Cropping Systems Research Program at the Nova Scotia Agricultural College

Newsletter & Fact sheet #2 June 2004

Scope: To provide information on the Cropping Systems research and activities in the region to the Atlantic Canada growers.

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WINTER WHEAT – A GOOD FIT

by Jack van Roestel - AgraPoint

Winter wheat acreages have really increased in western NS the past 5 years. The reason for this increase is the hot demand for feed wheat by local mills for use in the poultry and hog industry (especially as corn prices trend upwards). Winter feed wheat also alleviates some of the spring planting workload, and it's been a more profitable crop than barley.

There has been limited winter feed wheat production in central and eastern NS along with other parts of the Maritimes. With the use of hardier varieties that we currently are recommending (AC Grandview, AC Winsloe, Pioneer 25R49, 25R26, Freedom, and AC

Sampson) along with good field selection and planting dates there should be opportunities for more winter wheat acreages in these locales.
In the Annapolis Valley, winter feed wheat fits best on silage corn, barley or early harvested vegetable land. With this cropping sequence, winter wheat can easily be no-till seeded or often seeded conventionally after one pass with a roller harrow or these disc harrow-bar crumbler combos. Winter wheat on plowed down forages is a less desirable option due to the prevalence of wireworms in this situation, unless you have access to a Lindane type seed treatment which is being phased out in 2004.

The main factors in winter feed wheat success are:
- Field selection; reasonable drainage, with few depressional areas where ice sheeting could occur ,plus some ability to hold snowcover
- Planting date is critical; Annapolis Valley floor (Sept. 15-25th) all other areas of Maritimes (Sept. 5-12th). With no-till seeding you need to be on the early end of these dates. To see the importance of seeding date, check out the Sept. 15, Sept. 30, Oct. 15,2003 wheat and triticale seedings at the Agrifest Show in Canning on August 5 – 8th.
- Good seeding rate and appropriate starter fertilizer; seeding rates need to be heavy enough (i.e. 130-145 kg/ha) so that 375-400 seeds/m² are dropped. At seeding time use a moderate manure application or a fertilizer supplying 20N and all the required P & K (e.g. 12-24-24 or 5-20-20)
- Adequate spring nitrogen; application of 85-100 N (preferably split between mid-late April and 4 weeks after the 1st application)
- Spring herbicide and pre-heading fungicide if required.

Winter feed wheat is an enjoyable crop to grow where it is so robust in the early spring, harvests in mid-August and should leave you with some profit at the end of the season. With good management winter feed wheat should consistently yield around 4.5-6 t/ha (1.8-2.2 t/acre) with a straw crop of about 3 t/ha.

MEASURING PLANTING SUCCESS IN SPRING CEREALS & CORN

by Jack van Roestel- Agrapoint

After the spring planting rush and 1st cut forages, many growers don't give spring grain and corn crops much attention until harvest time (providing weeds and pests are not an issue). I'd encourage you to spend a little time assessing your planting success.

Assess spring cereals in mid-late June for seeding depth and check for tillers. The seeding depth on most barley and wheat fields should be 2-3 cm (around 1 inch). On sandier soils especially, there was some deep seeding that took place this spring with seeds down at a 2-2.5 inch depth. Planting too deep delays emergences, stresses the seedling and predisposes it to more soil diseases, and reduces tillering (potential for additional heads/plant). Too deep a seeding is not always because of inadequate seed drill adjustment, but often occurs when the seedbed is too fluffy from just using a disc harrow or a light S-tyne harrow with rolling baskets. Tillage equipment is expensive, but with big acreages and for optimal seedbeds you need to have either a roller harrow or one of these newer heavy bar crumblers that hook behind a disc harrow or cultivator.

Re-assess spring cereals after heading to check the seeding rate and nitrogen fertility. Take a ruler or meterstick to the field, count heads and determine what the average head density is. Optimal seeding rates are considered to be 300-350 heads/m² or 28-33 heads/ft². Head size and length should be fairly uniform if N fertility and soil moisture are adequate.

Corn fields should also be assessed around the 3-5th leaf stage for population, uniformity and colour. To determine your plant stand per acre, get yourself a
17.5 foot length of twine with a spike in each end. Count plants over this distance and multiply this figure by 1000 to find your plants per acre (x 2.47 = plants/hectare). Silage corn population should be 28,000-31,000 plants/acre and for grain corn around 26,000-30,000 plants/acre. Having occasional 1-2 ft seed gaps doesn't really affect corn yields very much (see recent Pioneer "Walking Your Fields" newsletter Volume 14-Issue 3). In terms of uniformity, most plants should be at a similar leaf stage if planting depth was good (about 2 inches or 5 cm depth). By the 5th leaf stage, plant colour should be a dark green, if the corn looks pale and growing temperatures have been warm, you need to consider a nitrate topdress. The ear length is determined at the 8th leaf stage of corn so nitrogen shouldn't be lacking at this growth stage.

What is Nutrient Management all about?

Lise LeBlanc, M.Sc., P.Ag.,
LP Consulting Ltd.

Nutrient Management is one of the top issues facing Canadian farmers. It has been a hot topic over the past few years and situations such as Walkerton have brought it to the forefront of environmental concerns. There have been extensive changes in farming over the past 10 years in Canada. Changing markets, global competition, government policies and consumer demands has forced changes on producers. The public is concerned about the environmental impacts of excessive nutrients from manure and fertilizers.

We've read about it in the news, discussed it at farm meetings and seen nutrient regulations being implemented all around us. So what is a nutrient management planning? How does it differ than the fertility plans that have traditionally been developed for producers?]

The answer is that fertility plans only address part of crop and livestock management in a sound environmental system. Fertility plans only look at the nutrient requirements of the crop. The full nutrient value of available manure and previous crops are not usually taken into consideration. Or if they are, only a nominal nutrient value is allocated.

A nutrient management plan requires detailed farm information. It involves carefully analysing the crops nutrient needs by looking at soil analysis, past history of nutrient application (manure, fertilizers), crop rotation, cover crops, addition of other organic materials, soil site features and the quality of your manure. When looking at total nutrient availability on the farm, producers may be applying excessive nutrients that won't increase crop growth.

What information will the planner be looking for?
(1) Soil tests - it is essential to soil test at least every 3 years to determine nutrient levels and keep track of the trend towards increasing or decreasing levels. This is key to a good nutrient management plan. If the soil test indicates that you have high levels, there is usually no yield respond to the application of nutrients and it increases the risk of nutrient leaching. What is the CEC level? Low CEC fields are usually sandy soils with high nutrient leaching potential. This affects nutrient management strategies.
(2) Manure tests - it is important to know the quantity and ratio of nitrogen, phosphorus and potassium in the manure. It varies widely from farm to farm, depending upon animal type, feed and state of the manure (solid, liquid). A manure plan needs to be customized for the farm. Knowledge of nutrient availability is important. For example, poultry manure provides almost immediate availability of nitrogen (similar to 34-0-0) while dairy manure provides continual release of nitrogen over 2-3 years.
(3) Previous and future crops - several crops release nitrogen into the soil when plowed under for the next years crops. For example, mixed forage will provide 30 units of nitrogen for the next crop and soybeans can provide between 20-45 units depending upon yield. A crop rotation will need to be developed for a three year plan.
(4) Soil pH levels - pH affects the availability of nutrients to the crops. Low pH will decrease the availability of phosphorus, potassium, calcium, magnesium. It will also decrease the activity of microorganisms in the soil. These organisms are important for the release of nutrients from soil particles. If you have low soil pH, 75% of the nutrients you have applied may not be available to the crop. There is also an increase in iron, aluminium and magnesium toxicity. High pH levels will decrease the availability of zinc, manganese, boron and copper. Check the magnesium/calcium ratio to determine if calcitic or dolomitic lime is best for your farm.

(5) Farm maps - these can be LEAPS maps, GPS or maps can be developed from aerial photographs. This helps to provide for more accurate acreages and can show various water courses.

What information must be included in an approved plan?

- Farm description - this includes land base, soil types, pH range, phosphorus levels, crops grown over the 3 year period., animal units per hectare (if applicable).
- Manure plan, 3 years (if you have manure) - this would include a spring, summer and fall manure plan for individual fields (based on farm practices), manure rates (this could be in loads per field based on your spreader size), the amount of manure that is available in the spring, summer and fall and how much is allocated for those times. If

there is more manure than the farm is able to utilize, an alternative manure plan must be developed.

- Fertilizer plan, 3 years - this would include fertilizer rates for individual fields and total purchase order for the fertilizers.
- Maps - this includes line plotted and aerial photographs.
- Liming program - rate per field and total lime requirements over 3 years.
- Manure and soil analysis - they must be taken within one year of the plan.
- Nutrient balance sheets - the balance sheets are done field by field which shows crops, nutrient requirements, nutrients added to the field and nutrients removed by the crop over the 3 year plan. If the field has excessive phosphorus, the final balance should show a reduction in levels (phosphorus level description).
- Environmental concerns - this discussions nutrient strategies based on soil type and proximity of water bodies.

