CANADIAN PHYTOPATHOLOGICAL SOCIETY

MARITIME REGION MEETING 2011

Potato Research Centre, AAFC, 850 Lincoln Road, Fredericton, New Brunswick

November 24, 2011

Canadian Phytopathological Society

Maritime Region Meeting
November 24 2011
Potato Research Centre – Agriculture and Agri-Food Canada
Fredericton, NB

INTRODUCTION

Welcome to Fredericton and to the 2011 Canadian Phytopathological Society Maritime Region Meeting. It has been a full year since we got together as a group, and I look forward to a stimulating afternoon of scientific discussion and fellowship.

There are 9 oral presentations, which includes our keynote presentation, on various topics in phytopathology scheduled for the afternoon. A dinner will take place in downtown Fredericton following the meeting.

I am pleased and honoured to welcome Dr. Khalil Al-Mughrabi, a research scientist at the Potato Development Centre, New Brunswick Department of Agriculture, Aquaculture and Fisheries, as our keynote speaker. Dr. Al-Mughrabi will update us on the Canadian Late Blight Working Group which he is chairing.

Many thanks to all who attended the meeting. I would particularly like to thank Dr. Xianzhou Nie, Potato Research Centre, Agriculture and Agri-Food Canada, and his colleagues for hosting this year's meeting and taking on the responsibilities of organizing the meeting, scheduling the presentations and preparing the book of abstracts. I would also like to thank the Canadian Phytopathological Society, represented by president Mary Ruth McDonald, for sponsoring this event. I trust we will be able to get together on a regular basis in future, and on that note, we will host the 2012 meetings in Kentville, NS.

This booklet contains abstracts of the oral presentations in the order that they were presented. All abstracts will subsequently be published in an upcoming edition of the Canadian Journal of Plant Pathology. The research work represented by these papers forms an important part of the on-going development of phytopathological research in the Maritimes.

Rick D. Peters
Maritime Region Rep
Canadian Phytopathological Society

The Canadian Phytopathological Society Maritime Region Meeting 2011

Thursday, 24 November 2011
Conference Room, Potato Research Centre-Agriculture and Agri-Food Canada
Fredericton, NB

13:00-13:10 **Introduction/Welcome:**
Rick D. Peters, CPS representative – Maritime region
Dr. Benoit Bizimungu, Acting Research Manager, PRC, AAFC

13:10-14:00 **Keynote Speaker: Khalil I. Al-Mughrabi,** Potato Development Centre, New Brunswick Department of Agriculture, Aquaculture and Fisheries, 39 Barker Lane, Wicklow, New Brunswick, Canada E7L 3S4

Canadian National Late Blight Working Group

14:00-14:15 **Late blight suppression in Confine™ treated potatoes achieved by fungicide's translocation to leaves and tubers - growth chamber and field experiments.** G. Wang-Pruski*, T. Borza, A. Schofield, M. Hickey, J. Rand, Z. Ganga, R.D. Peters, J. Coffin and R. Coffin

14:15-14:30 **Late blight fungicide Confine™ triggers broad changes in gene expression in potatoes.** T. Borza*, G. Simpson, R.D. Peters, Z. Ganga and G. Wang-Pruski

14:30-14:45 **PEI Plant Disease Diagnostic Service**. M.M. Clark* and A. Driscoll

14:45-15:00 **Interception of potato pests in imported microplants at the Canadian Food Inspection Agency Potato Post Entry Quarantine program during the past 10 years.** H. Xu*

15:00-15:30 Nutrition Break

15:30-15:45 **Detection of *Ralstonia solanacearum* race 3 biovar 2 in potato.** X. Li*, J. Nie and S.H. De Boer

15:45-16:00 **Prediction of *Potato virus Y* incidence in post-harvest tubers based on pre-harvest tuber tests using real-time RT-PCR.** M.S. Fageria*, M. Singh, U. Nanayakkara, Y. Pelletier and X. Nie

16:00 -16:15 **White mold, caused by *Sclerotinia sclerotiorum*: an emerging disease in potato production in Prince Edward Island.** R.D. Peters*, K.A. Drake, A. MacPhail and C.J. Banks

16:15 -16:30 **Efficacy of selected fungicides, plant by-products, and soil amendments against powdery scab of potatoes.** K.I. Al-Mughrabi, K. Jayasuriya* and R. Poirier

16:30-16:40 Wrap-up

18:00 Dinner (to be determined)

Note to presenters: please ensure that your presentation is given to the audio/visual coordinator 30 min prior to the start of the meeting.

