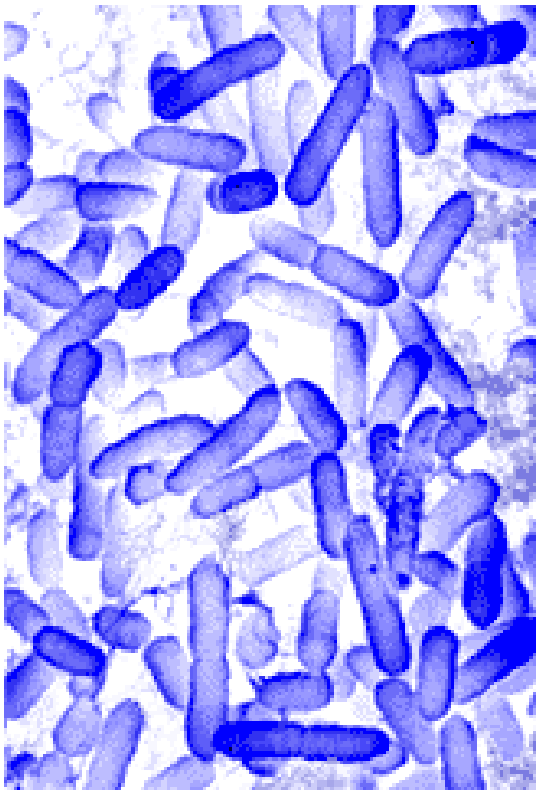
CANADIAN PHYTOPATHOLOGICAL SOCIETY

MARITIME REGION MEETING 2007



Crops and Livestock Research Centre,
Agriculture and Agri-Food Canada,
Charlottetown, Prince Edward Island

November 29, 2007

Canadian Phytopathological Society
Maritime Region Meeting
November 29, 2007
Crops and Livestock Research Centre, Charlottetown, PE

INTRODUCTION

Welcome to Charlottetown and to the 2007 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 11 oral presentations and two poster presentations on various topics in phytopathology scheduled for the afternoon. A dinner and presentations will take place at Outriders Pub following the meeting.

I am pleased and honoured to welcome Dr. Tony Sturz (Strategic Planning Specialist, Executive Council Office, Government of Prince Edward Island) as our keynote speaker. Dr. Sturz is renowned for his work on bacterial endophytes and their involvement in disease suppression. His presentation is entitled: "**Bacterial root zone communities, endophytes, beneficial allelopathies and plant disease control.**"

I am also pleased to welcome Dr. Jim Menzies, current president of CPS, and would like to thank him for taking the time to attend our regional meeting. Maintaining this connection with our national society is an important aspect of our own development as a regional group.

Many thanks to all who attended the meeting. I would also like to thank the Canadian Phytopathological Society, represented by president Jim Menzies, for sponsoring this event. I trust we will be able to get together on a regular basis in future, and on that note, the 2008 meetings will be held in Fredericton, NB. Dr. Xianzhou Nie of Agriculture and Agri-Food Canada, Potato Research Centre has graciously agreed to host the meeting in 2008.

This booklet contains abstracts of the oral and poster 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

Canadian Phytopathological Society - Maritime Regional Meeting 2007
Scientific Program

Thursday, 29 November 2007
Conference Rooms A/B, Crops and Livestock Research Centre

13:00-13:10 **Welcome and Introduction:** Rick D. Peters, CPS Representative - Maritime region

13:10-13:20 **Welcome to AAFC Charlottetown**: Dr. Manon Proulx - Research Manager

13:20-13:30 **Greetings from CPS**: Dr. Jim Menzies - CPS President

13:30-14:15 **Keynote Speaker: Dr. Tony Sturz**, Strategic Planning Specialist, Executive Council Office, Government of Prince Edward Island
"Bacterial root zone communities, endophytes, beneficial allelopathies and plant disease control"

Session A: Pathogen Detection

14:15-14:30 Detection of *Phytophthora erythroseptica* from soils using a baiting technique combined with conventional and real-time PCR. U.N. Nanayakkara*, M. Singh, K. Al-Mughrabi and R.D. Peters.