NSDAF Farm Investment Funding

Nova Scotia has taken a very proactive approach with the Nova Scotia Federation of Agriculture taking a lead in developing NMP criteria and standards for their producers. The province has developed a funding program that pays for 100% of nutrient management planning (up to $1500), additional nutrient management dollars for farms that cost more than the $1500 (50% funding). They also provide funding for information that is essential for the planning process: soil and manure testing , GPS farm mapping programs (50%) and lime transportation subsidies (75%).

Nutrient Management Planning Training

The Continuing Education Department of the Nova Scotia Agriculture College has developed a week long Atlantic Province nutrient management training program to train government, nutrient management planners and producers. This provides the background for nutrient management. Each province is developing a 1-2 day course that participants complete after they have attended the week course. This short course will educate planners, etc on that particulars provinces nutrient management planning standards and criteria as well as any legislation that pertains to nutrients.

Where are we going from here?

The initial driving force for nutrient management legislation in many areas have generally come from Municipalities. Society is demanding more accountability which can often lead municipalities to implement aggressive regulations.

The challenge we will face is municipal vs provincial regulations. Environment is one of the top issues that cuts across jurisdictions with each municipal level developing bylaws and regulations according to their own priorities. Municipal governments often control land use issues. This can allow small interest groups to have a lot of influence over council decisions and have a strong impact on councils that may have no agricultural experience. There can often be no coordination between municipalities which leads to patchwork guidelines and regulations across the provinces.

It is important for farm organizations to have open communication with municipalities and have a proactive approach on environmental issues. Producers need to be involved in local governments. They are the ones with agricultural experience to provide valuable input into council decisions.

There is a misconception that farms that do not have manure do not have to be concerned with nutrient management planning. The addition of commercial fertilizers every year has an impact on soil health. Previous crops, soil pH and over or under application of nutrients all affect soil quality. If fertilizers were applied based on an “average” fertility recommendation rate, soils may have excessive nutrient levels.

Nutrient management planning does not completely change current farm management practices but reorganizes farming methods based on new expectations that are sensitive to potential environmental impacts. Lists of standard practices and traditional farm recommendations that have been used in the past and continue to be used are much simpler to recommend. Unfortunately they do not adapt specific conditions of farming operations or address the changes that are needed in current farming practices.

Fertility recommendations are no longer adequate to meet the short and long term goals of successful farm planning.

Nutrient management planning will provide a high net return if properly implemented. Producers will immediately see a direct benefit to their bottom line! This is definitely a positive aspect to a negative farm issue.

Shifting Manure use from N-based to P-based applications.

By Professor Craig Miller, NSAC

Traditional use of livestock manure in soil fertility management has been based on nitrogen (N) -- the amount of manure applied is determined from the crop's N requirement and the available-N content of the manure. There are a number of reasons for this approach. N is the most expensive fertilizer nutrient to buy, so careful attention to N carried the greatest economic benefits. N is also the most mobile fertilizer nutrient - its overuse can result in pollution of both surface and groundwater.

Application of livestock manure based on crop N requirements results in the build-up of soil phosphorus (P). This is because most crops require about 1/10 to 1/5 as much P as N, while most manure contains ¼ to ½ as much P as N. The excess P provided by the manure remains in the soil whence it may be taken up by subsequent crops.

Up to a point, the build-up of soil P benefits crop production; however, in areas with concentrated livestock populations, soil test P values have risen over time into the high to excessive range, which raises environmental flags. The movement of soil P and manure P into surface waters stimulates growth of aquatic weeds and algae which cause a variety of problems. When these organisms die their decomposition consumes oxygen, depleting the supply that other organisms require. If the contaminated water is used for stock watering toxins produced by algae can poison livestock.

These environmental concerns have led a trend toward P-based manure application. With this approach the P-content of the manure is matched with the crop P requirements to determine manure application rates. In the mid-Atlantic States which drain into Chesapeake Bay, P-based manure use is written into environmental regulations. Other jurisdictions are following with guidelines or regulations limiting P loading of soil by manure application.

Lab analysis can determine the P content of livestock manure very accurately; however, to determine the appropriate manure applications for crop production it is also necessary to know how much of the manure P is actually available for crop uptake. Estimates of manure P availability (as a % of total manure P content) vary quite widely (between 35% and 95%). The wide range of estimates makes practical management decisions difficult.

Of particular importance for producers is the availability of manure P relative to commercial fertilizer P. Because soil test recommendations are based crop yield response to additions of fertilizer, applications of manure P should be based on its availability relative to fertilizer P. The appropriate factor to apply to the manure P application would be the fertilizer P equivalence of the manure: that is, plant uptake of manure P as a percent of uptake of fertilizer P which would produce the same crop yield.

Estimates of fertilizer P equivalence of manures range from 10% to more than 100%. The variation results from differences in soil properties, manure type and management practices, crop and climate, as well as methods of lab analysis. This high degree of variability suggests that manure P recommendations need to be based on field crop trials for particular soil types, manure sources and crops under the specific growing conditions in various geographic regions.

The Cropping Systems Research team at the Nova Scotia Agricultural College, under Dr. Valtcho Jeliazkov has initiated a research project to determine the fertilizer P equivalence of different livestock manure on soils with different properties. The information derived from this research would assist producers in making management decisions which give the greatest economic benefit from manure use, while helping to mitigate the potential environmental problems.

Farming Systems Research (FSR) at the University of Guelph:

Update by Dr. Glen Filson

In August, 2004, UBC Press will publish Intensive Agriculture and Sustainability: a Farming Systems Analysis, which organizes some of the key analyses produced by the University of Guelph's Farming Systems Research team over the past decade. This collection analyzes the

reasons for the public's scrutiny of intensive agriculture and the prospects for sustainable farming now that concerns are mounting about food quality, manure runoff, greenhouse gases, extra-label use of antibiotics, pesticide use and rural conflict. Intensive Agriculture and Sustainability outlines the advantages of Farming Systems Analysis for understanding the implications of modern, intensive agriculture. The book describes some of the major environmental and social problems connected with intensive farming; outlines a framework for analyzing its sustainability; discusses key linkages among the environmental, economic, and social indicators; outlines modelling trade-offs between profitability and environmental sustainability; and then analyzes various farming systems using case studies. The authors conclude that rural conflict and government regulation are likely to continue unless the public joins with farmers to help fund stewardship practices and stabilize farm incomes.

The new Director of Farming Systems Research, hydrological engineering Professor Ramesh Rudra has recently received significant new funding from the Ontario Ministry of Agriculture and Food, Environment Canada and several other agencies for a four year long study of the Development of a Watershed System Capacity Procedure for Water Quality. Co-investigators on this latest farming systems teach include Professors Mike Goss, Bahram Gharabaghi, Ed McBean, Wanghon Yang, Glen Filson and McGill's Prof. Shiv Prasher. In Ontario in the aftermath of the Walkerton tragedy, it is now clear that the public strongly favours the protection of source water. Agriculture can be a major source of non-point pollution. The latest direction of this farming systems team will be to examine agricultural land use plans and management practices to ensure that the province's water quality objectives are met. This farming systems research team, in collaboration with another teach headed up by Prof. Mike Goss focusing on microbial loads connected with agricultural land use activities in watersheds, will study the sources of soil erosion, sediments and nutrients associated with agriculture. A social scientific component of the study analyzes opportunities and barriers to farmers' adoption of environmental best management practices with the goal of developing more effective technical and financial incentives to ensure farmers' participation in environmental protection.
For more information, please contact Dr. Glen Filson: (519-824-4120 Ext 56231), gfilson@oac.uoguelph.ca

Cropping System Research In Ontario

by Dr. Bill Dean,
Cropping Systems Professor, University of Guelph

In Ontario, the main field crops include corn, soybeans, winter wheat, spring cereals, forage legumes and forage legume/grass mixtures. A large percentage of the field crop acreage is associated with livestock production. Consequently, interactions between livestock and crop production heavily influence cropping systems.

Cropping system research historically has been driven by agronomic/economic questions. Increasingly, however, cropping system research objectives are based on a desire to address social and environmental issues. Nutrient management effects on groundwater and greenhouse gas production, tillage and rotation effects on carbon sequestration, effects of agronomic practices on soil quality are examples of current research efforts by myself and others involved in cropping systems research in Ontario that tend to reduce the focus on increasing production efficiency. In my program current projects include the following:

1. Nitrogen Dynamics Associated with Fall applied Manure: In Ontario, most livestock growers do not have manure storage for 365 days. Regulations currently require 200-240 day storage. Consequently, manure must be applied in the late summer or early fall to ensure adequate storage over the winter. Nitrogen in fall applied manure is susceptible to loss to both groundwater and air. Nitrogen losses associated with fall applications of manure represent an environmental and economic concern to growers. In collaboration with Dr. John Lauzon two trials are being conducted. Trial #1 examines the influence of different cover crops and cover crop control timing on losses of nitrogen and the

agronomic benefit to a subsequent corn crop. Trial #2 compares the losses of nitrogen from various forms of manure applied either in the fall or in the spring. The objective of these trials is to determine the form of nitrogen losses from various systems and identify agronomic management practices to minimize these losses. This research is being funded by the Livestock Environmental Initiative, New Directions Ontario Pork Producers, Ontario Cattleman's Association, Dairy Farmers of Ontario, and the Poultry Industry Council.

