

Abstracts of Technical Papers

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SESSION 1. WHOLE FARM NUTRIENT MANAGEMENT MODELS

Opportunities and challenges for balancing farm nutrients. Shabtai Bittman, Derek Hunt, and Grant Kowalenko, Agriculture and Agri-Food Canada, Agassiz, BC.

The benefit of manure has been known for eons, but using manure sustainably in today's agriculture remains a challenge. Effective application methods help in the use of inorganic nitrogen in the manure. However, it is difficult to optimize crop yields without over applying P and even organic N. The reason is the low N:P ratio of manure, which results from overfeeding P, and ammonia losses from barns and storages. Even low-cost methods for removing manure solids help improve the N:P ratio of the liquid fraction; it results in two products, a watery fraction high in inorganic N, which can be applied near the barn, and a thick P-rich fraction, which can be transported or used strategically. We have found that the watery fraction is more effective than the whole manure in terms of more crop uptake and less ammonia loss, although this was true mainly under cool conditions. Combining manure separation with "Aeration-Banding" (SSD applicator) can reduce ammonia loss by 80%. The sludge portion can replace starter fertilizer for corn if it is injected at corn row spacing and the corn is then planted within 5 cm of corn rows. Efficacy of manure can still be improved without high-cost processing. Strategic use of manure is essential for sustainable whole farm nutrient cycling.

Key words: Manure, phosphorous, nitrogen, nutrient balance

Nitrogen cycling: Reducing losses from agricultural systems. John A. MacLeod and Mark Grimmett. Agriculture and Agri Food Canada. CLRC, Charlottetown, PE, Canada C1A 4N6.

The three unpaired electrons in the atomic structure of nitrogen (N) results in the existence of N containing compounds with a wide range of characteristics. Inorganic and organic N containing compounds exist in solid, liquid and gaseous phases in nature, and many biological processes lead to transformations among these compounds and phases. The transformations that

occur within soils are sometimes referred to as the soil N cycle – a portion of the overall N cycle. The soil N cycle provides for gains to and losses from the soil system. Losses from the soil N cycle occur in a variety of ways including volatilization, leaching and crop removal. Careful management of cropping systems can maximize crop removal and minimize volatilization and leaching losses. For example, volatilization losses can be minimized by rapid incorporation of manures. Leaching losses can be minimized by the use of cover crops after harvest. Careful timing of incorporation of legume residues to match timing of N mineralization to crop uptake can also reduce leaching losses. Maximizing crop utilization and minimizing N loss will result in lower potential for contamination of air and water with unwanted N compounds.

Key words: Nitrogen, nitrogen cycling, nitrogen utilization

Predicting nitrate levels in receiving waters from farming intensity in Prince Edward Island. Yefang Jiang^{1*} and Cindy Crane², ¹Aquatic Ecosystem Management Research Division, Water Science and Technology Directorate, Environment Canada, and Agriculture and Agri-Food Canada, PRC, Fredericton, NB, Canada E3B 4Z7; and ²Water Management Division, Prince Edward Island Department of Environment, Energy and Forestry, Charlottetown, PE, Canada C1A 7N8.

Nitrate contamination of groundwater is of increasing concern in Prince Edward Island, where the population is entirely dependent on groundwater. This study investigated the relationship between agricultural production systems and nitrate concentration in the receiving waters using numerical groundwater modeling and monitoring data. Nitrate transport modeling in the Wilmot River watershed suggests elevated nitrate concentrations in receiving waters are positively correlated with potato cropping intensity, as indicated by a linear relationship between nitrate concentration and percentage of land under potato production systems. An analysis of monitoring data and land use information in 30 watersheds in Prince Edward Island indicates measured nitrate concentrations in surface waters are linearly correlated with the percentage of land under potato production, which agrees with the findings from the numerical modeling. The relationship provides an effective tool for watershed planners to use in determining the acceptable potato acreage, rotation length and N application rates for water quality protection.

Key words: Correlation, groundwater nitrate-N, potato, cropping intensity, Prince Edward Island

Selected low-disturbance liquid manure application systems: Results, implications and future considerations.

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Land application of manure can directly impact soil, air and water quality. Application technologies that improve the utilization of nutrients in the manure will decrease the environmental impact of manure application. Trials were initiated in 2005 to compare the effect of various manure application technologies: below crop canopy injection (sleighfoot), low ramp application (dribble bar) and in-ground injection (initiated in 2007) with conventional splash pan. Forage yields, although differences were not always significant, generally followed the order: sleighfoot in-ground injection > dribble bar > splash pan. Ammonia volatilization generally followed the order: splash pan > dribble bar > sleighfoot. Odour, evaluated with the olfactometer at the Charlottetown Research Station, was greatest with the splash pan and least with the sleighfoot. Greater persistence of *Escherichia coli* was found where manure had been incorporated than where manure had been left on the surface. *Escherichia coli* tended to persist to a greater extent on dykeland versus upland soils.

Key words: Manure application, forage yield, ammonia volatilization

Whole-farm nutrient budgets of organic dairy farms.

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The sustainability of organic dairying in Canada, with respect to nutrients, remains unexamined. To assess how management affects nutrient status, we documented

whole-farm nutrient (NPK) budgets over 2 yr (2003 to 2005) and soil (0 to 15 cm) P and K status on 15 long-term Ontario organic dairy farms. Farm size, livestock density and herd productivity averaged 110 ha, 1.00 livestock units ha⁻¹ and 5656 kg milk cow⁻¹ yr⁻¹, respectively. Annual farm nutrient surpluses of 75 (N), 1 (P) and 11 (K) kg ha⁻¹ yr⁻¹, were lower than those reported for confinement-based dairy farms in the US, pointing to possible environmental benefits from reduced off-farm impacts on air and water quality. Weighted average soil test P levels were low (<10 mg kg⁻¹) on approximately 50% of farms, while exchangeable K levels were moderate to high (76 to 160 mg kg⁻¹) on all farms. Four farms adopting a 'self-sufficient' approach, producing most feed on-farm, imported little P as feed (1.37 to 1.90 kg P ha⁻¹ yr⁻¹) and had negative average farm P balances (avg. -1.54 kg P ha⁻¹ yr⁻¹). An integrated nutrient management approach, along with a flexible feed import strategy, fosters the sustainability of organic dairying systems.

Key words: Organic dairying, nutrient budget, nitrogen, potassium, phosphorus, soil fertility

Effect of nutrient management on nitrate-N movement through the soil profile.