14:30-14:45 Molecular detection and identification of tobacco veinal necrosis and potato tuber necrosis strains of *Potato virus Y* in tobacco samples. H. Xu*.

14:45-15:00 Evaluation of a multiplex TaqMan PCR assay for detection and differentiation of *Globodera pallida* and *G. rostochiensis*. M. Madani*, L.Ward and S.H. De Boer.

15:00-15:15 Development of universal primers for detection of potato carlaviruses by RT-PCR. X. Nie*, Y. Bai, T.A. Molen, and D.C. Desjardins.

15:15-15:30 Are bacteria the causal agent of the zebra chip disease of potato? X. Li*, S.H. De Boer, G. Secor, J. Gourley, P. Ross, V. Rivera, and J. Rengifo.

15:30-16:00 **Nutrition Break and Poster Session**

Ribosomal RNA gene sequence polymorphism in the same genome is common among phytopathogenic enterobacteria. H. M. Sun, X. Li*, L. Ward, and S.H. De Boer.

An internal reaction control for use in a TaqMan PCR test for *Ralstonia solanacearum* race 3 (biovar 2). D.S. Smith* and S.H. De Boer.

Session B: Disease Management

16:00-16:15 Effect of different foliar fungicides on the development of lesions caused by *Alternaria solani* (early blight) and *Alternaria alternata* (brown spot) on potato foliage. S. Veenhuis-MacNeill*, R. Coffin, R.D. Peters, G. Wang-Pruski, H.W. Platt, R. Pitblato, T. Hamill, M. Maynard.

16:15-16:30 Use of salicylic acid as a tool in controlling black scurf (*Rhizoctonia solani*) disease in potatoes. K.I. Al-Mughrabi and A. Vikram*.

16:30-16:45 Compost effects on apple replant disease. G. Braun* and K. Fuller.

16:45-17:00 Evaluations of in-furrow products on development of scab lesions on potato tubers. R. Coffin*, S. Veenhuis-MacNeill, C. Goyer, M. Filion, S. Watts, T. Hamill, and M. Maynard.

17:00-17:15 Managing potato diseases caused by *Fusarium* spp. in the Maritimes. R.D. Peters*, K.A. Seifert, H.W. Platt, K.A. Drake, I.K. Macdonald, S. MacInnis, R.H. Coffin, M.M. Clark, S. Moorehead and K.I. Al-Mughrabi.

17:15-17:30 **Wrap-up**

18:30 **Dinner – Outriders Pub**

Note to presenters; Please ensure that your presentation is given to the audio/visual co-ordinator at least 1 hour prior to the start of the session

Keynote Address
13:30-14:15

Bacterial root zone communities, endophytes, beneficial allelopathies and plant disease control. A.V. Sturz*. *Executive Council Office, Government of Prince Edward Island, 95-105 Rochford St., Charlottetown, PE C1A 7N8 Canada.*

The release of root exudates from plants encourages the formation of beneficial bacterial communities within and around root systems. These bacterial communities produce secondary metabolites that can improve plant health and crop yield. Certain of these metabolites have antibiotic or lytic properties, while others induce systemic disease resistance in the host plant, or interfere with the nutritional requirements of phytopathogens. Man-made attempts at applying bacteria for biocontrol purposes have met with limited success. Crop management systems used to distort agro-ecosystems through, for example, the use of tillage operations, alternate cropping systems, monoculture, crop rotation length, fertilizer and organic amendments, and various crop protection chemistries, will stimulate disease suppression and disease suppressive bacterial communities. However, the direct management of soil microbial communities for consistent disease control appears to be elusive.