2. Long Term Tillage Trial: This study, initiated in 1976, evaluates the soil and crop effects of 10 tillage systems commonly used in Ontario in a corn soybean rotation. Tillage systems range from a low disturbance no-till system to a conventional moldboard plow system 2004 represents the seventh rotation cycle since the introduction of soybeans into the rotation in 1991. In addition to yield, various soil quality parameters are continuously measured. In 2001, soil samples were taken to determine organic carbon. Results indicated that tillage affected distribution of organic matter but not total amount. (Funded by OMAF) .

3. Long Term Rotation Trial: This study, initiated in 1980, evaluates the effect of rotation on soil properties and corn response. The thirteen rotations include continuous corn, continuous alfalfa, and eleven treatments of two years of corn followed by two years of a rotation crop (soybean, winter wheat, alfalfa, red clover, spring cereal). All treatments are split and mouldboard plow and no-till systems are compared. Included in the measurements are organic carbon, nitrous oxide, nitrate availability and nitrogen use efficiency. (Funded by OMAF)

4. Frost Seeding of Spring Cereals: Yield of spring cereals is generally favored by early planting dates. In Ontario, cereal planting normally occurs once soil moisture levels have decreased to a level where tillage and/or planting equipments can be operated. Frost seeding is a technique whereby planting is conducted when the soil surface is sufficiently frozen so as to support planting equipment, while not preventing penetration by planter seed furrow openers. In 2003, replicated trials were conducted at three sites to compare frost seeding of four spring wheat [milling and feed] varieties to a 'normal' seeding date. At approximately eight additional grower sites frost seeding was evaluated in strip trials. Plant stands, heading dates, protein, straw quality and yield were evaluated. Results indicate that spring wheat yields can be significantly increased by frost seeding. This research is being conducted in collaboration with Dr. Duane Falk and Peter Johnson (OMAF) (Funded by the Ontario Wheat Board)

5. Spatial Response to Intensive Crop Management Systems. In this long term trial (3-6 years) corn and soybean response to management systems ranging in intensity from low input to very high input are being evaluated across a field landscape. Treatments are clustered so that the effects of potassium fertility rate and placement can be evaluated. : (Funded by Potash Phosphate Institute and the Ontario Agribusiness Association)

6. Physiological Response of Seedling Maize to Soil Properties: A Ph.D student is currently developing a research proposal to determine the effect of soil properties on corn growth and development. This research will compliment previous research efforts by Bev Kay, Thijs Tollenaar and myself examining the role soil properties in determining rates of development and biomass accumulation of corn grown in soils with increasing clay content, increasing aggregate size or reduced tillage. The intent is to better understand crop response to soil-altering agronomic practices such as tillage. (Funded by NSERC).

7. Tillage intensity and fertilizer placement evaluation: A disc ripper tillage system is being compared against no-till, zone-till and moldboard plow systems.

Fertilizer timing and placement is also being evaluated within each system. The trial is being conducted in collaboration with Greg Stewart (OMAF). (Funded by Monsanto Canada Inc.)

8. Side dressing of liquid hog manure: Corn yield response, soil compaction and nitrate leaching of side-dress manure applied to 8-10 leaf corn is compared to side-dress fertilizer nitrogen response. Initial results indicate that the benefit of side-dressed hog manure exceeds its nutritive value. This trial is being conducted in collaboration with Jake Kraayenbrink, a Wellington County hog producer.
For more information contact Dr. Bill Dean, Ph:(519) 824-4120, bdeen@uogueph.ca

PEI Cropping Systems Research: Rotation Length and Tillage Systems in Potato Production

By Brian Sanderson, Rick Peters and Martin Carter
Crops and Livestock Research Centre, Agriculture and Agri-Food Canada, 440 University Avenue, Charlottetown, PE C1A 4N6.

Crop rotation is a management practice as old as agriculture itself. It has many potential benefits including the reduction of soil erosion, control of plant diseases and the general maintenance of plant and soil health. The focus of the Prince Edward Island Crop Rotation Act is on controlling soil erosion by limiting the frequency of row crops in the rotation.

Research scientists at Agriculture and Agri-Food Canada in Charlottetown have developed a field laboratory in Prince Edward Island to assess the feasibility of using minimum tillage practices in combination with crop residue mulches (after the potato harvest) in 2- and 3-year potato rotations. Certain indicators were selected to assess change and feasibility of the cropping systems. These included i) potato yield and quality, ii) diseases caused by soil-borne pathogens, and iii) surface residue levels after potato planting and soil organic matter and structure.

The field laboratory was established in 1994 and featured 2 rotations: a 2-year (potato and spring barley) rotation and a 3-year (barley [undersown with red clover], red clover, and potato) rotation. For the potato year, two tillage systems were super-imposed on the rotation plots: a conventional and a conservational (minimum tillage) system. The conventional system consisted of mouldboard ploughing in the late fall followed by discing twice and cultivating in the spring for both rotations. The conservation tillage in the 3-year rotation consisted of spraying the red clover with glyphosate in fall and leaving the residue as a soil cover for the winter, followed by chisel ploughing in spring. In the 2-year rotation, the barley stubble was chisel ploughed after harvest and again in spring.
split plot with 6 reps
To assess change in cropping systems, research and experience has shown that various indicators take different numbers of rotation cycles to show significant trends. Some are quite obvious, like the increase in surface residue cover prior to planting with the conservation tillage system in both the 2 and 3-year rotations. The percent soil residue cover ranged from 15 to 36%.

When total tuber yield of the treatments are compared to the conventional 3-year rotation over the last 6 years of the study, the yields ranged from an average increase of 0.86 t/ha with the 3-year conservation tillage system to decreases in the 2-year rotation of 0.94 t/ha for the conventional and 1.76 t/ha for the conservation tillage system. However, the marketable tuber yield was 4.57 t/ha less for the 2-year versus the 3-year rotation.

Tillage systems did not significantly impact marketable tuber yield, however soils under conservation tillage had significantly higher contents of organic carbon, macro-C, and microbial carbon and increased aggregate mean size density compared to the conventional tillage system.

Potatoes are susceptible to attack by a wide range of soil-borne pathogens, including those that cause stem and stolon canker, black scurf, silver scurf , dry rot, common scab and pink rot. These diseases are associated with soil in many parts of the world where potatoes are grown and can significantly affect crop yield and tuber quality.

Assessments of potato stems, stolons and tubers for disease caused by Rhizoctonia solani (stem and

stolon canker and black scurf) demonstrated that since 1998, levels of stem and stolon canker and black scurf have been substantially reduced in plants grown in 3-year rotations compared to those grown in 2-year rotations.

To further explore the disease control effect, a broader range of soil-borne potato diseases were examined from 2000 - 2003. Tubers were rated not only for black scurf, but also for lesions caused by Helminthosporium solani (silver scurf), Fusarium spp. (dry rot), and Streptomyces spp. (common scab). As well, tubers harvested from field plots were challenged with Phytophthora erythroseptica, causal agent of pink rot, in storage.

A reduced severity of silver scurf and dry rot was sometimes found in tubers from plants grown in 3-year rotations with minimum tillage. However, in general, the severity of dry rot, silver scurf and common scab was not significantly influenced by tillage systems or rotation length. Following inoculation with P. erythroseptica, tubers harvested from 3-year rotation plots were more resistant to pink rot than those harvested from 2-year rotation plots. In addition, potato plants grown in the greenhouse in soils extracted from the 3-year rotation plots of the field trial were more resistant to pink rot than plants grown in soils extracted from the 2-year rotation plots. In direct contrast to conventional wisdom, minimum tillage did not cause an increase in severity of diseases caused by common soil-borne pathogens.

In the last few years of disease assessment in this field trial, plants grown in a 3-year rotation using minimum tillage practices have been consistently less severely affected by diseases caused by soil-borne pathogens than plants grown under 2-year rotations with conventional tillage. In addition to reducing disease levels with a longer rotation (3-year), minimum tillage may also provide added disease control benefits by stimulating the growth of soil bacteria which antagonize and compete with potato pathogens.

The field laboratory is now starting the eleventh year of production. To this point, the 3-year conservation tillage system has been shown to have advantages over the other systems examined, including a reduction in tillage/energy costs, maintenance of a continuum of soil cover near 30 % prior to potato planting, reducing the risk for soil erosion, improved soil organic and physical quality at the soil surface leading to reduced risk due to moisture stress, and reduced severity of diseases caused by soil-borne pathogens.

CROPPING SYSTEMS RESEARCH AT CROPS AND LIVESTOCK RESEARCH CENTRE, CHARLOTTETOWN, PEI. WEED MANAGEMENT

Jerry A. Ivany - PhD, P.Ag.