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There are growing concerns on Prince Edward Island with the overuse and inefficient application of fertilizers in potato production. The objective of this study are: (1) to investigate the effects of nutrient management (NM) fertility recommendations versus traditional fertility rates on marketable potato yields and soil NO₃⁻ leaching, and (2) to determine whether zero tension lysimeters are an effective alternative method to tile drain systems for the determination of NO₃⁻-N concentration of water leaving the root zone. Fourteen commercial fields were established using split nutrient application rates; NM and traditional, each field had four zero tension lysimeters monitored on a 7-to 10-d cycle. In addition, twelve 0.5-ha plots were used in an attempt to correlate lysimeter water samples with tile drain water samples. Nitrate concentration levels ranged from 1.67 to 38.21 mg L⁻¹ NO₃⁻-N in the tile lines and up to 98.47 mg L⁻¹ NO₃⁻-N in the lysimeters.

Key words: Nitrate, leaching, potatoes, lysimeters, tile drainage

POSTER SESSION

Factors that affect potato consumption and purchasing. R. S. Veitch¹, G. Wang-Pruski¹, M. MacPherson², S. Dukeshire², C. Rangel², and V. Varma¹. ¹NSAC, Department of Plant and Animal Sciences, Truro, NS (e-mail: rveitch@nsac.ca); and ²NSAC, Department of Business and Social Sciences, Truro, NS.

Canadians consume on average 70 kg (157 pounds) of potatoes each year or 1.5 kg (3 pounds) of potatoes each week. Next to wheat, no other foodstuff comes close to potatoes in terms of importance to the Canadian diet. Nevertheless, potatoes are losing their grip on Canadian cuisine and being replaced with various food alternatives. The objective of this study was to gain a deeper understanding of what potato characteristics (e.g., size, packaging, variety, origin) influence consumers' purchasing decision for potatoes. Primary grocery shoppers participated in a total of six focus groups, two each in Truro, Halifax, and Toronto. Results of the focus groups revealed that consumers have strong emotional attachments to particular types of potatoes. Russet Burbank and Yukon Gold were the two types that most consumers commonly used and recognized because of their size, shape, color and versatility. The characteristics of these two types of potatoes are the standard by which consumers thought about potatoes, and thus is the standard used when purchasing potatoes. This was evidenced from the initial negative reactions when focus group participants were shown alternative packaging/presentation as well as new varieties of potatoes. However, when details about their alternative usage were given, interest was expressed in these new types of presentation and varieties. Consumers also had strong preferences for packaging of potatoes, preferring packaging that allowed them to see and touch the potatoes, contained potatoes of uniform size, and was environmentally friendly. Opportunities for producers and sellers are discussed in the context of the study's findings.

Key words: Potato, consumption, purchasing, potato size and alternative packaging

Socio-cultural and life style influences on potato consumption in Canada. R. S. Veitch¹, C. Rangel², G. Wang-Pruski¹, S. Dukeshire², M. MacPherson², and V. Varma¹. ¹NSAC, Department of Plant and Animal Sciences, Truro, NS (e-mail: rveitch@nsac.ca); and ²NSAC, Department of Business and Social Sciences, Truro, NS.

The morphological and physiological traits of potatoes make them resilient and versatile and a very important part of daily diets for humans. In today's highly diverse diets, there are strong socio-cultural and lifestyle factors

that influence food consumption, even staples such as potatoes. Based on the results of six focus groups, two each conducted in Truro, Halifax, and Toronto, we identified how potato consumption is embedded within a wider network of health, social, environmental, and politically related concerns in today's Canadian society. Our findings suggest that, although potatoes are almost a cultural icon as they are ubiquitous in Canadian diets, potato consumption is also directly affected by participants' life stage factors, such as age, family size, work outside home, and the influences of new demographic groups in the Canadian social fabric. Potato consumption is also subject to political consumerism, with focus group participants emphasizing environmental concerns pertaining to both the production and packaging of potatoes. Thus, our results seem to suggest that potatoes have been exposed to shifting, changing and conflicting values in today's Canadian society. In this case, more research is needed to identify how potatoes, as a cultural object, are embedded into conceptual, socio-cultural and political networks, and how those networks affect the ways that potatoes are marketed and perceived by the public.

Key words: Potato, consumption, lifestyle, socio-cultural and environment

Cloning of dehydroascorbate reductase gene from potato and spinach genomes. V. P. Sivaramakrishnan¹, G. Wang-Pruski¹, and M. Hodges². ¹Department of Plant and Animal Sciences, NSAC Truro, NS (e-mail: sivaramakrishnanv@nsac.ca); and ²Agriculture and Agri-Food Canada, Kentville, NS.

Ascorbate (vitamin C) is a hydrophilic compound critical to plant development and metabolism. One of its primary functions is regulating the oxidative stress associated with plant abiotic/biotic stress and senescence. Previous work has associated declining ascorbate content with the onset of senescence and resultant postharvest quality in horticultural commodities. Potato is the fourth food crop in the world and represents an important source of ascorbate due to the large amount consumed in Western countries. Spinach is an important and widely consumed leafy vegetable that has high antioxidant contents. The goal of this research is to clone the gene for the enzyme dehydroascorbate reductase (DHAR) responsible for re-reducing the oxidized ascorbate back to its active form. Based on the published DHAR gene and EST sequences from the Genbank (<http://www.ncbi.nlm.nih.gov>), two pairs of PCR primers were designed and PCR were carried out using the cDNA extracted from the leaves of potato and spinach. The PCR products were cloned into pGEM-T vector and subsequently DNA sequenced. The sequences were analyzed by software and confirmed from the homologous search in the Genbank

(<http://www.ncbi.nlm.nih.gov>). The polypeptide coding for the potato DHAR was found to be 211 amino acids and the polypeptide for spinach DHAR protein was found to be 267 amino acids. The complete gene coding sequences have been deposited in Genbank with accession numbers of EU247958 and EU247959 for potato and spinach, respectively. The obtained genes will be used for gene expression studies in order to relate the DHAR to the postharvest quality of vegetables.

Key words: Potato, vitamin C, postharvest, genomes and dehydroascorbate reductase

New wild blueberry leaf nutrient ranges for Prince Edward Island growers. Kevin Sanderson¹, Sylvia Wyand¹, Chris Jordan², and Sherry Fillmore³. ¹Agriculture and Agri-Food Canada, CLRC, Charlottetown, Prince Edward Island; ²Prince Edward Island Department of Agriculture, Fisheries and Aquaculture, Charlottetown, Prince Edward Island; and ³Agriculture and Agri-Food Canada, AFHRC, Kentville, Nova Scotia.