Session A: Pathogen Detection
14:15-14:30

Detection of *Phytophthora erythroseptica* from soils using a baiting technique combined with conventional and real-time PCR. U.N. Nanayakkara*, M. Singh, K. Al-Mughrabi and R.D. Peters. *Agricultural Certification Services, Fredericton, NB; (K.A-M.) New Brunswick Department of Agriculture and Aquaculture, Wicklow, NB; (R.D.P.) Agriculture and Agri-Food Canada, Charlottetown, PE.*

Pink rot of potato caused by *Phytophthora erythroseptica* is an important storage disease in the maritime region of Canada. As all natural inoculum sources of *P. erythroseptica* (zoospores, sporangia and oospores) can be found in soil, soilborne detection of the pathogen is important for disease management decisions. Extraction of target DNA and purification from soil samples is often labor-intensive due to contaminants. Baiting techniques combined with molecular diagnostic methods have been successfully utilized in soilborne detection of several pathogens. Hairy nightshade (*Solanum sarrachoides*) is a known weed host of *P. erythroseptica*. A baiting technique was developed with hairy nightshade seedlings and leaves. One-to-two week old nightshade seedlings were suspended on styrofoam beads and incubated in zoospore suspensions or flooded soils in a growth cabinet set to 18◦C with an 18 hour photoperiod. Young nightshade leaves were also floated in zoospore suspensions and flooded soils under the same conditions. Nightshade seedlings and leaves incubated in zoospore suspensions and infested soils developed water soaked spots and yellowing, followed by wilting within 7 days. However, DNA extracted from seedlings or leaves generated a 136 bp product in conventional PCR assay after only 5 days of incubation. Detection was also confirmed by real-time PCR assay. This method will allow the detection of *P. erythroseptica* in soil without the need for direct extraction. Results from several experiments will be discussed.

Session A: Pathogen Detection
14:30-14:45

Molecular detection and identification of tobacco veinal necrosis and potato tuber necrosis strains of *Potato virus Y* in tobacco samples. H. Xu*. *Canadian Food Inspection Agency, Charlottetown Laboratory, 93 Mount Edward Road, Charlottetown, PE, C1A 5T1.*

Potato virus Y (PVY) isolates are classified into several strain groups, such as the common strain (PVY^{O}), tobacco veinal necrosis strain (PVY^{N}) including isolates that can cause potato tuber necrotic ringspot disease (PVY^{NTN}) and stipple streak strain (PVY^{C}), on the basis of phenotypic reactions in differential potato cultivars carrying specific resistance genes. Most PVY strains can infect tobacco plants and cause vein clearing followed by leaf mottling except PVY^{N} isolates that induce severe necrotic symptoms on tobacco stems and leaves. PVY^{NTN} can also cause tobacco leaf and stem necrosis under greenhouse conditions. To date PVY^{NTN} has not been detected in tobacco fields. Molecular procedures were developed in this study for detecting and identifying PVY strain types in tobacco samples. Reliable detection of PVY RNA was achieved by RT-PCR, multiplex RT-PCR and real-time RT-PCR using primers specific to the 5' and 3' regions of the PVY genome of different PVY strains. RFLP was introduced to verify PCR amplicon identity and differentiate PVY strain types. PVY isolates were collected from a tobacco field and amplicons were produced from these samples in RT-PCR by primer sets specific to both PVY^{N} and PVY^{NTN} isolates. Further RFLP and sequence analysis indicated that tobacco PVY isolates, PVY-204 and PVY-205, were PVY^{NTN}-like viruses. Phylogenetic analysis based on the amino acid and nucleotide sequences of both P1 protein and NIb genes showed that PVY-204 and PVY-205 were closely related to PVY^{NTN} isolates detected in many European counties and Mexico but significantly different from many other North American PVY^{NTN} isolates.