Keynote 13:10-14:00

Canadian National Late Blight Working Group

Khalil I. Al-Mughrabi

Potato Development Centre, New Brunswick Department of Agriculture, Aquaculture and Fisheries, 39 Barker Lane, Wicklow, New Brunswick, Canada E7L 3S4

The National Late Blight Working Group was established by the Potato Committee Executive (now the Canadian Potato Council) of the Canadian Horticultural Council (CHC) in 2009 to serve on behalf of the national industry in a consultative role with the potato research community in Canada and around the world to reduce the impact of late blight on potato production while obtaining a greater understanding of the disease. The role of the working group was to establish a national late blight research program, a national late blight strain identification program, a national late blight extension program, and a national potato website. Two research projects have been funded through the CHC Agri-Science Cluster for Horticulture program. These include assessing the efficacy of new fungicides and fungicide combinations for control of late blight; and function of phosphorous acid related compounds on suppression of late blight in potatoes. Some funding has been secured through Agriculture and Agri-Food Canada, University of Manitoba, and the private industry to conduct the national survey to characterize strains of *Phytophthora infestans* causing late blight of potato and tomato in Canada. A dramatic increase in the incidence of late blight and changes within populations of *P. infestans* were observed recently in Canada. The occurrence of several new genotypes with associated phenotypes that dominated pathogen populations in various regions has also been documented. The working group shares information on late blight occurrences in Canada and the USA on a regular basis throughout the growing season. Changes in late blight populations in Canada are closely monitored and such information is shared with representatives from all provinces. A PowerPoint presentation and a comprehensive fact sheet on the management of late blight of potatoes were created and uploaded to the CHC website. The working group is currently compiling historical data and research summaries on late blight in Canada; and preparing a list of potato professionals across Canada and their contact information. Once complete, the documents will be uploaded to the CHC website. This working group is the first national group for late blight in Canada and has proven to be very useful.

Late blight suppression in Confine™ treated potatoes achieved by fungicide's translocation to leaves and tubers - growth chamber and field experiments.

G. Wang-Pruski*, T. Borza, A. Schofield, M. Hickey, J. Rand, Z. Ganga, R.D. Peters, J. Coffin and R. Coffin

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The suppressing effects of phosphite-based fungicides on a variety of pathogens, including the oomycetes *Phytophthora infestans* (late blight causing agent) and *P. erythroseptica* (pink rot causing agent), are well documented. However, less is known about essential aspects such as the rate of phosphite translocation, the optimum concentration in plants necessary to obtain maximum protection against pathogens, and the timing of applications. In order to address some of these questions, we investigated the suppressing effects of the phosphite-based fungicide Confine™ on potato late blight disease. Field and growth chamber experiments followed by phosphite analysis by ion chromatography demonstrated that Confine™ is readily translocated when applied as a foliar spray; and detectable amounts of phosphite accumulated in both leaves and tubers. Whole plant infection and detached leaf experiments indicated a strong positive correlation between the build-up of phosphite by plants and increased resistance to late blight infection. The amount of phosphite translocated into tubers during the growth season had no negative influence on seed germination and overall plant growth. Tubers originating from plants treated with Confine™ showed less susceptibility to late blight infection; however, the additional postharvest treatment on tubers when being placed into storage may still be necessary to maximize the resistance to late blight.

Late blight fungicide Confine™ triggers broad changes in gene expression in potatoes.