Generally, wild blueberry leaf nutrient standards developed in Maine by Trevett (1972) are used by the N.A. wild blueberry industry. Many factors influence the reliability of these standards, including regional differences, soil type, management practices, climate change, plant evolution from modern monoculture growing system and more. To address the needs of Prince Edward Island wild blueberry growers, we performed a nutrient survey to validate leaf nutrient levels found in Prince Edward Island blueberry fields. Sixty-one fields (2003–2005) were sampled at the tip die-back growth stage during the sprout year of the traditional 2-yr blueberry cycle. All fields sampled were considered to be developed with at least 90% vine coverage. Leaf N, P, Mg, Cu and Mn content were not affected by year surveyed. Leaf K, Ca, B and S were higher and Zn and Fe were lower in 2003. Most elements were notably deficient of Trevett standards except for K, Ca, and Mg, while Ca and Mn were in excess. Mean leaf nutrient concentrations were: 1.51% N, 0.127% P, 0.51% K, 0.59% Ca, 0.16% Mg, 0.22% S, 2.8 ppm Cu, 32.0 ppm B, 11.4 ppm Zn, 21.6 ppm Fe and 1351 ppm Mn. Data analysis indicates all elements except for Mn are described by the survey mean \pm SD. New Prince Edward Island leaf nutrient ranges are proposed for Prince Edward Island fields. Prince Edward Island wild blueberry growers now have a new tool to assess plant nutrient status under local conditions. For growers using fertilizer as a management tool, individual elemental levels may now be accurately assessed.

Key words: Wild blueberry, *Vaccinium angustifolium* Ait., foliar analysis, leaf nutrient ranges

***Ascophyllum nodosum* (L.) Le Jolis extract improves root nodulation in alfalfa.** Wajahatullah Khan¹, Ravishankar Palanisamy¹, Simon D. Hankins², Alan T. Critchley², Donald L. Smith³, Yousef Papadopoulos⁴, and Balakrishnan Prithiviraj¹. ¹Department of Plant and Animal Sciences, NSAC, Truro, Nova Scotia; ²Acadian Sea-plants Limited, Dartmouth, NS; ³Department of Plant Science, Macdonald Campus of McGill University, Ste Anne de Bellevue, QC; and ⁴Agriculture and Agri-Food Canada, CLRC, Charlottetown, PE.

Sinorhizobium meliloti is a soil bacterium that colonizes alfalfa root and forms symbiotic root nodules wherein they fix atmospheric nitrogen. A complex inter-organismal signaling events precedes this association. Factors that affect the plant-bacterial signaling can have advantageous or detrimental effect on the plant-bacteria association. Extracts of *Ascophyllum nodosum* (L.) Le Jolis (a brown seaweed) have been used as a plant biostimulant and as a soil amendment for over a century. The extracts exhibits a wide range of biological activity on plants like improved growth, enhanced tolerance to biotic and abiotic stress and also alter population dynamics of rhizosphere microflora. However, the chemical component(s) of *A. nodosum* that elicits these biological effects is largely unknown. We tested the effect of *A. nodosum* extracts on alfalfa root nodulation in the greenhouse by treating the roots of 10-d-old-alfalfa prior to bacterial inoculation. *Ascophyllum nodosum* extracts at a concentration of 1 g L⁻¹ significantly increased the total number of functional nodules, root and shoot dry weight. The extract-treated root attracted more bacteria as compared with untreated roots. Further, *A. nodosum* extract induced higher concentration of Nod factors in *S. meliloti* as evidenced by root hair deformation activity. Taken together, our results suggest that *A. nodosum* extract affects plant-to-bacteria and bacteria-to-plant signaling culminating in improved nodulation of alfalfa plants.

Key words: Alfalfa, *Sinorhizobium meliloti*, nitrogen fixation, symbiosis, plant-microbe interaction

Timing of manure application effects on forage yield and N and P uptake. J. Wells^{1*}, A. V. Rodd², R. Gordon¹, J. MacLeod³, and A. Madani¹. ¹NSAC, Truro, NS (e-mail: JWells@nsac.ca); ²Agriculture and Agri-Food Canada, Nappan, NS; and ³Agriculture and Agri-Food Canada, CLRC, Charlottetown, PE.

The evaluation of time of manure addition to grassland agri-ecosystems was initiated after a manure management survey of Nova Scotia beef and dairy producers indicated that farmers tended to surface spread their

manure (80%) to forage land. Among the respondents, that manure application was equally distributed among spring, summer (after 1st cut), early fall (after 2nd cut) and late fall (early November). The purpose of this trial was to determine the nutrient availability of semi-solid beef manure applied at different times of the year. Two experiments were established in 1995 on pure timothy stands on two contrasting soil types: the dykeland and upland. Manure surface applied in either the spring, summer, early fall and late fall each year for 10 yr was compared with spring applied fertilizer N. There was little effect of time of year of surface application of semi-solid beef manure on forage yield or uptake of N or P.

Key words: Manure, forage, time of application, yield, N, P

***Ascophyllum nodosum* extract induced disease resistance in *Arabidopsis thaliana* is independent of salicylic acid.**

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Extracts of a marine brown algae, *Ascophyllum nodosum*, elicited disease resistance in *Arabidopsis thaliana* against a bacteria pathogen, *Pseudomonas syringae* pv *tomato* DC3000. The extract-treated plants exhibited significantly reduced disease symptoms as compared with untreated plants. Salicylic acid (SA) is a major signaling molecule implicated in plant disease resistance. To study the role of SA signaling in *A. nodosum* extract induced disease resistance, we used a transgenic line, NahG (which constitutively expresses salicylic acid hydroxylase and, therefore, is not capable of accumulating SA), of *A. thaliana* and also estimated the phenylalanine ammonia lyase (PAL) in *A. nodosum* extract treated plants. The expression of PR1 (Pathogen related protein 1), a marker gene associated with induced resistance, was studied using a transgenic *A. thaliana* plant in which the PR1 promoter was fused to the β -glucuronidase (GUS) reporter. We found that *A. nodosum* extracts significantly reduced the area of leaf infected and subsequently the disease intensity (DI) in wild type *A. thaliana*. Surprisingly, the extracts also elicited disease resistance in NahG plants. Furthermore, the extract did not induce PAL activity or cause an increase of PR1 gene expression associated with disease resistance. These results suggest that SA is not involved in the *A. nodosum* mediated disease resistance.