Cropping systems research on weed management in feed crops and potatoes provides information and technologies on weed control in barley, soybeans, field corn and forage crops as well as these crops in the potato rotation. Research includes non-chemical weed control and management, factors affecting herbicide activity, weed biology, weed competition and weed threshold effects on crop yield, and cultivar responses to herbicides. Research currently underway includes:

Feed Crops

Effect of crop density, spacing and time of removal of weeds in soybeans (MII Project)
This project was set up in collaboration with East Coast Commodities. The project is examining the effect on yield of soybean plant density, seeding date and row spacing in no-till seeded narrow-row soybeans using glyphosate resistant soybean cultivar. Effect of time of application of glyphosate from unifoliate leaf to the 4th trifoliate leaf is being assessed as well.

Effect of time of removal of weeds on corn yield (with Vernon Rodd).
The project is examining the effect of weed competition on yield of silage corn using a glyphosate resistant corn cultivar to determine the effect of time of application of glyphosate from seed leaf to the 7th leaf is being assessed as well. The value of a single well timed application verses two applications of glyphosate is being determined.

Control of Galium Mollugo L. in pasture (with Vernon Rodd).
This experiment is evaluating selected herbicides for effectiveness in control of the perennial weed Galium Mollugo (smooth bedstraw). This weed has been increasing in pastures throughout the

Region and information is not available on best herbicides to use to give effective control.

Mechanical and herbicide methods for weed control in organic barley and wheat (with Hans Nass).
This project is examining the effectiveness of using a finger weeder once or twice to control weeds in barley and wheat grown using organic culture methods. The mechanical treatments are being compared to an effective herbicide treatment for effect on crop yield.

Potatoes
Effect of previous rotation crop on weed spectrum in fields.
Three experiments have been established at the Harrington Research Farm on PEI starting in 1997 to examine the effect on weed management and species change, potato tuber disease, and potato yield of the rotation crop grown before potatoes in a three year rotation. The experiments are in the second phase of the rotation. Crops being evaluated include the standard red clover, silage corn, soybeans and canola.

Physical and non-chemical methods for weed control in potatoes (with several CLRC scientists).
Experiments are underway examining ways to obtain effective weed control in potatoes using different types of cultivation equipment (potato cultivator, finger weeder, multi-head rotovator, Buddingh cultivator) either alone or in combination with thermal (propane flamer) or organic chemicals (corn gluten, acetic acid).

NSAC Cropping Systems Research Program – Current and Accomplished Projects

Update by Dr. Valtcho Jeliazkov

1. Development of profitable and sustainable cash cropping systems for Atlantic Canada. I. Responses of cash cropping systems to tillage, N, and sulfur. Location: Field #206, Truro.
The objectives of this project are: (1) To evaluate the effect of tillage practices (no-till and conventional), N (optimal, reduced and increased), and S (two rates plus a control) addition on: (1.1) crop productivity, (1.2) grain, seed, protein and oil content and quality; (1.3) N, P, other major and micronutrients bioavailability and uptake; (1.4) soil physical, chemical, and biological properties; (1.5) weed, pest and diseases populations. (3) To evaluate the economic performance of various treatments and recommend best ones to the industry. Crops are corn, wheat and canola.
Our results indicate that, corn under no-till produced higher yields than under conventional, while spring wheat yielded better under conventional tillage. Expectantly, mycorrhizae developed better under no till than under conventional tillage. Also, S addition tends to suppress mycorrhizae development on corn and wheat under both no-till and conventional tillage systems. This experiment was modified in the spring of 2004. The objective is to evaluate crops (corn, wheat, and canola) and soil response to different N level and two tillage systems.

2. **New Cash Crops for Nova Scotia. I. Introduction, Environmental and Economic Evaluation of over 40 Aromatic and Medicinal Crops**. Accomplished. Two locations: (1) Truro, NS, and Canning, NS.
The goal of this project is to introduce new low-volume high-cash crops for Nova Scotia. The objectives are: (1). Introduction, screening and evaluation of 40 aromatic and medicinal crops in order to identify crops that are: (1.1) able to develop and reach technical maturity under the environmental conditions of Nova Scotia; (1.2) show productivity and product quality comparable to those grown in the US; (1.3) demonstrate potential to be developed as specialty crops for niche markets and for value added processing. (2) Evaluation of economic performance of selected aromatic crops by comparison with other major crops in Nova Scotia. (3) Comparison of the productivity and quality indices of varieties and species grown on two different locations.
The project involves both annual and perennial crops. All annual crops developed and yielded well. In 2001/04, all perennial crops with the exception of *Dracocephalum* (dragonhead) over wintered successfully in both locations. The project has been completed. Kelly Bowes (a graduate student) defended here MSc thesis in 2003. Four manuscripts were sent to refereed scientific journals. Results were also presented at 3 Conferences. A fact-sheet is to be developed based on the results from this project.

3. **Crop performance, soil conservation and nutrient efficiency in a no-till grain/forage based rotation.**
Location: Field #401, Truro. Long-term trial.
The goal of this research is to estimate optimal manure rates in order to minimize nutrient loss and maximize crop yields of rotations involving corn, wheat and soybean under no-till system. The specific objectives are: (1) To evaluate the effect of grain/forage based crop rotations and manure application under zero tillage on: (1.1) crop performance in respect to plant development, yields and produce quality, (1.2) changes in N and other nutrients availability, uptake, and losses, including leaching (via deep core sampling at 80cm and measure of nitrates and ammonium). 2) To estimate phytoavailaibility of macro and micronutrients after two years of manure application under different rotations via soil analysis and correlate the data to oat development, productivity, and nutrient uptake. Results from the first two years regarding responses of corn, spring wheat, and soybeans, are being sumirized by Kim Parsons in her MSc thesis. The mix of timothy and red clover responded positively to liquid manure application in the spring before seeding. Increased rates of liquid manure application increased yields, however, only the highest manure rate (64t/ha) provided yields significantly higher than the unfertilized control. The highest yields were obtained from the NPK optimal treatment, suggesting that liquid manure alone cannot substitute for optimal NPK application. In the third and fourth year, starter fertilizer was also provided.

4. **Conserving soil, water and air quality and improving sustainability of major cropping systems in Atlantic Canada**
Location: Truro area, NS.
Six long-term trials were established under this project. Research areas include reduced and zero tillage, liquid and solid manure application to small grains and forages, N management, S application as gypsum or elemental S, Source Separated Municipal Solid Waste compost application, Sewage Sludge Compost application to forages, soil and water quality; nutrient management of forages, species diversity and population shifts within 4 years; nutrient leaching and management in cash crops. Results so far have been presented at conferences and over field open days (twilight tours for growers). Four manuscripts are to be prepared for scientific journals. In addition, 2-3 facts-sheets may be developed in early 2005.

5. **The role of mycorrhizae in a no-till grain/forage based rotation.** Accomplished.
Location: Field # 401, 401A, 206, and Cox greenhouses at NSAC.
The objectives of the project were to evaluate the effect of crop rotation and manure application under zero till on (1) nutrient and trace element transfer in manure/soil/plant systems (2) changes in nutrient availability to plants over the growing season, (3) mycorrhizae associations and their role in nutrient availability and uptake. Results from the container experiments show that yields of the three corn, wheat, and soybeans were highest in the NK treatment and lowest in the unfertilized control. Suppression of mycorrhizae with the addition of Benlate did not affect the yields of the three crops. Fertility treatments did not significantly affect % RLM (Root Length infected by Mycorrhizae) of the two crops. Generally, mycorrhizae suppression altered tissue content of several nutrients and trace elements in 7 w old plants but not in 14 weeks old plants, suggesting a crucial role of mycorrhizae in early plant nutrition. Field experiments have shown that three years of liquid manure application under no-till system increased mycorrhizae associations in the roots of spring wheat in all rotations, and of soybeans in wheat/corn/soybeans, but not in corn/wheat/soybeans rotation. Fertility treatments and rotations did not affect mycorrhizae association in corn roots. The highest manure rate and the commercial fertilizer suppressed root mycorrhizae associations relative to the untreated control or to optimal and reduced manure rates. A manuscript is under preparation for a refereed journal.

6. **Remediation of lead enriched soils in Nova Scotia.** Current.
The goal of the project is to develop feasible approaches for reducing and/or eliminating the phytoavailability of Pb and other toxic elements enriched soils of NS. We will also estimate the ability of various digestion methods for recovery of heavy metals in Atlantic Canada soils. Some of the results have been reported at two conferences. A MSc student Mike Munroe is compiling his two-year results into a thesis.

7. **Integrated Weed Management in Aromatic & Medicinal Crops, and Herbaceous Ornamentals.**
The objectives are: 1) to examine alternative means and strategies for weed control in aromatic

and medicinal crops, to reduce direct foliar applications of weed control products, 2) to examine new weed control product usage in aromatic and medicinal crops, 3) promote weed management as one part of an integrated pest management (IPM) program and ensure that additional weed control products made available through registration are developed into an environmentally conscious and sustainable pest management program. 4) to develop recommendations and facilitate the transfer of information to industry regarding IPM in new crops. We screened over 30 chemicals for weed control of over 30 species. Results were presented at the Annual Meeting of Can Soc Weed Sci in Halifax (Dec, 2003). Two manuscripts are under preparation. In addition, some of the results were included in Kelly Bowes MSc thesis.