Session A: Pathogen Detection
14:45-15:00

Evaluation of a multiplex TaqMan PCR assay for detection and differentiation of *Globodera pallida* and *G. rostochiensis*. M. Madani*, L.Ward and S.H. De Boer. *Canadian Food Inspection Agency, 93 Mount Edward Rd., Charlottetown, PE, C1A 5T1 Canada.*

The most important species of the genus *Globodera* are the potato cyst nematodes (PCN), *G. rostochiensis* and *G. pallida*, found in many potato growing areas. In Canada one or both PCN species occur in restricted areas of Newfoundland, Vancouver Island and Quebec. Because effective integrated pest management relies on correct identification of target nematodes, both real-time TaqMan and EvaGreen-based PCR assays were developed for simultaneous detection and identification of these species. Several putative primer pairs and species-specific probes were designed from the internal transcribed spacer (ITS) sequenced in this study. Using two different probes to *G. pallida* and *G. rostochiensis*, labeled with Cy3 and Cy5 fluorescent dyes, respectively, we could specifically and independently detect both species by a multiplex PCR assay in a single reaction tube to a sensitivity of 1/50 of a single nematode target. We could also detect and identify to species PCN using DNA extracted directly from soil and plant screenings retained on 60 mesh sieves conventionally used to extract cysts from field soil. Melting curve analysis of a 231 bp amplicon from the ITS 1 region generated by real-time PCR in the presence of EvaGreen revealed the presence of a single peak for each species. Melting temperature for amplicons were 87±0.05C° and 92±0.05°C for *G. pallida* and *G. rostochiensis*, respectively, and 90±0.05°C for a hybrid fragment that amplified when both species occurred in the sample.

Session A: Pathogen Detection
15:00-15:15

Development of universal primers for detection of potato carlaviruses by RT-PCR.
X. Nie*, Y. Bai, T.A. Molen, and D.C. Desjardins. *Potato Research Centre, Agriculture and Agri-Food Canada, P.O. Box 20280, 850 Lincoln Road, Fredericton, NB, Canada E3B 4Z7.*

Five potato viruses, namely *Potato virus S* (PVS), *Potato virus M* (PVM), *Potato latent virus* (PotLV), *Potato virus P* (PVP) and *Potato rough dwarf virus* (PRDV) are recognized as members or tentative members of the genus *Carlavirus*, *Flexiviridae*, to date. To facilitate efficient and accurate detection of these viruses in potato, degenerated universal primers were designed based on the conserved amino acid and nucleotide sequences. Two sense primers, i.e, Car-F1 and Car-F2 were designed based on the amino acid sequences "SNNMA" and "GLGVPTE", respectively, in the coat protein. The reverse primer, Car-R, which was located at the bordering region of the nucleic acid binding protein gene and the 3'untranslated region, was selected. In addition, a reverse primer, dT-B, which was derived from the oligo-dT targeting the poly(A) tail, was also used. Successful application of fragments within the predicted size range of carlaviruses was obtained using Car-F1 paired with either Car-R or dT-B from tested carlaviruses (PVS, PVM and PotLV) by RT-PCR. The Car-F2 failed to yield clear-cut fragments within the predicted size range when paired with either Car-R or dT-B in RT-PCR. However, a less degenerated version of the primer, Car-F2b, resulted in amplicons within the predicted size range when paired with either Car-R or dT-B. Sequencing of the tentative carlavirus-fragments resulted from Car-F1/Car-R and Car-F2b/dT-B proved their carlavirus-origin, thus indicating the high specificity of the primers. The sensitivity of Car-F1/Car-R or Car-F2b/Car-R mediated RT-PCR for detection of carlaviruses from potato tubers were assessed using composite samples involving one viruliferous-potato-tuber RNA sample with up to 49 virus-free-potato-tuber RNA samples under the optimal annealing temperature. The target carlaviruses were readily detected from all composites, demonstrating a high sensitivity. The method was further evaluated using presumed virus-free or carlavirus-viruliferous potatoes of several cultivars, and reliable results were obtained.