Key words: *Ascophyllum nodosum*, disease resistance

***Ascophyllum nodosum* extracts impart freezing tolerance in *Arabidopsis thaliana*.** P. Rayorath^{1*}, B. Benkel¹, M. Hodges², and B. Prithiviraj¹. ¹Department of Plant and Animal Sciences, NSAC, Truro (e-mail: bprithiviraj@nsac.ca); and ²Agriculture and Agri-Food Canada, AFHRC, Kentville, NS.

Abiotic stresses are the principal cause of crop failure in Canada, accounting for more than 50% loss in productivity of major crops. Among different abiotic stresses, freezing stress is an important factor causing significant economic damage to crop plants as well as limiting arable land across Canada. Therefore, understanding freezing stress and mechanisms of freeze tolerance, and methods to enhance freezing stress tolerance in plants is important. *Ascophyllum nodosum*, a marine brown algae, is a dominant perennial seaweed confined to the intertidal zone along the north Atlantic basin and parts of the north-western coast of Europe. Application of *A. nodosum* extract imparts abiotic stress tolerance in citrus, grapes, Bermuda grass and Kentucky bluegrass. An experiment was conducted to study the ability of *Ascophyllum nodosum* extract to impart freezing tolerance in *Arabidopsis thaliana*. Two bioassays, the Petri dish freezing tolerance assay and the Electrolyte leakage assay, were carried out to determine the level of protection that *A. nodosum* extracts offer against freezing stress in *A. thaliana*. *Ascophyllum nodosum* extract imparts significant freezing tolerance; in the Petri dish freezing tolerance assay, treated plants survived temperature of -7.5°C , while the control plants did not survive this temperature. In the electrolyte leakage assay, the LT_{50} was lowered by 2°C in the treated plants. Gene expression analysis by RT-PCR revealed that *A. nodosum* induced freezing tolerance is mediated by a differential regulation of major cold response genes.

Key words: Freezing tolerance, *Ascophyllum nodosum*, *Arabidopsis thaliana*

Soil nitrate leaching in the second year of a plot experiment with four different sward types.

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The nitrogen-conserving function of four sward types was tested in the second year of a plot experiment on a sandy soil at the Nova Scotia Agricultural College in Bible Hill, NS. Main plots ($n=4$) comprised a control and three seasonal applications of ammonium nitrate at medium and high rates. The subplots represented four grass-white clover sward types of varying grass species

richness (i.e., one, two and four species). Ceramic suction cups were permanently installed 0.5 m deep for repeated sampling of the soil solution ($n=12$) from April to November 2007. In the control plots, the sward dominated by white clover leached approximately twice as much nitrate than the three grass-dominated swards. Total seasonal N application rates ranging from 114 to 228 kg N ha⁻¹ significantly elevated the nitrate-N level in the soil solution up to an observed peak value of 130 ppm. The N plots showed a pronounced seasonal increase from an average value of 5 ppm nitrate-N in spring to 30 ppm nitrate-N in mid-summer across sward types. The seasonal increase of nitrate leaching was most pronounced in swards dominated by a single grass species compared to mixtures of two and four grass species.

Key words: Leaching, soil nitrate, biodiversity, sward type, suction cups

Diversity of beetles (Coleoptera) in a managed dairy pasture in Nova Scotia. Clayton W. D'Orsay^{1, 2}, David B. McCorquodale², and Donna Giberson¹. ¹Department of Biology, University of Prince Edward Island, Charlottetown, PE (e-mail: cdorsay@upei.ca); ²Department of Biology, Cape Breton University, Sydney, NS.

Dairy cow grazing intensity can affect pasture biodiversity and sustainability. How grazing affects biodiversity was explored looking at ground beetles (Coleoptera: Carabidae) in a managed pasture in Bible Hill, Nova Scotia. Species richness and abundance of ground beetles was compared across grazing treatments. Less intensive grazing patterns resulted in significantly higher abundances of multiple species and higher species richness of ground beetles than more intensive grazing patterns. This trend differs from earlier studies on the same pasture, suggesting a delay in faunal response to grazing manipulation.

Key words: Diversity, Carabidae, pasture management

SESSION 2: NOVEL CROPS, CROPPING SYSTEMS AND ROTATIONS

Crop rotations – Purpose and benefits. T. S. Sahota. Thunder Bay Agricultural Research, Station, 435 James St. S, Thunder Bay, Ontario, Canada P7E 6S7 (e-mail: tarloksahota@tbaytel.net).

This paper reviews the work done on crop rotations in North America. Crop rotations have been found to improve or maintain soil quality (fertility, structure - soil tilth/aggregate stability, organic matter, infiltration, mining of nutrients from deeper soil profiles, minimizing

soil erosion), reduce the buildup of weeds, insect-pests and diseases, such as Black Leg in canola, Take-all and Fusarium Head Blight in wheat, and White mould in broadleaf crops (by breaking their cycle), and restrict the build up of herbicide resistance in weed species. Fibrous-rooted crops e.g., winter cereals (especially under seeded to red clover), and mixed hay, contribute most to the soil quality. The highest aggregate stability was recorded in the first year corn following 2 yr of barley, which was equal to or greater than that in corn following wheat or alfalfa. The lowest aggregate stability was observed in corn following soybeans. Corn-barley-3-yr hay was 10-12 times more effective than corn-corn in reducing the loss due to soil erosion. Cereal crops' yield was higher after legumes than after cereals or corn, whereas the reverse seemed to be true for legumes. Inclusion of winter wheat in corn-soybean rotation improved the yield of corn and soybean in conventional tillage, but not in zero tillage. Suitable crop rotations for organic farming and vegetable crops and some other aspects of crop rotations are also discussed in the paper.

Key words: Crop rotation, soil quality, tillage, pests, yield

Comparing environmental benefits of crop-based bio-energy alternatives in Atlantic Canada. Michael Main. NSAC, Truro, NS.