T. Borza*, G. Simpson, R.D. Peters, Z. Ganga and G. Wang-Pruski

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Phosphites represent a class of reduced-risk fungicides that are effective in suppressing the development of late blight (*Phytophthora infestans*), a major disease of cultivated potato (*Solanum tuberosum*). The toxic effect of phosphites to *P. infestans* is well-documented; however, it is not clear if phosphites suppress *P. infestans* development directly or indirectly, by activating specific plant defence mechanisms. In order to further investigate the molecular mechanisms by which phosphites enhance the resistance of potatoes to *P. infestans* infection, the expression pattern of 15 potato genes involved in carbohydrate metabolism, energy production and plant defence mechanisms was analysed using quantitative RT-PCR. The experiment employed Confine™, a mono- and di-potassium salt formulation of phosphorous acid (Winfield Solutions, LLC, St. Paul, MN). Leaf samples of Confine-treated (sprayed with 1% Confine) and untreated (control) potato plants were collected 30 min, 2 h, 6 h, 24 h and 48 h and 10 days after the treatment. Quantitative RT-PCR analyses indicated that most of the genes analysed were up-regulated upon Confine treatment and the strongest induction was generally evident at 24 h after treatment. Ten days after Confine treatment, the expression level of almost all genes analysed regressed to the pre-treatment levels. Ten days after the Confine treatment, untreated and treated plants were inoculated with *P. infestans* at the rate of 10^5 sporangia/plant and the severity of disease was monitored during a four-week period. Four weeks after the inoculation, the percentage of foliar infection in untreated plants was >95% while in Confine-treated plants it was <20%.

PEI Plant Disease Diagnostic Service

M.M. Clark and A. Driscoll

PEI Department of Agriculture, Kensington Potato Services, 7 Gerald A. McCarville Dr. PE, C0B 1M0

The Plant Disease Diagnostic Service provides farmers and agri-businesses with a disease identification and control advisory service. The laboratory handles all commercial crops with the majority of the samples being potatoes. During the 2011 growing season, abnormal climatic conditions contributed to the development of bacterial infections in the potato crop. Episodic high intensity rainfall coupled with warmer than normal September temperatures contributed to the development of seed piece decay and tuber rots. Potato tuber diseases such as pinkeye, pink rot and late blight developed later in the potato growing season. A new disease in PEI corn was confirmed this season by Xiaoyang Zhu, a Biologist of Corn Pathology and Breeding with Agriculture and Agri-Food Canada in Ottawa, Canada. Northern Leaf Blight is a corn disease caused by the fungal pathogen, *Setosphaeria turcica* (Luttrell). Symptoms include elliptical, grayish-brown lesions appearing first on the lower leaves. The fungus survives in corn residue and is spread by wind or rain. Disease development is induced by warm temperatures (18-27 C or 64-77 F) and wet periods. An infection results in reduced yields, small kernels, and an overall loss in crop quality.

Interception of potato pests in imported microplants at the Canadian Food Inspection Agency Potato Post Entry Quarantine program during the past 10 years.

H. Xu

Canadian Food Inspection Agency, Charlottetown Laboratory, 93 Mt. Edward Rd., Charlottetown, PE, Canada, C1A 5T1

Small quantities of *Solanum* germplasm can be introduced into Canada, as tissue culture microplants and tubers for vegetative propagation. Potato germplasm approved for entry under an import permit must be subjected to a process of quarantine testing in the Potato Post Entry Quarantine (PPEQ) program at the Charlottetown Laboratory of the Canadian Food Inspection Agency. Over the past 10 years (2000-2010), 328 accessions of potato germplasm were imported and tested under the PPEQ program. Approximately 80% of the accessions were imported from only five countries, the Netherlands (51.22%), United Kindom (15.24%), Chile (6.7%), France (4.88%) and South Korea (3.05%) and the other 20% of the accessions were from 10 other countries. Over 85% of the imported potato germplasm accessions were from eight European countries. The entire quarantine testing scheme for this program consists of three testing streams, pre-greenhouse testing of microplants, testing mother plants grown out in the greenhouse, and pre-release testing of microplants. The complete process of quarantine testing takes over 6 months. In the past 10 years, 33 of the 328 applications (10.1%) were rejected due to the detection of potato pests during quarantine testing. Of the 33 rejected import applications, 60% and 30% were due to the detection of bacteria and viruses, respectively. Fungi and *Potato spindle tuber viroid* were also detected in some accessions. Most of the viruses detected were characterized and identified and many of them are regulated or quarantine pests listed in Canada. The interception of these harmful or destructive pathogens of potatoes by the PPEQ program prevented the introduction of foreign potato pests into Canada.

Detection of *Ralstonia solanacearum* race 3 biovar 2 in potato.