Session A: Pathogen Detection
15:15-15:30

Are bacteria the causal agent of the zebra chip disease of potato? X. Li*, S.H. De Boer, G. Secor, J. Gourley, P. Ross, V. Rivera, and J. Rengifo. *Canadian Food Inspection Agency, Charlottetown Laboratory, Charlottetown, PE, Canada C1E 1Z5; (G.S., V.R., J.R.) North Dakota State University, Department of Plant Pathology, Fargo, ND, USA 58105.*

With symptoms of internal necrosis resulting in severe discoloration of processing crisp chips, "Zebra Chip (ZC)" is a new disease of potato originally discovered in Mexico in 1994. The disease has been observed since 2000 in Guatemala and the southern United States, and has spread further northward into some central areas of the US recently. In affected regions, ZC has become a leading cause for rejection of potatoes for consumption and processing, resulting in millions of dollars in losses to potato growers. It is unclear whether or not the appearance of this disease and its northward spread is associated with global warming, but its appearance and spread is of increasing concern to the potato industry. Initially, primer pairs targeting the 16S rDNA of phytoplasma, bacteria-like organisms (BLO), and other plant pathogens were used for determining the identity of the causal agent. One primer pair, designed to specifically amplify rDNA of the cucurbit yellow vine BLO, successfully amplified a 650 bp fragment from ZC-infected tuber tissue extracts, repeatedly. Further cloning and sequencing revealed that the amplicons consisted of closely-related rDNA fragments of 650 bp with similarity of > 97% to various enteric bacteria originating from diverse plant and insect sources. Using eubacterial primers targeting 16S rDNA, we amplified and constructed a library of eubacterial *rrn* operons of a ZC-diseased potato tuber to evaluate the entire endophytic prokaryote community associated with the disease. Ribosomal DNA-RFLP was used as an initial screening process to select the dominant candidates in the clone library for detailed sequence analysis. DNA alignment and blast searching indicated that the dominant clones were very closely related to the 650 bp fragments with a few base pair substitutions. The small number of base substitutions may indicate a different origin of these sequences, or may be due to PCR errors, or sequence variations within different copies of the rrn operons of the same genome. The evidence, to date, indicates that there is a close association between the BLO and ZC etiology. Further research is being carried out including attempts to isolate ZC-associated bacteria on laboratory media.

Poster Session
15:30-16:00

Ribosomal RNA gene sequence polymorphism in the same genome is common among phytopathogenic enterobacteria. H. M. Sun, X. Li*, L. Ward, and S.H. De Boer. *South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China; (L.W., X.L., S.H.D.) Canadian Food Inspection Agency, Charlottetown Laboratory, PE, C1A 5T1, Canada.*

Enterobacteria traditionally classified in the genus *Erwinia*, including some important pathogens of potato, are now placed into several different taxa on the basis of sequence analysis of 16S rRNA, e.g. *Pectobacterium atrosepticum* for *E. carotovora* subsp. *atroseptica*, *Pectobacterium carotovorum* for *E. carotovora* subsp *carotovora*, and *Dickeya* spp. for *E. chrysanthemi*. However, there is lingering concern among some bacterial taxonomists about whether the rRNA sequence ought to be the sole basis of bacterial taxonomy. Nevertheless, more than 220,000 16S rRNA sequences have been accumulated in the Ribosomal Database Project (RDP II) in more than a decade and used for universal analysis of phylogenetic relationships among microorganisms. During analysis of a group of plant-associated bacterial isolates, we found sequence variations (polymorphisms) among various copies of 16S rDNA within the same genome. Further analysis revealed that sequence variations between different copies of 16S and 23S rDNA within a single genome are common among plant pathogenic enterobacteria such as *P. atrosepticum*, *E. amylovora*, and *Dickeya dadantii (E. chrysanthemi)*. Such variation appears to be a common phenomenom for this specific group of plant pathogens, each with 7 copies of rRNA operons within the genome. However, 16S and 23S rDNA sequences in the other plant pathogenic bacteria, such as *Pseudomonas syringae* pathovars, *Xanthomonas campestris* pathovars, and *Ralstonia solanacearum* are identical among the various copies of the rrn operons within their genomes. Further study is being carried out to analyse the transcription, stress and pathogenicity functionality of the rDNA polymorphisms in the enteric phytopathogens, which may have some impact on the current taxonomy and classification of this group of plant pathogens. The sequence polymorphism may encode a specific stress adaptation including antibiotic drug resistance.