Potential environmental performance of five major bioenergy systems based on crops that can be grown in Atlantic Canada are compared: 1. Willow coppice for electricity/heat cogeneration; 2. grass pellet fuels for heat; 3. ethanol from sugar beet in an integrated biorefinery; 4. biodiesel from canola; and 5. ethanol from small grains. An energy assessment was based on life cycle assessment methodologies, using literature data. Systems 1 and 2 show the largest energy gains after subtracting life cycle inputs, with energy ratio of 8–14 (end product fuel energy:life cycle energy inputs). These systems are also expected to have very low risk for soil erosion and nutrient leaching, and are suitable for good or marginal soils. System 3, using beet pulp to partially fuel the processing of beets to ethanol, can produce a very high fuel yield, but may be expected to have a life cycle energy ratio of 2 or less. Net gains are less than for systems 1 and 2. Because of late harvest followed by bare soil, this system has very high potential for soil erosion. System 4 (canola biodiesel) produces a lower fuel yield than sugar beet ethanol, but is expected to have a higher energy ratio (3.4), and less potential for soil erosion. System 5 (ethanol from small grains) has both low fuel yield and a low expected energy ratio (1.6), leading to low potential for environmental benefits. Of the systems evaluated, the greatest environmental benefits could be gained by use of fibrous perennials for

generating electricity and heat, but prudent production practices for sugar beet ethanol and canola biodiesel could also result in some benefits.

Key words: Bioenergy sources, ethanol, biodiesel, willow coppice

Changes in soil health throughout an organic potato rotation. K. L. Nelson¹, D. H. Lynch^{1*}, and G. Boiteau². ¹Nova Scotia Agricultural College, Truro NS (e-mail: klnelson@nsac.ca); and ²Agriculture and Agri-Food Canada, PRC, Fredericton, NB.

Organic potato production utilizes extended rotations including legumes to maintain soil health, a central concept in sustainable agriculture. We evaluated changes in soil health indicators throughout a 5-yr rotation following the potato crop to determine sustainable rotation lengths. Total soil organic C (TOC) and N, pH, microbial biomass C (MBC), light fraction (LF), bulk density, and earthworm abundance were examined at four organic potato production sites in New Brunswick and Prince Edward Island. Long-term pasture sites at each farm were included as reference fields. The phase of the rotation had no effect on bulk density, pH, LF, or total C and N concentration. Mean earthworm numbers and biomass were significantly affected, with lowest numbers and biomass occurring during the potato year (\bar{X} = 73.5 m⁻² and 32.2 g m⁻², respectively), recovering only after 4 yr (\bar{X} = 450.3 m⁻² and 168.4 g M⁻², respectively) in the rotation to pasture levels. MBC/TOC was also lowest in the potato year (\bar{X} = 297.36 g soil C), increasing after three years (\bar{X} = 626.79 g soil C) to pasture levels.

Key words: Soil health, organic farming, potato, rotation, sustainable agriculture

Nitrogen management for optimum yield and quality in cereals. C. D. Caldwell* and D. MacDonald. Nova Scotia Crop Development Institute, Department of Plant and Animal Sciences, NSAC, Truro, NS (e-mail: ccaldwell@nsac.ca)

The effect of nitrogen application rates on grain and protein yield of winter and spring cereals was evaluated using small field plots over several years and several sites in Nova Scotia. For winter wheat, in most cases, there was no yield response beyond 50 kg ha⁻¹ N applied as a split application (80 kg ha⁻¹ N total). Higher N levels resulted in lower yields in some years and varieties due to increased lodging and/or disease. Levels of powdery mildew generally increased, while leaf septoria decreased with higher N. For spring barley, applications of greater than 50 kg ha⁻¹ N had no effect on grain yield of most

varieties. In spring wheat, yields did significantly increase from the 50 kg ha⁻¹ N level to the 100 kg ha⁻¹ rate and again to the 150 kg ha⁻¹ rate, although only by 0.2 and 0.4 t ha⁻¹; protein levels increased by over 1.3% with each increase in N rate.

Key words: Wheat, barley, nitrogen response, grain yield, protein

Can nitrogen be managed in a carrot rotation? Basil Dickson¹, Kevin Sanderson¹, Sylvia Wyand¹, and Sherry Fillmore². ¹Agriculture and Agri-Food Canada, CLRC, Charlottetown, Prince Edward Island (e-mail: Dicksonb@agr.gc.ca); and ²Agriculture and Agri-Food Canada, AFHRC, Kentville, NS.

A long-term carrot rotation study was established in 2005 at the Harrington Research Farm. The objectives were to determine the effect of applied N to the carrot crop in a 3-yr crop rotation, evaluate biweekly correlations of real-time Greenseeker, Cardy meter and LECO N in carrot petioles and establish residual soil nitrogen levels available to the carrot crop following several common crop rotations. Crop rotations were: (1) barley under-seeded to timothy/timothy/ carrot; (2) barley under-seeded to timothy/timothy followed by pearl millet/carrot and (3) barley/ pearl millet/ carrot. Rotation crops were grown using standard agronomic practices. Within carrot plots, six combinations of pre-plant and top-dress N were applied at from 0 to 150 kg N ha⁻¹. Preliminary results indicate carrot germination was not affected by applied N. Where no N was applied, pre-plant soil N averaged 16.2 and 2.6 mg kg⁻¹ compared to 2.8 and 0.5 mg kg⁻¹ post-harvest, for the 0–30 and 31–60 cm depths, respectively. Across N treatments, values of soil N after carrot harvest ranged from 2.5 to 3.3 mg kg⁻¹ and from 0.4 to 2.8 mg kg⁻¹ for the 0- to 30- and 31- to 60-cm depths, respectively, and were not affected by treatment. Bi-weekly soil N (0–15 cm) ranged from 2.8 to 106 mg kg⁻¹ and increased with rate of applied N. Carrot petiole N ranged from 1.8 to 5.5% and increased with rate of applied N. Bi-weekly soil N and petiole N decreased over the season, with higher rates of applied N treatments decreasing at a slower rate. Cardy petiole N followed a similar trend as LECO N, but was more variable. Across sampling times, reflectance difference values (NDVI) for Greenseeker increased as petiole N decreased. In year 2 and year 3 of this study, biological carrot yield was increased as rate of applied N. Data from at least two crop rotation sequences will be required to validate the impact of crop rotation on N management and the remaining study objectives.

Key words: Carrots, nitrogen, crop rotation, Greenseeker, Cardy, LECO, soil N

The challenges of analyzing alternative crop amendments for nutrient and metal composition. Mark Grimmett* and John MacLeod. Agriculture and Agri-Food Canada, CLRC, Charlottetown, PE (e-mail: grimmettm@agr.gc.ca).