X. Li*, J. Nie and S.H. De Boer

Canadian Food Inspection Agency, Charlottetown Laboratory, Charlottetown, PE, C1A 5T1.

Introduction of the potato brown rot pathogen, *R. solanacearum* biovar 2 (race 3), is considered to be a major threat to the potato industries in temperate regions like Canada and the USA. Numerous methods have been developed for detection of this pathogen, some of which have been used in combination as routine methods in post-entry quarantine testing programs. However, the detection limit for each of the methods is largely unknown but is required information to design the most economic and effective methods and protocols for detection of the bacterium. In this study, we evaluated the sensitivity and specificity of nine protocols for assaying the presence of *R. solanacearum* biovar 2 (race 3) strains. The Bio-Taqman assay with internal control had several advantages over other protocols, and detected three *R. solanacearum* biovar 2 (race 3) strains pre-inoculated into potato sap samples at a sensitivity of 10^2 CFU/ml. The assay did not cross-react with other biovar strains tested. The negative effect of PCR inhibitors was eliminated in this assay. The serological assays tested, ELISA and immuno-lateral flow devices (immuno-LFD), were highly efficient for confirming the identity of *R. solanacearum* strains to species level, but could not be used to differentiate *R. solanacearum* biovar 2 (race 3) from biovars 1 and 3. The detection sensitivity of serological assays, determined using five *R. solanacearum* strains spiked potato sap samples, was 10^4-10^6 CFU/ml. The best strategy for monitoring the presence of *R. solanacearum* biovar 2 (race 3) was a combination of molecular and serological tests.

Prediction of *Potato virus Y* incidence in post-harvest tubers based on pre-harvest tuber tests using real-time RT-PCR

M.S. Fageria[1]*, M. Singh[1], U. Nanayakkara[2], Y. Pelletier[2] and X. Nie[2].

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PVY incidence was compared in pre- and post-harvest tuber testing in 11 potato fields in New Brunswick with cultivars Adirondack Red, Calwhite, Goldrush, Innovator, Russet Burbank and Shepody during 2009 and 2010. One hundred randomly selected plants from each field were tested for PVY using real-time RT-PCR. Pre-harvest tubers were tested for PVY in week of August 17th and post-harvest tubers at the end of the growing season (week of September 6th). In all the fields, the PVY incidence was higher in post-harvest tubers than pre-harvest tubers. The PVY incidence in pre-harvest tubers ranged from 1% (Innovator field no. 1) to 21% (Shepody field no. 2) in 2009 and 2% (Adirondack Red) to 30% (Goldrush field no. 2) in 2010. However, in post-harvest tubers conducted the week of September 6th PVY incidence ranged from 2% (Adirondack Red) to 37% (Shepody field no. 1) in 2009 and 5% (Calwhite field no. 1) to 39% (Goldrush field no. 2) in 2010. In all the fields, the post-harvest tuber tests showed higher PVY incidence than pre-harvest tuber tests. However, there was a high correlation (r) between pre- and post-harvest tuber tests, i.e., 0.839, and 0.802 in 2009 and 2010, respectively. This data suggests that on the basis of pre-harvest tuber testing, decisions can be made about whether to use top-kill where the virus threshold is required for post-harvest testing. For instance, if a field shows 3% PVY incidence at the time of pre-harvest tuber testing means this field may not show PVY incidence < 3% at the time of post-harvest testing. The pre-harvest test can be conducted 20-30 days before the final harvesting of tubers.

White mold, caused by *Sclerotinia sclerotiorum*: an emerging disease in potato production in Prince Edward Island.

R.D. Peters*, K.A. Drake, A. MacPhail and C.J. Banks

Agriculture and Agri-Food Canada, Crops and Livestock Research Centre, 440 University Ave., Charlottetown, PE C1A 4N6, Canada.