8. **New uses and product development from agricultural waste**. Accomplished.
The project is exploring opportunity for development of greenhouse growth medium for container grown plants using various waste products. Final report is being compiled. Results will be sent to a refereed journal.

9. **Development of Profitable and Sustainable Cash Cropping Systems for Atlantic Canada. II. Fitting New Cash Crops Into Grain and Forage Rotations.**
The project explores opportunities for introduction of new cash crops into rotations, to optimize nutrient management of new crops and selected crop rotations, to decrease their pressure on the environment. The project involves both controlled environment and field experiments. Medicinal crops (coriander, dill, milk thistle, and fennel) are being grown in rotations with corn, spring wheat, canola, and soybeans and under three fertility treatments (NPK, solid manure, NPK+solid manure), and two application rates (optimal and reduced).

10. **Effects of Municipal Solid Waste (MSW) compost, gypsum, and solid manure on forage crops and on soil chemical and biological properties under a dykeland system**.
Accomplished.
The goal is to assess methods for elevating soil fertility and nutrient efficiency of conventional systems and systems at transition from conventional to organic production. Specific objectives include: I. To evaluate the effect of organic amendments (solid manure, and industrial compost) and gypsum in a two-year transition period to organic systems on timothy/red clover productivity and quality (3) nutrient availability, (4) soil chemical, physical and biological properties. II. To evaluate NS produced Source Separated Municipal Solid Waste Compost (SS-MSW) as a macro and micronutrient fertilizer, and its eligibility for use in conventional and transitional organic systems. Treatments consisted of 2 rates of SS-MSW compost, two rates of solid manure, and two rates of NK fertilizer in combination with three levels of sulfur as gypsum. Rate one and two of the SS-MSW compost, manure, and fertilizer provided 95 and 190 kg of available N/ha respectively, while gypsum rates provided 0, 20, and 40 kg of total S/ha. Forage yields from the first cut were highest in the compost treatments, lower in manure and NK treatments, and lowest in the control. Forage yields from the second cut were higher in all fertility treatments and lower in the untreated control. Addition of sulfur did not influence yields but increased protein content of forage. Our results suggest that high rates of SS-MSW application do not result in elevated levels of heavy metals and trace elements in forage. Both rates of SS-MSW compost provided high yields and may completely substitute commercial fertilizer application on grass/clover mix on dykelands.

11. **Optimizing N management and liquid manure applications to permanent forages on dykelands**. Accomplished.
The objective is to assess the effect of different rates of liquid manure and fertilizer on forage yields and quality, N, P, and K use efficiency, on N leaching, and on mycorrhizae association.

12. **Effects of solid manure application on N and P use efficiency and leaching under a long-term grain/forage rotation**.
The project evaluate the effect of ecolo-till (subsoiling) and liquid manure application to N and P use efficiency and leaching under no-till corn system and various fertility treatments.

13. **Remediation of high phosphorus soils in Nova Scotia.**
We evaluate various approaches to reduce P in P-enriched soils. Both phytoremediaton and immobilization approaches are considered. The project is in its second year. Results from

the first year field experiments are yet to be analyzed.

14. **Evaluation and chemical characterization of five high value crops for NS.**
The objectives of the field experiments are: 1.To evaluate the suitability of five new crops (All-heal (Prunella vulgaris), Roseroot (*Rhodiola rosea*), Scullcap (*Scutellaria spp*), Sheep sorrel (*Rumex acetosella*), and Elecampane (*Inula helenium*) for the environmental conditions of NS. 2. To develop alternative methods for weed control for the five (5) crops. 3. To study the effect of location, mycorrhizae, compost, and plastic mulch on productivity and chemical constituents of the above crops. All the above are perennial crops, the experiment was established in 2003 and will be harvested in 2004.

15. **Assessment of Phosphorus (P) and potassium (K) status of NS soils. Predicting P and K mineralization**.
The long-term goal of this study is to provide information on the processes developing in NS soils with respect to P and K, to explain how management practices in representative farms and fields changed P and K levels during the last 15-18 years, and to predict P and K potential of NS soil types. Specific objectives include detailed survey, analysis of soil test reports, generation of GIS maps, development of fact sheets for growers. The project will be initiated in July, 2004.

16. **Assessment of Sewage Sludge Compost as Soil Amendment and Nutrient Source for Field and Greenhouse Crops.** Initiated in May 2004.
The long-term goal of this study is to assess comprehensively Sewage Sludge (SS) compost as soil amendment and plant nutrient source and evaluate its environmental impact. Specific objectives are: (1) To evaluate effects of heavy rates of SS-compost application on: (1.1) Crop yields and nutrient uptake, (1.2) Soil quality (mycorrhizae establishment of plant roots, (1.3) heavy metals bioavailability, mobility, and speciation (1.4) nitrates, phosphates, and sulfates in soil profile 0-30cm, (2) To develop recommendations for NS growers on the use of SS compost as plant nutrient source for agricultural crops and generate fact sheets.

For more information on all the above projects please contact Dr. Valtcho Jeliazkov, (902) 893 7859, vjeliazkov@nsac.ns.ca

NS Crop Development Institute (CDI) Current Research Projects

Trial Location(s): Truro, NSAC and/or Canning, Lyndhurst Farms Ltd.
Contact: Dr. Claude Caldwell or Doug MacDonald
Phone: (902) 893-6680 (902) 893-7751 or
Email:Ccaldwell@nsac.ns.ca
or Dmacdonald@nsac.ns.ca

1**. Response of Winter Cereals to Management**. (fourth cropping season)
The objectives of this project are: (1) To evaluate the effect of nitrogen rates and disease/lodging management for various winter wheat and winter triticale varieties on yield, protein, disease levels and lodging levels. (2) Compare responses between two locations and (3) To determine the most economical and environmentally sound management strategy for winter cereals.

2. **Seeding Time Response of Winter Cereals.** (third cropping season)
The over all goal of this project is to assess late seeding of winter cereals in hopes to better fit this crop into crop rotations involving fall harvested crops such as potatoes and carrots. The objectives are to determine the effect of seeding date on the winter survival, yield and quality of various new varieties of winter cereals.

3**. Evaluation of New Triticale Varieties (Winter & Spring) and their Response to Management.**
The objective of these trials is (1) To evaluate the adaptability of new triticale varieties to the Maritime region as an alternative feed grain. Trials compare yield, quality and disease resistance of the triticales to recommended small grains. (2) To conduct studies examining responses to management inputs (nitrogen levels, disease and lodging control) on yield and quality (protein levels and feeding properties)(3) to determine economically and environmentally sound management strategies for new triticale varieties.

4. **Evaluation of Winter Spelt and its Response to Seeding Rate.**
The objectives of these trials are to evaluate winter spelt for adaptability to the Maritime region and compare management effects such as seeding rate on yield and quality.

5. **Selection and Evaluation of New Winter Wheat Varieties from Recently Bred Lines.**
These projects involve the continuation of the winter wheat breeding program initiated by Dr. Gary Atlin, former plant breeder with the NSAC Plant Science Dept. Objectives of the trials are: (1) To screen new lines for winter survival, disease resistance, yield and quality. (2) To continue evaluation of lines currently in registration-recommendation trials for responses to management inputs.

6. **Response of Alternative Feed Grains to Management.**
The objectives of this project are to (1) Evaluate alternatives, such as triticale and hulless barleys, to traditional small grains for livestock feed. (2) Compare responses in yield and quality (protein yields) of alternative grains and traditional small grains to management inputs (nitrogen rates and disease/lodging management).

7. **Response of New Recommended Varieties of Barley, Spring Wheat and Oats to Management.**
The objective of these trials is to evaluate the response of the newest recommended varieties of these crops to management inputs such as nitrogen levels and disease and lodging control. New varieties will not always respond to management inputs the same as older varieties and it is necessary to determine optimal management practices for all varieties.

8. **Evaluation of Seed Treatment Products on Barley, Spring Wheat and Soybeans.**
These trials conducted in cooperation with Gustafson are intended to determine the efficacy of various seed treatment products in preventing pathogens (soil or seed born) or insect attacks under cool, wet seedbed conditions. Treatments are tested under early seeding conditions to determine products that provide protection when emergence is delayed because of cool, wet conditions at seeding time or following seeding.

9. **The Effects of Seeding Rate and Date on Spring Wheat.**
The objective of this trial is (1) To determine the effect on yield of seeding spring wheat varieties at 75% of the recommended seeding rate and (2) To compare these seeding rates at an early and late seeding date.