The analysis of nutrients and metals in agricultural materials often creates unique challenges for the analytical laboratory. The challenges of three different agricultural samples will be discussed in this paper: (1) lobster and crab shells, (2) cement kiln dust used for liming, and (3) liquid hog manure. Lobster and crab shells represent a heterogeneous sample that requires aggressive grinding to produce a particle size required for analysis and is prone to grinder contamination of chromium and iron. Cement kiln dust is high in Ca and requires 10- to 100-fold dilution prior to analysis. This dilution results in other trace elements of interest falling below method detection limits. Liquid hog manure is a slurry that quickly partitions into solid and liquid phases with 75-80% of the total nitrogen present in the liquid portion of the sample. Each sample type requires special consideration when sampling, storing and preparing.

Key words: Nutrient analysis, metal analysis, crop amendment, and sampling

SESSION 3: BREEDING AND VARIETIES

Forage breeding and new varieties. Yousef A. Papadopoulos¹, Bruce Coulman², Real Michaud³, Surya N. Acharya⁴, Shabtai Bittman⁵, Don Viands⁶, Heathcliffe Riday, Arvid Boe⁸, Tim Phillips⁹, Michael D. Casler, and S. A. E. Fillmore¹⁰. ¹AFHRC, Truro, NS (e-mail: Papadopoulos@agr.gc.ca); ²Saskatoon Research Centre, Saskatoon, SK; ³Soils and Crops Research and Development Centre, Saint-Foy, PQ; ⁴Lethbridge Research Centre, Lethbridge, Alberta; ⁵Pacific Agri-Food Research Centre, Agassiz, BC; ⁶Cornell University, Ithaca, NY; ⁷USDA-ARS, US Dairy Forage Research Center, Madison, WI; ⁸Plant Science Department, South Dakota State University, Brookings, SD; ⁹Department of Agronomy, University of Kentucky, Lexington; ¹⁰AFHRC, Kentville, NS.

At Agriculture and Agri-Food Canada, the focus of the forage breeding program is to identify and develop novel germplasm and cultivars. The main objective is to produce cultivars with superior persistence, nutritive value and forage yield. This program also emphasizes two other objectives, namely: (1) to identify or develop new germplasm which can produce a significant improvement in soil structure and general health; and (2) to develop red clover germplasm containing useful organic molecules which may lead to new bio-based products having high value to the nutraceutical industry. In

addition to cultivar and germplasm development, the above researchers are currently investigating efficient breeding methodologies responsible for developing cultivars adapted to diverse regions across Canada rather than being focussed on regional adaptations. In this presentation we will cover recent advances from these studies as they relate to novel germplasm development. As Agriculture and Agri-Food Canada forage researchers are of limited number and resources are limited as well, breeding efforts are focussed on a few major forage species used in Canada; namely, timothy, meadow and hybrid bromegrass, crested wheatgrass, alfalfa, red clover and birdsfoot trefoil. Despite the fact that Agriculture and Agri-Food Canada breeding programs in other forage species have been or will be discontinued, the above Agriculture and Agri-Food Canada researchers are currently in the process of commercializing several new cultivars and germplasm of the following species: orchardgrass, smooth bromegrass, white clover, alsike clover, and kura clover.

Key words: Persistence, nutritive value, forage yield, bio-based products, nutraceutical, isoflavones

The identification of perennial ryegrass and Festulolium cultivars adapted for production in Atlantic Canada. Y. A. Papadopoulos¹, S. Todd², K. B. McRae³, and S. A. E. Fillmore³. ¹Agriculture and Agri-Food Canada, AF HRC, Truro, NS; ²Agriculture and Agri-Food Canada, ACCCRC, St. John's, NL; ³Agriculture and Agri-Food Canada, AFHRC, Kentville, NS.

Atlantic Canada is an excellent environment for perennial forage grasses. Perennial ryegrass produces good yield with superior quality; however, its persistence in Atlantic Canada is unreliable. Festulolium is a hybrid grass derived from a cross between species of the genus *Lolium* (either annual or perennial ryegrass) and species of the genus *Festuca* (tall or meadow fescue). In Europe, this hybrid displays good quality attributes from the *Lolium* genome and good persistence attributes from the *Festuca* genome. This study evaluated stand persistence, herbage yield and forage yield of seven Festulolium hybrids (Felopa, Barfest, Lofa, HZ 7 DK, HZ 11 DK, Perun, HYKOR and HZ 15 DK) and four reference species [perennial ryegrass (Bastion), annual ryegrass (Barextra), tall fescue (Festorina), meadow fescue (Miner)] were evaluated from 2004 to 2007 to determine their adaptation to Atlantic Canada climate. This trial was seeded at Charlottetown, Prince Edward Island (46N, 63W) in 2004 as a randomized complete randomized block design with three replicates. A complementary trial was seeded at St. John's, NL (47°N; 52°W) in 2006 with four replicates; the treatments consisted of five Welsh high sugar ryegrass varieties (Aber Avon, Aber Dart, Aber Star, Ba 13582 and Ba

13613) tested against five reference species [perennial ryegrass (Bastion), timothy (Champ), bluegrass (Lato), meadow fescue (Mimer) and Festulolium (HZ 7 DK)]. Plots of the above trials were harvested to assess yield and herbage quality using a hay management system. Herbage yield and persistence measurements of the Festulolium hybrids were significantly better than the main species used to produce them, and also the Festulolium types (crosses using annual vs. perennial ryegrass parentage or tall vs. meadow fescue) differed. Seasonal dry matter production was 6.55, 8.49, 8.27 t ha⁻¹ for 2005, 2006, and 2007, respectively. In 2005, HZ 7 DK was the highest yielding Festulolium, producing 8.4 t ha⁻¹ compared with the average of the three checks at 6.7 t ha⁻¹. In 2006 and 2007, cultivar Hykor produced the highest yield, 10.8 and 10.1 t ha⁻¹, respectively, compared with the check average of 8.6 and 7.9 t ha⁻¹. In general, the above two hybrids (HZ 7 DK and Hykor) appear to have good herbage yield and acceptable quality compared with the check cultivars. The results of this study indicate that some Festulolium hybrids are well adapted to Atlantic Canada.

Key words: Interspecific hybridization, forage, grasses, herbage quality

Agronomic evaluation of spring and winter triticale as influenced by location across Canada. R. S. Veitch*¹, C. D. Caldwell^{1,2}, R. Lada¹, D. M. Anderson¹, and D. MacDonald². ¹Department of Plant and Animal Sciences, NSAC Truro, NS (e-mail: rveitch@nsac.ca); Nova Scotia Crop Development Institute, Truro, NS.

