (ECOA)
- Chair, Animal Welfare Task Force of ECOA
- Member, Steering Committee for OACC Prairie Coordinator
- Facilitator, Organic Prairie Research Coalition
- Member, Advisory Committee on Agriculture, Statistics Canada
- Member, Organic Value Chain Round Table
- Member, Action Team assessing the Environmental Performance of Agriculture in Nova Scotia
- Chair, Local Food Team, Spirit of Nova Scotia
- Secretary, Living Earth Council (LEC)
- Chair, Cool Truro Campaign, LEC
- Supervisor for Ph.D. candidate, Julie Bailey, Dalhousie
- Supervisor for M.Sc. candidate, Caroline Halde, NSAC
- Committee member for M.Sc. candidates Amanda Ward, Margaret Graves, Kathryn Rutherford and Brent Jackson, NSAC

Andy Hammermeister:

- Member, Agriculture Institute of Canada (AIC)
- AIC Board of Directors
- Member, Canadian Society of Agronomy
- Member, Canadian Society of Soil Science
- Professional Agrologist, Nova Scotia Institute of Agrologists
- Chair, Organic Extension Forum
- Co-Supervisor for M.Sc candidate Donald Kerr, NSAC
- Committee member for M.Sc candidates Sebastian Margarit, Caroline Halde and Emily Clegg, NSAC
- Manager, OACC

COMMITTEES AND PROFESSIONAL ACTIVITIES

Derek Lynch:

- Voting member of CGSB technical committee on Canadian standards for organic agriculture and PSC working group member
- Chair of Expert Committee on Organic Agriculture, and Research Working Group representative on the Organic Value Chain Round Table
- Eastern Director, Canadian Society of Agronomy
- Instructor for Composting and Compost Use, NSAC. Web based distance and program based undergraduate course
- Co-instructor for Graduate Communications course, NSAC, and Nitrogen in Crop Production course, NSAC
- Instructor for Soil Organic Matter Dynamics and Management, Graduate module. Department of Plant and Animal Science, NSAC
- Supervisor/co-supervisor for Ph.D. Candidates Justin Renkema, Dalhousie University and Kim Schneider, University of Guelph
- Supervisor for M.Sc. candidates Karen Nelson, Sukkasini Thissaverasingan, Emily Clegg and Amanda Ward, NSAC

Jane Morrigan:

- Member, Animal Welfare Task Force (AWTF), Expert Committee on Organic Agriculture (ECOA)
- Professional Agrologist, Nova Scotia Institute of Agrologists
- Instructor, Animal Welfare course at the Nova Scotia Agricultural College
- Supervisor for undergraduate 4th year project student Michelle Peck, NSAC
- Member, Animal Welfare Committee, NSAC
- Member, Animal Welfare Foundation of Canada, Board of Directors
- Member, Animal Care and Use Committee (ACUC), Nova Scotia Agricultural College (NSAC)

OACC Advisory Board

OACC is an operating division of the Nova Scotia Agricultural College (NSAC) and is served by an Advisory Board representing stakeholder groups from across Canada. It is comprised of members appointed by the President of NSAC for staggered three year terms. The 2008 Board is shown below.

For a current list of Board Members see: www.oacc.info/Board/board_welcome.asp

OACC Board members deliberate and make recommendations about policy, strategic directions and sustaining OACC. The Board considers feedback from Advisory Forums held at organic conferences across Canada each year. Groups represented on the Board include organic farmers, transitional farmers, food distributors and retailers, university researchers, students, Agriculture and Agri-Food Canada and organic organizations. The board must include at least one member from Manitoba or Alberta, and each of British Columbia, Saskatchewan, Ontario, Québec and the Atlantic provinces.

We are indebted to past and current Board members who selflessly contribute time and help us to pursue our Vision.

2008 Advisory Board Members:

- **Ian Cushon**, Chair - Moose Creek Organic Farm Inc., SK
- **Danielle Brault** - Répondante en agriculture biologique MAPAQ, QC
- **Martin DeGroot** - Organic Farmer, Mapleton's Organic, ON
- **Dag Falck** - Nature's Path Foods, BC
- **Deb Foote** – The Organic Grocer, BC
- **Peter Hinklenton** - Agriculture and Agri-Food Canada, NS
- **Randy Gubersky** - Gubersky Family Farm, AB
- **Chantal Jacobs** - Saskatchewan Agriculture and Food, SK
- **Alison Nelson** – Student, University of Alberta, AB
- **Ann Slater** – Organic Farmer, Ecological Farmers Association of Ontario, ON
- **Keri Sharpe** – Alberta Agriculture, Food and Rural Development, AB
- **Bill Thomas** – Thomas Canning, ON
- **Paul Voroney** – University of Guelph, ON
- **Emmanuel Yiridoe** – Nova Scotia Agricultural College, NS

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Sukkasini Thissaverasingan (M.Sc.)
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Agriculture and Food Council of Alberta
Alberta Department of Agriculture, Food and Rural Development
Alberta Livestock Industry Development Fund
British Columbia Ministry of Agriculture and Lands
British Columbia Organic Sector Development Program
Canadian Farm Business Management Council
Canadian Wheat Board
Dominion Produce
Dow Agro-Sciences Inc.
Ecological Farmers Association of Ontario
Envirem Technologies Inc.
Harmony Organic Dairy Products
Homestead Organics
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Agriculture and Agri-Food Canada is pleased to participate in the production of this OACC Annual Report for 2008. AAFC is committed to working with our industry partners to increase public awareness of the importance of the agriculture and agri-food industry to Canada. Opinions expressed in this document are those of OACC and not necessarily of AAFC.