10. **Environmental and Agronomic Evaluation of Paper Mill Biosolids as a Soil Amendment.**
The objective of the research is to examine the agronomic benefits and environmental risks associated with the land application of paper mill biosolids for field crop production. Objectives will be achieved by a series of on-farm field trials and greenhouse experiments with corn, grass forage and soybeans. Agronomic benefits will be determined by measuring yield and quality response to land applications in field trials. Environmental assessments will be conducted by soil sampling and analysis to trace movements of nitrate.

11. **Response of Herbaceous Perennials to Management.**
In cooperation with Balamore Farms Ltd., Great Village, NS the objective is to evaluate various managements (nitrogen applications, plant growth regulators and mechanical flower removal) for their effects on growth of field grown herbaceous perennials (Hosta, Daylily & Astilbe). These perennials are grown for the separation and resale of crown portions to commercial nurseries. Assessment of vegetative growth, crown and root development will be conducted under the various managements in a series of field and greenhouse trials.

12. **Impact of Rate and Timing of Late N Applications on Strawberries.**
In cooperation with Balamore Farms Ltd., Great Village, NS the objective is to test various levels of nitrogen applied at two times in August for their effects on production of strawberry plants grown for division and sale.

13. **Selection and Evaluation of New Field Pea Lines.**
The objective is to evaluate new lines of field peas for their yield potential and resistance to lodging under NS growing conditions. Lines under testing have been selected for their ability to remain standing to ease harvest and yield potential. Protein analysis will determine feed quality of the selected lines.

NEW PROJECT: Identification of Oilseed Crop Potential for PEI

Significant changes have occurred in agriculture on PEI in the past few years. Some of these changes result from local initiatives like the report Cultivating Island Solutions, the enactment of the Crop Rotations Act, and the increasing desire to enhance the ecological and economic sustainability of Island farms. Other changes reflect the broader market forces that have impacted negatively on Island farm profitability.

Such changes have emphasized the need to diversify crops and ,thereby, crop rotations on PEI. The evaluation of oilseed crops and their production appears to represent such an opportunity. The potential of oilseeds adapted to cool, temperate climates range from high value nutraceuticals, food, bioenergy, and biobased lubricants to lower value feed opportunities. Currently no research agency in the province or the region has a mandate to work with oilseed crops (the exception is the evaluation of soybean breeding lines at the AAFC Harrington Research Farm, where the emphasis has been on full-fat beans for livestock feed). Researchers anticipate that the results from this project will identify alternative rotational cash crops for PEI agriculture. The objectives of this project are to initiate work that

will identifying new crop opportunities in the oilseed sector, stimulate exploitation of those opportunities, and enhance the expertise in the region concerning oilseed crops.

PROJECT START DATE: February 2004
PROJECT COMPLETION DATE:March, 2007

NAME AND ADDRESS OF APPLICANTS:
CONTACT:

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P.O. Box 550
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Peter Boswall
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Charlottetown, PE C1A 7N3

Potato and its processing quality (or What can molecular biology do to improve potato quality)

By Dr. Gefu Wang-Pruski, NSAC

The potato is one of the world's major food crops, next to rice, wheat and corn. Its worldwide production is close to 300 million tons, grown on approximately 20 million hectares in over 140 countries. Potatoes are cultivated under a wider range of altitude, latitude and climatic conditions than any other major food crop. High yields and a balanced nutritional value make the potato a good source of carbohydrates, proteins, essential vitamins, minerals and dietary fiber.

In North America, more than 50% of its production is used for processing, mostly for French fries (over 85%) and chips (over 10%). Since many of its food products are accepted or rejected on the basis of color and appearance, after-cooking darkening (ACD), as one of the key quality defects, has been affecting the marketability of potatoes, both for processing and fresh markets.

After-cooking darkening occurs when potatoes are exposed to air after cooking, including boiling, baking, frying or dehydration. It is caused by a non-enzymatic oxidation reaction. During cooking, a ferrous-chlorogenic acid complex is formed which, on exposure to air, oxidizes to a bluish-gray compound ferri-dichlorogenic acid. Citric acid acts as an iron binding molecule, effectively competing with chlorogenic acid, and forming a colorless iron:citrate complex. After-cooking darkening has been reported from every potato growing area in the world and is one of the most widespread, undesirable tuber traits. Breeding attempts towards ACD elimination have been only partially successful; therefore, there are no cultivar available to processors that have acceptable agronomic and processing qualities and do not darken to a certain degree. Russet Burbank and Shepody, the most commonly used French fry processing cultivars in North America, still show significant darkening only after a few months in storage. Current prevention in processing industry is based on the addition of sodium acid pyrophosphate.

The research program led by Dr. Gefu Wang-Pruski at NSAC focuses on the

investigation of genetic and environmental determinations of the ACD trait. The genetic investigations include identification of genes essential for chlorogenic acid biosynthesis, genes that are differentially expressed during storage, genes whose expressions are linked with the trait, and finally the genome wide gene expression profiling. Study of the environmental effects have been focussing on storage conditions, soil type, and nutrient management. So far, three genes that are induced or suppressed by storage conditions have been identified. One of them has shown the correlation of its expression level with ACD. Another gene, named as cinnamic acid 4-hydroxylase, involved in chlorogenic acid biosynthesis has been identified from the potato genome. Its activity has been confirmed to be associated with ACD in potato. On the environmental side, we have strongly demonstrated that storage length affects the degree of the darkening. Longer the potatoes are stored, darker they become. The soil type and rates of NPK also significantly affect the degree of ACD. These effects are indeed related to the contents of chlorogenic acid, citric acid and iron in the potato tubers.

In conclusion, after-cooking darkening can be controlled by field management strategies in the short term; in the long term, genetic modification through marker assisted breeding approach could be the most effective way to select better cultivars for human consumption. As for processing industry, millions of dollars could be saved for the use of the chemical and recovery of the chemical from the waste water. For household consumption, the short-term solution is still a teaspoon of lemon juice.

For more information please contact Dr. Gefu Wang-Pruski at (902) 893 6247, of gwangpruski@nsac.ns.ca

NSAC CURRENT RESEARCH PROJECTS ON POTATO

Dr. Kris Pruski, NSAC

1. Evaluation of Garlic Barrier®, an insect repellent for control of green peach aphid (Myzus persicae) in potatoes (Solanum tuberosum L.). Project funded by Prince Edward Island Agricultural Research Investment Fund Inc., PEI Potato Producers Association and Island Organic Farms Ltd. Funding is for three years 2003-2005. The research plots are on PEI at Cavendish Farms. Research is done in collaboration with Dr. Robert Coffin (Cavendish Farms) and Dr. Christine Noronha (AAFC, Charlottetown, PEI).
Objectives: Evaluation of insect repelling properties of Garlic Barrier® repellent.

2. Physiological ageing in tuber size control of potato for processing and seed. Project #DEV22-013 funded by Technology Development Program (NSDAF and McCain Foods Ltd.). Funding is for two years 2003-2004. Research plots are at NSAC fields Brookside. Research is done in collaboration with Barb Daniels-Lake and Dr. Robert Prange, AAFC Kentville, NS. Three varieties are investigated: Atlantic, Russet Burbank and Shepody.
Objectives: Production of uniform large tubers for processing and/or production of uniform small tubers for seed.

3. Tuber size control in potato. Project #DEV97-115 funded by McCain Foods Ltd., NB, NSDAF and PEI Department of Agriculture and Forestry). Funding for six years 1999-2005. Research is done in collaboration with Barb Daniels-Lake and Dr. Robert Prange, AAFC Kentville NS. Two varieties are investigated: Russet Burbank and Shepody.
Objectives: Production of uniform tubers for both seed and processing by manipulation of storage conditions and planting density in the field.

4. IPM approach in control of potato infesting aphids in potato. Project #DEV23-024 funded by Technology Development Program (NSDAF and Island Organic Farms Ltd). Funding is for two years 2004-2005. Research is done in collaboration with Dr. Yvan Pelletier, Potato Research Centre AAFC, Fredericton, NB. Research plots are at NSAC fields Brookside. Two varieties are investigated: Russet Burbank and Shepody.
Objectives: Evaluation of insect repelling properties of Garlic Barrier® to aphids in potatoes. Laboratory observations of aphid flying and tasting behavior.

Value-added apple product research is funded by NSDAF

By Dr. Vasantha Rupasinghe, NSAC

The recently established Tee-Fruit Bo-product Research Program at the NSAC has received $75,000.00 from the Technology Development Program of the NSDAF to conduct research on apple-based food products. The funds will be used for two research projects that will look at the possibilities of introducing value-added food ingredients from apple and their by-products and improving the shelf life of snack apples for distant markets. The research program chair, Dr. Vasantha Rupasinghe, considers the Nova Scotia apple industry to be "unique" with the majority of the apples being processed for juices and pies. "Every year, the processing industry produces over 12 million pounds of waste which still contains valuable phytonutrients that could be utilized to produce novel bio-products" explained Dr. Rupasinghe. The new research program in collaboration with the PEI-Food Technology Center will examine new technologies for processing and manufacturing apples-based bio-products. The Nova Scotia Fruit Growers' Association supports this project.