One advantage of triticale (*X Triticosecale* Wittmack) over wheat is its adaptability; most triticales produce higher grain yields and proteins over various environments than wheat. The objective of this study was to evaluate new and currently used triticale varieties over various locations across Canada. The winter cultivars Elan, Enot, Fort, Factor and Titan consistently yielded well and had good grain proteins at all sites compared with wheat checks AC Winsloe and CDC Osprey. The spring cultivars Sandro, AC Ultima and Pronghorn were the most consistent for grain yields, and AC William and AC Alta had the most consistent grain proteins over all environments. However, AC William and AC Alta were among the lower yielding spring cultivars. Overall, triticale cultivars demonstrated better stability over environments, winter hardiness (for winter types), excellent resistant to powdery mildew and Septoria, higher grain yields and grain proteins compared with wheat checks. The single greatest concern is with susceptibility to fusarium infection. The winter cultivars Elan, Enot, Fort and Titan, and the spring cultivars AC Ultima, Pronghorn and Sandro showed good resistant to fusarium infection and DON accumulation.

Key words: Triticale, grain yield, protein, location effects and fusarium

SESSION 4: PEST MANAGEMENT – DISEASES, INSECTS AND WEEDS

Evaluation of herbicide applications following forage harvest to control smooth bedstraw (*Galium mollugo*). G. L. Graham* and G. Chiasson. New Brunswick Department of Agriculture and Aquaculture (e-mail: gavin.graham@gnb.ca)

Smooth bedstraw (*Galium mollugo*) is becoming a serious weed in pastures, hayfields and field margins across the Maritime region. It is typically found in acidic, low-fertility areas, but is moving into intensively managed areas. A trial was initiated near Bathurst, New Brunswick, to evaluate herbicide control options, with application made 2 wk after forage harvest. All rates of triclopyr and aminopyralid tested offered consistent control of smooth bedstraw in the season of application. The addition of 2, 4-D amine to aminopyralid did not improve control. MCPA amine, mecoprop/MCPA/dicamba, 2, 4-D amine and carfentrazone-ethyl demonstrated early activity on the weed, but had dissipated in further evaluations. The cost and control of aminopyralid and triclopyr should be evaluated further in the Maritimes, especially in comparison to glyphosate application followed by fertility and re-seeding treatments. Trial evaluations will continue in 2008 to determine control levels in the season following application.

Key words: *Galium mollugo*, herbicide, forage, aminopyralid, triclopyr

Evaluation of Bayer foliar fungicides for control of cereal diseases. D. MacDonald* and C. D. Caldwell. Nova Scotia Crop Development Institute, Department of Plant and Animal Sciences, NSAC, Truro, NS (e-mail: dmaconnald@nsac.ca)

Small plot field trials in NS evaluated the efficacy of the fungicides StrategoTM, ProlineTM and FolicurTM alone or in combination for their control of leaf and head diseases in winter wheat, spring barley and spring wheat. Fungicides were applied alone or in combination at various timings based on Zadoks growth stages (ZGS). Grain yields of Freedom winter wheat were not significantly affected by any of the treatments but Pioneer 25R47 had significantly higher yields with Stratego or Proline alone or in combination. Leaf Septoria and powdery mildew levels of Pioneer 25R47 were significantly higher in the check, Folicur alone and Proline alone at ZGS60 treatments. AC Westech barley yielded significantly higher with Proline alone, Stratego alone at ZGS39 and Stratego plus Proline treatments,

AC Helena grain yields were highest in the plots receiving the Stratego applied at ZGS39. Levels of deoxynivalenol (DON) were not high in any crops or varieties, and the only differences among treatments were found in the spring wheat.

Key words: Cereal diseases, fungicides, DON

Novel organic approaches to the management of *Agriotes* spp. wireworms. Joanna MacKenzie* and Andrew Hammermeister. Organic Agriculture Centre of Canada, Department of Plant and Animal Sciences, NSAC, Truro, Nova Scotia (e-mail: jmackenzie@nsac.ca).

Infestations of European wireworms, namely *Agriotes lineatus*, *A. obscurus*, and *A. sputator*, are resulting in significant reductions in crop yield and quality throughout the Maritimes. The destructive larvae of these species persist in the soil for several years, feeding on the roots of crop plants. Alternative methods of wireworm control, particularly organic practices, are desired as many of the persistent insecticides once employed become deregistered. Ongoing laboratory trials will involve determinations of wireworm crop preferences in search of bait crops, wireworm preference for a range of carrot varieties in search of a resistant variety, an examination of the effectiveness of selected organic feeding deterrents, and an evaluation of potential soil-applied organic controls. Results to date suggest that wheat may prove effective as a bait crop. Field trials will examine the role of rotational crops, such as buckwheat, brown mustard, alfalfa and flax, in creating a soil environment ill-suited to wireworm habitation.

Key words: Wireworm, click beetle, *Agriotes*, cultural management, crop rotation

Managing wireworms in agricultural fields. C. Noronha* and D. Carragher. Agriculture and Agri-Food Canada, CLRC, Charlottetown, PE.

Wireworms, the larvae of click beetles are found in all agricultural production areas in Canada. They feed on the root and underground parts of several crops such as oats, wheat, barley, clover, corn, carrots, lettuce, onions, peas, potatoes, parsnips etc.

Root crops such as potatoes and carrots are particularly susceptible because damage to the new tubers and carrots can reduce quality and yield. Insecticides registered for wireworm control in potatoes have proven to be ineffective. We conducted a study to determine the effectiveness of using crops that are thought to be unattractive to wireworms, in rotation with potatoes. The crops tested were brown mustard, alfalfa, and buckwheat, with barley under-seeded to clover as the control. Preliminary results indicate a decrease in the

number of adults and larvae found in the brown mustard crop as compared with the other crops. This study will continue over the next 2 yr to confirm these results.

Key words: Wireworms, damage, potatoes, crop rotation

The influence of organic seed treatments on barley seed vigour, establishment and yield in the Maritimes. D. S. Kerr¹, A. M. Hammermeister¹, and M. S. Adl². ¹Organic Agriculture Centre of Canada, NSAC, Truro, NS (e-mail: dskerr@nsac.ca); and ²Department of Biology, Dalhousie University, Halifax, NS.