Poster Session
15:30-16:00

An internal reaction control for use in a TaqMan PCR test for *Ralstonia solanacearum* race 3 (biovar 2). D.S. Smith* and S.H. De Boer. *Canadian Food Inspection Agency, Charlottetown Laboratory, Charlottetown, PE C1A 5T1 Canada.*

Ralstonia solanacearum causes bacterial wilt in a broad range of hosts and has economic significance worldwide. Race 3 (biovar 2) (R3B2) is a subspecific taxon within the species that infects solanceaceous plants at low temperatures, and causes brown rot of potato. R3B2 does not occur in Canada, but is a regulated, quarantine pest because of its ability to become established in temperate climates. The low detection limits obtainable with polymerase chain reaction (PCR) methods, make them highly attractive for diagnosing low-level, latent infections of important pathogens like *R. solancearum*. PCR methods used for diagnostic purposes, however, must provide adequate means for validating negative results. A reaction control was constructed to function with a previously published TaqMan assay for *R. solanacearum* R3B2. The reaction control was designed to amplify with the same primer set used to detect *R. solancearum*, while being distinguishable from the primary diagnostic target in real-time PCR. The synthesized construct was cloned into pCRII-TOPO, and the resulting plasmid, pRB2C2, maintained in *Escherichia coli* strain DHα-T1. DNA sequencing confirmed the presence of the reaction control insert within pRB2C2. Addition of pRB2C2 at 100 copies per reaction had no effect on the sensitivity of the TaqMan assay for *R. solanacearum* R3B2. The modified assay successfully detected *R. solanacearum* R3B2 in infected, asymptomatic tomato stems and leaves as well as in potato tubers and stems. The amplicons generated by *R. solanacearum* R3B2 and the reaction control were 68 bp and 94 bp in size respectively, and had respective melting temperature peaks of approximately 83 and 89.5 ^{o}C which could be easily distinguished. The effectiveness of the reaction control pRB2C2 in detecting inhibition or reaction failure in PCR was demonstrated with infected potato tuber extracts.

Session B: Disease Management
16:00-16:15

Effect of different foliar fungicides on the development of lesions caused by *Alternaria solani* (early blight) and *Alternaria alternata* (brown spot) on potato foliage. S. Veenhuis-MacNeill*, R. Coffin, R.D. Peters, G. Wang-Pruski, H.W. Platt, R. Pitblato, T. Hamill, M. Maynard. *Cavendish Farms, Kensington, PE; (R.D.P., H.W.P.) Agriculture and Agri-Food Canada, Charlottetown, PE; (G.W.-P.) Nova Scotia Agricultural College, Truro, NS; (R.P.) Weather Innovations Incorporated, Chatham, ON*

Potato diseases caused by *Alternaria* spp. periodically cause foliar necrosis and premature plant senescence in eastern Canada. To test the efficacy of various fungicide treatment regimes for control of early blight (*Alternaria solani* (Ellis & G. Martin) L.R. Jones & Grout) and brown spot (*A. alternata* (Fr.:Fr.) Keissl.), field trials were established in 2007. Shepody and Russet Burbank potatoes were planted in replicated plot islands and fungicides were applied every 6-8 days with a tractor mounted sprayer (500 liters per hectare, 310 kPa). Treatments included check plots treated with water, metiram, chlorothalinol, mancozeb, phosphorous acid, chlorothalonil + phosphorous acid and a succession of the tank mixes chlorothalonil + pyraclostrobin, chlorothalonil + fenamidone, chlorothalonil + cymoxanil, chlorothalonil + dimethomorph, and chlorothalonil + cyazofamid. All products were applied at the recommended label rates. Leaf lesions (concentric circles and patches of dead tissue along leaf margins) first appeared on Shepody in the check plots. Development of disease symptoms commenced 2 weeks later in Russet Burbank. Plots were rated weekly until top-killing. A tank mix of chlorothalonil + phosphorous acid improved suppression compared to either product applied alone. Plots treated with metiram were significantly less diseased than the untreated control plots. The most pronounced control/suppression occurred in the mancozeb treatment and the tank mixes of chlorothalonil + pyraclostrobin, chlorothalonil + fenamidone, chlorothalonil + cymoxanil, chlorothalonil + dimethomorph, and chlorothalonil + cyazofamid.