Value-added fresh-cut apples, which are loaded with vitamins, minerals, antioxidants and dietary fiber are an ideal healthy snack for all ages, from kids to the elderly. Dr. Rupasinghe has been researching the food processing technologies required to assure the quality and safety of fresh-cut fruits that have become an emerging sector in the food industry. We have to eliminate, by all possible means, the risk of contamination by pathogenic bacteria such as E. coli O157:H7, which could cause outbreaks of illness. This research project will look at, healthy and environmentally friendly, new decontamination methods and other processing technologies to extend the shelf life of snack apples. "This will allow our local industry partner, Scotian Gold Cooperative Limited to export their fresh-cut products to distant markets" he explained.

The Canadian apple industry in recent years has found itself with a huge problem of poor markets for fresh apples mainly due to world over-production and large imports. Nova Scotia growers faced with poor returns, below their investment costs, have been shifting away from apple production. "There has been about a 16 percent decline in the farm gate value of Canadian apple over the past five year average" said Dela Erith, the executive director of the Nova Scotia Fruit Growers' Association. The NS Fruit Growers' Association was the first group in Canada to realize they had to look at alternative products and marketing strategies. They became the first growers group to launch a research initiative to look at apple-based bio-products. They received help from both the provincial and federal governments to create the new faculty position at the NSAC, Tree-Fruit Bio-products Research Chair.

Dr. Rupasinghe's research program consists of multidisciplinary research components including market analysis, germplasm evaluation, food processing, phytonutrient analysis and clinical trials. The tree-fruit bio-product research program is the tenth commodity-based research chair program established recently at the NSAC.

For information, contact Dr. Vasantha Rupasinghe at vrupasinghe@nsac.ns.ca or 902-893-6623.

Agri-Futures Nova Scotia: an Update – June 2004

By Mr. Henry Bowers

Agri-Futures Nova Scotia has been responsible for the delivery of the Canadian Adaptation and Rural Development (CARD) fund for Nova Scotia since 1997. The CARD fund has contributed over $4.8 million to projects in Nova Scotia. These funds are now almost fully committed.

On April 7, 2004 Agriculture and Agri-Food Minister, Bob Speller, announced a new five year program, the Advancing Canadian Agriculture and Agri-Food program (ACAAF).

Although there are some changes in program areas, it is anticipated that eligibility criteria and the flexibility within the program will be unchanged. Also, we expect that Agri-Futures Nova Scotia will act as the delivery agent for the program in Nova Scotia. During the summer of 2004, Agri-Futures will make application to Agriculture and Agri-Food Canada for Nova Scotia's share of the funds and will develop guidelines and application procedures for the ACAAF program. Once these steps are completed, a memorandum providing the relevant information will be circulated.

The ACAAF program will continue the innovative and flexible approach established under CARD in funding projects at national, regional and provincial levels. The formation of strategic alliances and increased collaboration will be encouraged.

The ACAAF program is built on a three-pillar approach. Pillar I, industry led solutions to emerging issues, will support projects that test or pilot approaches and solutions and can serve as an incubator for initiatives holding future promise. Pillar II, capturing market opportunities by advancing research results, will support projects that transfer research results into market opportunities. Pillar III, sharing information to advance the agricultural industry, will support projects aimed at gathering, analyzing and sharing information to contribute to agriculture and agri-food policy directions.

Agri-Futures will continue to accept applications. A limited amount of funding is available under the CARD program. Larger projects will be assessed for their suitability under ACAAF and approval may be delayed until funding is confirmed and guidelines are finalized.

For further information, contact Henry Bowers, Executive Director Agri-Futures Nova Scotia at vernal.azimuth@ns.sympatico.ca or by telephone at 902-889-2323.

Technology Development 2000 Program

By Susan E. Simpson, NSDAF

The purpose of this program is to support the development and adaptation of new and leading agricultural technologies and knowledge that will enhance the competitive position of the Nova Scotia Agri-Food Industry. This is a federal and provincial cost shared program.

Eligible applicants for this program include individuals, partnerships, corporations, co-operatives, colleges, universities and foundations, farm organizations, commodity organizations, recognized agricultural water authorities and government agencies.

Assistance available through this program is on a cost shared basis with the applicant with funding levels and duration related to project category. For the majority of activities under Category A (General Technology), assistance may be up to 75 % of total project costs to a maximum of $20,000 per year for up to two program years. For activities under Category B (Agricultural Water Resource Development), assistance is up to 50 % of eligible project costs for one program year. Funding levels are up to a maximum of:

- $30,000 per project per year for individual projects, or
- $40,000 per project per year for community-based or multi-user projects.

It is anticipated this program will open by the end of June for the 2004-05 program year. For the current program year it is anticipated there will be two Calls for Proposals, in which Letters of Intent can be submitted. For complete program details please contact the Programs and Business Risk Management office at 902-893-6510 or 1-866-844-4276 or visit our website at www.gov.ns.ca/nsaf/prm

Second Atlantic Canadian Society of Agronomy Workshop

The second regional Canadian Society of Agronomy (CSA) Technical Workshop was held in Charlottetown, Prince Edward Island, on January 14 and 15, 2004. Participation was excellent with 91 attendees, including 12 graduate students who competed in a formal graduate student presentation/poster competition. Invited and volunteer papers totalled 27 presentations and 17 posters, and covered the following topic themes: climate change, crop stresses, cropping systems - nutrient use efficiency, cropping effects on environment and greenhouse gasses, crop production - fertility management, breeding, rotation and management, organic production, pest management and provincial field crop updates. Abstracts of all papers/posters will be published in a volume of Canadian Journal of Plant Science. Furthermore, this workshop provided a forum for agronomy workers (cereals, soybeans, corn, forages, pulse crops, etc.) in the Atlantic region to get together to exchange ideas and research results. Seventeen Certified Crop Advisors took advantage of eight CEUs and obtained these credits by attendance at the workshop. The Organizing Committee included the following

CSA members: Jerry Ivany (co-chair, AAFC), Yousef Papadopoulos (co-chair, AAFC), Brian Sanderson (Registration and AV Co-ordinator, AAFC) Ralph Martin (OACC-NSAC), Peter Boswall (PEIDAF), Mike Price (NBDAFA) and Jack vanRoestel (AgraPoint). Bert Christie (retired professor and scientist) and Bill Thomas (AgraPoint) assisted with judging the graduate student competition. The next Atlantic CSA Technical Workshop is planned for mid to late January of 2006. For more details please contact Yousef A. Papadopoulos, (Papadopoulosy@agr.gc.ca) or Jerry Ivany (Ivanyj@agr.gc.ca.).

NS Department of Agriculture and Fisheries
Legislation and Compliance
Quality Evaluation Services
Laboratory Services

By Mr. John K LeDue, NSDAF

Laboratory Services was created over a period of years from 1997 to 2003. Three sections have come together; Analytical, Dairy and Pathology. There is one Lab Manager and 3 Technical Laboratory Operations Supervisors. Lab staff include 7 Agricultural Technicians, 5 Medical Lab Technologist, 1 Lab Analyst, 5 Admin. Support and 3 Laboratory Assistants. The role of each section has remained fairly constant.

Analytical Services

Provides proximate and elemental analysis in the area of soil, soil amendments (manure/compost analysis), livestock feed, plant tissue, water. The lab is fully accredited for all registered tests(water only) under the Standards Counsel of Canada. For the year 2003 the Analytical Lab Processed the following Total samples:

Livestock Feed 4657
Compost/Manure/Miscellaneous 1519
Water 3158
Soils 8918
Greenhouse Soils 770
Plant Tissue 1343
Total 20365

Dairy Services

Maintains laboratory services for the determination of quality and composition of milk and dairy products including payment and The Atlantic Dairy Livestock Improvement Corporation (ADLIC) samples.The lab also conducts water testing for bacteria. The lab is fully accredited for all registered tests under the Standards Counsel of Canada.

For the year 2003 the Dairy Lab Processed the following Total samples:

Raw Milk 4517
Processed Milk 628
Ice Cream/Mixes 304
Sour Cream 471
Skim Milk 205
Calibration samples 463
Compositional samples 209280
Bacteria water samples 2806
Total 218674

Pathology Services

Provision of a veterinary diagnostic service throughout the operation of a veterinary pathology laboratory, which process specimens from all species of animals, and reports findings to livestock owners, to owners of companion animals, and to their veterinarians. For the year 2003 the Pathology Lab Processed the following Total samples:

Bacteriology 7985
Clinical Pathology 7715
Histology 6367
Parasitology 956
Aleutian Disease 361288
Post Mordems 800
Cremations 23
Send Outs 1121
Total 386255

Further information can be obtained from our website at:
http://www.gov.ns.ca/nsaf/programs/services.htm
Here are contained Fee Schedules, Submissions forms and fact sheets for all three sections. The site is being updated as quickly as information becomes available so check the site often.

News Flash:

Laboratory Services has received approval to purchase a new Inductively Coupled Plasma Spectrometer. This instrument will expand our elemental analysis to meet regulatory and clients protocols.