Reduced crop establishment is a growing concern on organic farms, with consequences of increased weed invasion and reduced yields. Organic farmers often use higher seeding rates to offset the anticipated lower establishment rates; however, the source and quality of seed is variable, which can make performance in the field difficult to predict. A variety of organic-approved seed treatments are available, intended to improve crop establishment through various mechanisms that are not yet well-understood. The objective of this study was to evaluate seven representative types of organic-approved commercial seed treatments for their potentially beneficial effects on seed vigour, crop establishment, and yield in barley (*Hordeum vulgare*). The vigour of treated barley seed lots was assessed by cold and seedling growth tests in growth chamber experiments. Field experiments were conducted at three locations to determine the relative performance of barley seed treated with the same seven seed treatments. Crop establishment was assessed, and various vigour measurements were collected at the three-leaf stage including seedling height, length and width of the third leaf, and above-ground biomass. Final crop height and yield were measured, and quality indicators including 1000-kernel weight (TKW), test weight (TW), and deoxynivalenol (DON) content were determined. Analyses are currently underway.

Key words: Seed treatment organic barley vigour

Sclerotinia rot in carrots – Research can make a difference! Kevin Sanderson and Rick Peters. Agriculture and Agri-Food Canada, CLRC, Charlottetown, PE.

Canadian research, within the past 5 yr, has identified that mowing the carrot canopy can alleviate conditions that are conducive to the development of *Sclerotinia rot* of carrots (SRC) caused by *Sclerotinia sclerotiorum*. Canadian farmers commonly grow carrots using a hilled system, but no commercial equipment is currently available to trim the carrot canopy. To further develop this concept as a tool for plant disease management, a prototype carrot foliage trimmer (CFT) was designed

and manufactured in 2006 at the Harrington Research Farm in Prince Edward Island. The CFT slices open the canopy and also removes older foliage lying on the soil surface. Opening the carrot canopy allows sunlight to penetrate, foliage to dry and removes older senescing foliage, thus eliminating conditions conducive to SRC development. Field evaluation indicates that trimming has no effect on carrot yield or quality. In 2006, trimming at row closure significantly reduced the incidence of SRC on foliage by about 82%. After 1 mo in storage, SRC was reduced by 75% in carrot roots. In 2007, two nine-row commercial units were built by the carrot industry, one in Nova Scotia, Canada and one in Wisconsin, USA. In Annapolis Valley, Nova Scotia, commercial trimming reduced the number of diseased petioles in the field by 72, 54 and 37% for the varieties Sugarsnax, Topcut and Uppercut, respectively. With the development of this technology, canopy trimming is rapidly becoming an effective tool in carrot disease management.

Key words: Sclerotinia rot, carrots, trimming, mechanical trimming, disease suppression

SESSION 5: NEW FIELD CROPS AND CROP UPDATE

Camelina: What is old becomes new. C. D. Caldwell*, S. Urbaniak, and D. MacDonald. Nova Scotia Crop Development Institute, Department of Plant and Animal Sciences, NSAC, Truro, NS (e-mail: ccaldwell@nsac.ca).

Camelina sativa is being evaluated for agronomic and economic suitability for the Atlantic region. It is well adapted to grow under a range of conditions across North America (and around the world). The oil has potential as a high-value niche market designer product for human consumption, base for cosmetics and lower value biodiesel feedstock. The meal is useful for a number of animal diets and has potential as a base for replacing fishmeal in aquaculture systems. The selection of cultivar is an important determinant for the potential success or failure of *C. sativa* production, but there is considerable genetic variation and a good chance for rapid advancement through breeding.

Key words: *Camelina sativa*, biodiesel, designer oils, fish feed, cultivars

Effects of row spacing and seeding rate on RR soybeans. D. MacDonald¹, C. D. Caldwell¹, J. VanRoestel², and B. Newcombe³. ¹Nova Scotia Crop Development Institute, Department of Plant and Animal Sciences, NSAC, Truro, NS (e-mail: dmacdonald@nsac.ca); ²AgraPoint International, Kentville, NS; and ³Cornwallis Farms Ltd., Port Williams, NS.

Replicated small plot field trials in NS from 2004 to 2006 evaluated the effects of row spacing and seeding

rate on the yield of two RoundUp Ready soybeans (Pioneer 90B11 and 90B73). There was no consistent effect of row spacing on yield. Significant positive yield response was seen from the 50 to 70 seeds m⁻² seeding rate for both varieties at most sites and a non-significant (over site-years) trend towards higher yields at 90 seeds m⁻². Based on these results (two varieties with 5 site years), the recommended seeding rate would be in the range of 70 seeds m⁻² in a 30-cm row spacing. Field scale strip trials conducted by Cornwallis Farms Ltd. in 2007 evaluated the effect of 7- vs 15-inch row spacing on three varieties seeded at the same seeding rate (approximately 50–60 seeds m⁻²) on upland and dyke soil types. Averaged over all fields, no significant yield difference between row spacing was found.

Key Words: Soybeans, row spacing, seeding rate

Factors influencing potato consumption in eastern Canada. R. S. Veitch^{1*}, G. Wang-Pruski¹, S. Dukeshire², M. MacPherson², C. Rangel², and V. Varma¹. ¹NSAC, Department of Plant and Animal Sciences., Truro, NS (e-mail: rveitch@nsac.ca); and ²NSAC, Department of Business and Social Sciences, Truro, NS.

Potatoes are one of the four staple food crops in the world that have made significant contributions to human life and economy. However, potato consumption has declined in the past decade and it is unclear as potato acreage has declined in every major potato producing province since 2004. The Potato Consumer Research Initiative (PCRI) was formed in 2006 to look into the declining consumption and ways to improve consumption for industry. The objective of this project is to gain a better understanding from the consumers' perspective of factors that impact potato purchasing and consumption and to identify strategies to increase the likelihood of consumers purchasing potatoes. A focus group orientation was used to examine cooking with potatoes, purchasing behaviour, purchasing preference and concerns of purchasing potatoes. It was found that consumers have strong, set schemas about the category of potato and they used this when judging potatoes. Potatoes had to be medium to large and uniform in size, but the cleanliness, firmness and healthiness of the potato was also important to consumers. Packaging was also a concern with consumers as they wanted to see and feel the potato. Newer varieties were not well received at first but most consumers did express interest when exposed to longer. Overall, the shape, size, color and appearance of the potato influenced consumer's decisions when purchasing potatoes. Packaging was also a concern and with the appearance of the potato it would seem to indicate that these areas hold the best marketing potential.

Key words: Potato, consumption, purchasing, packaging and potato size