The fungus *Sclerotinia sclerotiorum* (Lib.) de Bary is a pathogen of over 400 different plant species. In potato (*Solanum tuberosum* L.), the pathogen infects senescing leaves or blossoms via ascospores dispersed by wind and rain. Infected blossoms lodge in the canopy and initiate stem lesions which can girdle the stem leading to plant wilting and premature senescence. In some parts of North America, particularly potato production regions using high fertility and irrigation, white mold can cause significant yield losses. However, in Canada, the incidence of white mold in potato is sporadic and the disease is rarely targeted for management by growers. In 2011, a very wet summer contributed to a high incidence of white mold in potatoes grown for tablestock in eastern Prince Edward Island. In some cultivars, up to 90% of the stems in certain fields were infected and harboured the black sclerotia of the fungus observed when stems were cracked open to reveal the pith. Affected fields senesced earlier than healthy fields resulting in reduced tuber yields. Two applications of fluazinam, one at 90% crop flowering and a second 1-2 weeks later, significantly reduced stem infection by 50-60%. More research is needed on the impact of white mold on potato production in Canada and potential disease control alternatives.

Efficacy of selected fungicides, plant by-products, and soil amendments against powdery scab of potatoes.

K.I. Al-Mughrabi, K. Jayasuriya* and R. Poirier

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Powdery scab, caused by *Spongospora subterranea* f. sp. *subterranea*, is a challenge in almost all potato growing regions in the world which leads to significant reduction in marketable yield. Powdery scab lesions on tubers downgrade quality of seed, fresh or processing potatoes. Two field trials were conducted in 2010 and 2011 in a powdery scab infested potato field in New Denmark, New Brunswick, Canada to assess the efficacy of various products. Disease-free 'CalWhite' seed potatoes were used in 2010 and treatments included: [1] Control; [2] fluazinam (25 g/100 kg seed); [3] fluazinam (50 g/100 kg seed); [4] fludioxonil (2.5 g/100 kg seed); [5] mancozeb (40 g/100 kg seed); [6] fluazinam (2 kg ha^{-1}; in-furrow); [7] fluazinam (4 kg ha^{-1}; in-furrow); [8] mancozeb (7.5 kg ha^{-1}; in-furrow); [9] mancozeb (15 kg ha^{-1}; in-furrow); [10] cyazofamid (1.86 kg ha^{-1}; in-furrow); [11] sulfur (168 kg ha^{-1}; soil); [12] boron (2.8 kg ha^{-1}; soil); [13] ammonium nitrate (168 kg ha^{-1}; soil); and [14] mustard meal (1064 kg ha^{-1}; soil). Treatments had no significant effect on plant emergence or vigor. Fluazinam (1× and 2×), mancozeb (1×) or cyazofamid applied in-furrow significantly reduced disease incidence and severity and increased marketable yield by 22.1%, 26.5%, 41.6% and 30.5%, respectively. Boron soil amendment significantly reduced the disease incidence by 66.9% and increased marketable yield by 23.9%. The trial was repeated in the same field in 2011 using disease-free seed of two potato cultivars (CalWhite and Red Lasoda) and the following treatments: [1] Control; [2] fluazinam (25 g/100 kg seed); [3] mancozeb (40 g/100 kg seed); [4] fluazinam (2 kg ha^{-1}; in-furrow); [5] mancozeb (7.5 kg ha^{-1}; in-furrow); [6] cyazofamid (1.86 kg ha^{-1}; in-furrow); [7] sulfur (168 kg ha^{-1}; soil); [8] boron (2.8 kg ha^{-1}; soil); and [9] mustard meal (1064 kg ha^{-1}; soil). For the potato cultivar CalWhite, fluazinam applied at 2 kg ha^{-1}, mancozeb at 7.5 kg ha^{-1}, and cyazofamid at 1.86 kg ha^{-1} significantly reduced powdery scab incidence and increased marketable yield by 75.5%, 57.0%, 65.9%, respectively. For Red Lasoda, in-furrow treatment with fluazinam or mancozeb significantly reduced disease incidence and increased marketable yield by 109% and 150%, respectively. In-furrow application of cyazofamid significantly increased marketable yield by 86.5% due to significant reduction in disease severity. Addition of boron significantly suppressed the disease in both cultivars and increased marketable yield. The results of this 2 year study suggest that in-furrow application of fluazinam, mancozeb or cyazofamid in *S. subterranea* infested fields can significantly suppress powdery scab incidence and increase marketable yield. Soil amendment with boron can be a potential alternative for fungicides.

Appendix

Participants of CPS Maritime Region Meeting 2011

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