Session B: Disease Management
16:15-16:30

Use of salicylic acid as a tool in controlling black scurf (*Rhizoctonia solani*) disease in potatoes. K.I. Al-Mughrabi and A. Vikram*. *New Brunswick Department of Agriculture and Aquaculture, Wicklow, New Brunswick, Canada.*

The effect of salicylic acid (SA) in suppressing black scurf (*Rhizoctonia solani* Kuhn, AG-3) disease in potatoes (cv. Atlantic) was tested under screenhouse conditions at the Potato Development Centre, Wicklow, New Brunswick, Canada. The study was designed as a completely randomized block and contained eight treatments which were replicated four times. The eight treatments were: untreated, uninoculated control (CTH); untreated control inoculated with *R. solani* (CTD); healthy seed potatoes treated with SA (STH); seed inoculated with *R. solani* and treated with SA (STD); healthy seed potatoes with SA applied foliarly (FAH); seed inoculated with *R. solani* and SA applied foliarly (FAD); healthy seed with SA applied as soil drench (SDH); seed inoculated with *R. solani* and SA applied as soil drench (SDD). Observations included seedling emergence, disease severity and yield. Disease severity of black scurf in stems was significantly reduced in all SA treatments compared to the untreated, inoculated controls. Black scurf disease severity in stems was reduced by 89.6% and 88.8% in FAH and SDH treatments compared to CTD. Significant increase in yield was observed in treatments which were inoculated with *R. solani* and treated with SA compared to the uninoculated controls. The findings of this investigation suggest that SA has the potential to be used as an alternative tool in managing black scurf disease in potatoes.

Session B: Disease Management
16:30-16:45

Compost effects on apple replant disease. G. Braun* and K. Fuller. *Atlantic Food and Horticulture Research Centre, Agriculture and Agri-Food Canada, 32 Main St., Kentville, NS, B4N 1J5, Canada.*

Apple replant disease (ARD), a common disease in temperate climate apple production, has a complex etiology and is easily managed by broad spectrum soil fumigants. However, efforts to eliminate the use of methyl-bromide and other potentially hazardous soil sterilants has resulted in a plethora of research projects on organically based management strategies. The effects of composts on ARD have been widely published but rarely with the same results. Composts have been demonstrated to alleviate, exacerbate or have no effect on ARD. In our ARD field study on the effects of preplant deep ripping of the soil, compost incorporation or soil fumigation with Telone C-17 applied alone or in combination resulted in a 74% and 117% increase in yield for the deep ripping + compost and deep ripping + compost + fumigation treatments, respectively. All treatments significantly reduced lesion nematode numbers below 1490/kg dry soil in the non-treated control, however, only deep ripping + fumigation + compost reduced nematodes to below ~225/kg dry soil which is considered the threshold for economic damage. Mycorrhizal colonization of the roots in deep ripped soil + compost was 172% greater than deep ripping alone which was not different than the non-treated control. Deep ripping + compost also increased the number of fine apple roots by 117% compared to trees in deep ripped soil alone. The mode of action of compost resulting in significant yield increases is still under investigation.