For more information please contact Mr. John K LeDue, Phone 902-893-6552, leduejk@gov.ns.ca

Upcoming events and Announcements

CSA ANNUAL MEETING

to be held in conjunction with
Canadian Societies of Animal Science and Canadian Society of Soil Science
THE SCIENCE OF CHANGING CLIMATES
Impact on Agriculture, Forestry and Wetlands
University of Alberta
Edmonton, Alberta July 20-23, 2004
For more information please see:
http://www.agronomycanada.com/events.html

2004 ASA-CSSA-SSSA International Annual Meetings

(American Society of Agronomy,
Crop Science Society of America, and
Soil Science Society of America) with the Canadian Society of Soil Science
Science to Secure Food and the Environment
Seattle, Washington - Oct 31 - Nov 4, 2004
For more information please see: http://www.asa-cssa-sssa.org/anmeet/index.html

Organic Research Field Day Organic Agriculture Centre of Canada - Nova Scotia Agricultural College

When: 1:00 PM, Thursday, July 29th
Where: Brookside Road, Bible Hill, NS
Contact: Andy Hammermeister (893-8037) or Marlene Allen (893-7256) for directions or details

The OACC is looking for your feedback on a wide range of research projects:
- flax seeding date and intercropping trial
- living mulches for cabbage and squash
- fertility management of potatoes
- potato hilling techniques
- wheat seeding rates and weed competition
- soybean finger weeding trial
- farming systems with livestock and forages
- vermicompost evaluation trial with corn and lettuce
- intercropping of barley, oats and peas.

Join us for great discussions about the challenges and opportunities for organic farming, treatment successes and failures, research needs, and tips for on-farm research. We are especially interested in hearing the ideas of producers.

The OACC field day is being held in conjunction with the Nova Scotia Agricultural College Open House beginning at 9:30 AM on July 29. Experience the sights, sounds, and tastes of the NSAC while touring the dairy barns, greenhouses, gardens and research facilities of the beautiful NSAC campus.

Agrifest

August 5-8, 2004
At Lyndhurst Farms, Canning Nova Scotia

Agrifest is taking place on a 50-acre site in Canning, Nova Scotia, August 5th to 8th 2004.
Hosted by AgraPoint
www.agrifest.com
1-866-606-4636 toll-free for tickets and info
Site Times
Thursday, August 5th 9 am - 6 pm
Friday, August 6th 10 am - 5 pm
Saturday, August 7th 10 am - 8 pm
Sunday, August 8th 10 am - 5 pm

Twilight Tours for growers and general public: Cropping Systems Research at NSAC

Hosted by the Cropping Systems Research Program

First Tour: July 27th/04 (Tue), 6:00 PM
Second Tour: August 12th/04 (Thurs), 6:00 PM.
Meeting place: Truro AgriTech Park Cropping Systems Research Centre Building.
Directions: From Main Street in Truro take Pictou Road. After the RCMP station go left into Innovation Road. At the first stop sign go right into Research Drive, the Cropping Systems Research Centre Building is at the end of Research drive.

Agenda for both tours:
6:00 PM Welcome by Dr. Valtcho Jeliazkov. Coffee, cookies, and cold drinks.
6:00-6:10 Cropping Systems Research Building and the new equipment and machinery purchased

with the CFI (Canadian Foundation for Innovation) Fund.
6:15–6:35 Field 206: Development of profitable and sustainable cash-cropping systems for the Maritimes. I. Responses of Cash Cropping Based Systems to Tillage (conventional vs no-till), and Nitrogen
6:40- 7:00 Field 400A: Effect of ecolo-till and liquid manure application to N and P use efficiency and leaching under no-till system
7:00-7:20 Field 400: Crop performance, soil conservation, and nutrient efficiency in a no-till grain/forage based rotation
7:30-7:55 Field 306: Dykeland projects
1.Soil Conservation and Crop Productivity of Dykeland Cropping Systems. I. Municipal Solid Waste compost, Sewage Sludge compost, and solid manure effects on forage. 2. Manure application to timothy and red clover in a dykeland.
8:10-8:30 Nova Scotia Agricultural College, Cox building Room 14.
Demonstration on the new Scanning Electron Microscope (SEM) and the Energy Dispersive X-ray (EDX) microanalyzer.
8:30-8:50 – NSAC Cox Greenhouses. Container experiments with Sewage Sludge Compost and solid manure: nutrient availability and effects on agricultural crops.

Everyone is welcome
For more information please contact the Cropping Systems Research Program at NSAC at (902) 893 4767, or Dr. Valtcho Jeliazkov at NSAC: Ph: (902) 893 7859, Fax: (902) 897 9762, e-mail:vjeliazkov@nsac.ns.ca

National Network on Farming Systems Research and New Technology Development

We would like to establish a National Network on Farming Systems Research and New Technology Development. Our idea for a National Network was based at least in part on the success achieved by the Organic Agriculture Centre of Canada based at the NSAC in Truro, NS, and also inspired by the success of the Farming Systems Research group at the University of Guelph. The objectives of such a National Network will be to promote sustainable agriculture, to link agricultural and environmental research (to link farming and the environment), to stimulate the application of multidisciplinary systems approach in agricultural research.

As a first step towards a national network we would like to establish a listserve and initiate discussion on the way to go. If you would like to be included in the listserv, please contact Glen Filson at the University of Guelph: gfilson@oac.uoguelph.ca or Valtcho Jeliazkov at NSAC: vjeliazkov@nsac.ns.ca.

CFI project brings the first Electron Microscope at the NSAC campus

Canada Foundation for Innovation (CFI) Project Summary
Project Title: **Expanding Infrastructure Capabilities of the Cropping Systems Research Program at the Nova Scotia Agricultural College**
Project Leader: Dr. Valtcho Jeliazkov (Zheljazkov)
CFI Funding: $132,562 (Under the New Opportunities Fund)
Nova Scotia Research Innovation Trust (NSRIT) Funding: $132,562
Total Project Cost: $370,461

Project Summary:

The CFI and NSRIT funding was used to purchase a Hitachi S-3000N Variable Pressure Scanning Electron Microscope (SEM) coupled to Oxford INCA Energy 350 Energy Dispersive x-ray Spectrometry (EDX) system. The SEM/EDX system will be used to enhance Dr. Valtcho Jeliazkov's Cropping Systems Research Program, other users research programs, and will be used for training of graduate students and other highly-qualified personnel. The mandate of Dr. Jeliazkov's program is to improve agronomic, economic and environmental sustainability of major cropping systems in Atlantic Canada. This is the only such program in the four Atlantic Provinces and the largest in Canada. The infrastructure will allow researchers to conduct a wide variety of research projects. More specifically, it will be used immediately by Dr. Jeliazkov in the following types of studies:

- Studies aimed at understanding plant-soil relationships, movement of nutrients and trace elements in the manure-soil-plant system and compost-soil-plant systems

- Studies investigating nutrient management and tillage practices and their affect on soil quality, amd mycorrhizal associations in major field crops in Atlantic Canada; understand the role of mycorrhizae in nutrient uptake

- Studies within the project "Introduction, Environmental and Economic Evaluation of Aromatic and Medicinal Crops". This research project will identify new low-volume high-cash crops, and evaluate ecological and economic feasibility for growing of these new crops in the region. The potential for growing crops for essential oils and other secondary metabolites production will be assessed. The SEM/EDX will be used for detailed studies on secretory structures of Aromatic and Medicinal Crops as a function of agricultural practices and the environment. The results from this and similar projects may: (a) improve the economic performance of cropping systems by fitting new cash crops into existing rotations; (b) increase opportunities for development of new products (such as nutraceuticals, aromatherapy products, plant extracts), for domestic and international market, and for value-added processing; (c) enhance the prospects for developing of local small-scale industry based on the products from the new crops: essential oils and various bioactive substances that have wide application as flavouring and fragrance agents, as active substances in perfumery and cosmetics, in health products, in nutraceuticals and functional foods, in herbal remedies, in herbal tea preparations.

- Studies on the remediation of lead (Pb)-polluted soils in Nova Scotia. This research aims at developing patentable technology for clean-up of Pb-polluted agricultural soils as well as a remediation technology for highly heavy metal polluted sites. The applications of suggested approaches will reduce Pb availability to plants and thus toxic metal contamination of plant produce. The infrastructure is essential for studying heavy metal mobility in soil following the application of various amendments, and to estimate movement of pollutants in the soil-plant system.

- Studies on remediation of phosphorus (P) enriched soils in NS. P management and excess of P in agricultural soils may become a national issue with respect to sustainability of agriculture and water quality. The SEM/EDX systems will be used to study P-enriched soils following various agricultural practices as well as mobility of P in soil/mycorrhizae/plant system.

The data collected will help to 'fine-tune' existing agricultural systems, to develop new crops and cropping systems, to improve environmental and economic sustainability and profitability of farming and reduce the negative effect of some agricultural practices on the environment in Atlantic Canada. It is hoped, that the SEM/EDX system will facilitate new product and technology development at NSAC and in the region.