Session B: Disease Management
16:45-17:00

Evaluations of in-furrow products on development of scab lesions on potato tubers. R. Coffin*, S. Veenhuis-MacNeill, C. Goyer, M. Filion, S. Watts, T. Hamill, and M. Maynard.
Cavendish Farms, Kensington, PE; (C.G.) AAFC, Fredericton, NB; (M.F.) Université de Moncton, NB; (S.W.) Engage Agro, Guelph, ON

Numerous researchers have been evaluating soil applied treatments to reduce scab on potatoes with limited success. Shepody and Prospect tubers, with scab lesions, were planted in scab infested soil. In-furrow treatments were applied in a 15 cm band immediately prior to planting the seed pieces. Treatments included an untreated check, Polyram fungicide, Oxytetracycline antibiotic, liquid elemental sulfur and Converted Organics granular and liquid concentrate. None of the treatments resulted in reduced plant vigor or development. Tubers from 10 plants in each of 3 replications were harvested, blind coded and rated. Most of the tubers had some surface scab but negligible pitted scab. All tubers were placed into one of four categories based on percent scab of total surface area, 0%, 1-10%, 11-50% and 51-100%. There was considerable variation from replication to replication. Overall, there was slightly more scab on the Shepody tubers than the Prospect tubers. None of the treatments had any appreciable effect on scab in the Prospect variety. In the Shepody tubers, the Converted Organics products noticeably decreased the amount of surface scab, whereas the liquid elemental sulfur gave an obvious increase.

Session B: Disease Management
17:00-17:15

Managing potato diseases caused by *Fusarium* spp. in the Maritimes. R.D. Peters*, K.A. Seifert, H.W. Platt, K.A. Drake, I.K. Macdonald, S. MacInnis, R.H. Coffin, M.M. Clark, S. Moorehead and K.I. Al-Mughrabi. *Agriculture and Agri-Food Canada, Crops and Livestock Research Centre, 440 University Ave., Charlottetown, PE Canada; (K.A.S.) Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, Central Experimental Farm, KW Neatby Bldg., 960 Carling Ave., Ottawa, ON Canada;(S.M.) Cavendish Agri-Services, P.O. Box 247, Kentville, NS Canada; (R.H.C.) Cavendish Farms, Kensington, PE Canada; (M.M.C.) PEI Department of Agriculture, Kensington, PE Canada; (S.M.) McCain Foods Canada, Borden-Carleton, PE Canada; and (K.I.A.) NB Department of Agriculture and Aquaculture, Wicklow, NB Canada.*

Fusarium spp. are important pathogens of potatoes that cause yield losses at planting and in storage following harvest. Surveys from 2000-2007 in the Maritimes have shown that *Fusarium sambucinum, F. coeruleum* and *F. avenaceum* are the most important causal agents of seed-piece decay and dry rot in this region. Some minor *Fusarium* spp. that were pathogenic to tubers were also recovered in the surveys including *F. crookwellense*, *F. sporotrichiodes* and *F. oxysporum*. The predominant *Fusarium* spp. found in seed pieces provided inoculum for infection of daughter tubers and therefore, these species were also most commonly isolated from tubers in storage. However, high levels of seed infection did not always translate into high levels of dry rot in storage, because the amount of tuber wounding at harvest was normally the biggest factor determining post-harvest dry rot. Inoculation trials revealed that isolates of *Fusarium* spp. from cereal (*F. sporotrichioides* and *F. graminearum*) and forage (*F. avenaceum* and *F. oxysporum*) crops could also be pathogenic to potato tubers. Isolates of the various *Fusarium* spp. were tested for their sensitivity to thiophanate-methyl (potato seed-piece treatment) and thiabendazole (post-harvest treatment) using an amended agar assay. In all cases, isolates of *F. sambucinum*, the major dry rot pathogen, were resistant to both products. By contrast, all other *Fusarium* spp. were sensitive to both products. In 2007, isolates of *F. sambucinum* and *F. coeruleum* resistant to fludioxonil were found. Ultimately, the management of Fusarium dry rot and seed-piece decay will depend upon integrating a number of control options.