# Potato Progress

**Research and Extension for Washington's Potato Industry**
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# Potato Cyst Nematode


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**USDA-ARS and Washington State University, IAREC, Prosser WA**


**PCN in Idaho**

Potato cyst nematode (PCN) has been in the news a lot these past two years and has indirectly impacted Washington State via the ban on Alberta seed potatoes. In April 2006, the pale cyst nematode, *Globodera pallida*, was found during a routine survey of tare soil at an ISDA grader facility in eastern Idaho and subsequently traced back to a field in Bingham County, ID. Initially, this led Japan to prohibit all potato imports from the USA and several other countries banned potatoes from Idaho. Since these initial findings, PCN has been found in a total of 8 fields in Idaho, all in proximity to one another. Previously, in the United States, PCN had only been found in upper New York State and Long Island. This was a different species of PCN called golden nematode, *Globodera rostochiensis* and was found in 1941.

PCN is a quarantine pest and is not found in many countries, which can lead to aggressive measures to keep PCN from being introduced. In August of 2006, APHIS and ISDA established a regulated area near Shelley, ID of about 10,000 acres that was under a Federal Domestic Quarantine Order to restrict interstate movement of products including potatoes, nursery stock, compost, farm equipment and many other items at risk to spread PCN. PCN infests roots, but not tubers, but can be spread through soil adhering to tubers. PCN can also be spread through wind blown soil, contaminated farm equipment, animals, water, etc.

**PCN symptoms and economic impact**

PCN affects potatoes and some closely related plants, including tomatoes, eggplants, and some weeds. PCN can cause patches of poor growth, a sickly yellow appearance, wilting at midday, or death of the foliage and delayed flowering. Infested areas of fields enlarge with each potato crop and the nematode population increases. If uncontrolled, PCN can reduce potato yields 80 - 100 percent. PCN can significantly reduce tuber size even with the foliage showing only minor symptoms. Females form cysts that typically contain 200-600 eggs and the eggs can stay dormant in the soil for up to 30 years.

Estimates have been made that if PCN became more widespread in the U.S. that crop losses of $5 billion could result. The spread of PCN to new sites in the U.S. could result in trade embargoes, compromising domestic and international trade. Quarantines would affect the potato industry, but also agricultural commodities shipped from the regulated areas and carrying soil such as all nursery, turf, root, and tuber crops.

**PCN in Alberta**

Of great concern to the Washington industry was the finding of PCN in two seed potato fields in Alberta in 2007. Each farm had a single positive sample, the first farm had one sample out of 284 test positive and the second had one out of 143. A retest was conducted using 610 soil samples from the two fields, but PCN was not detected. A more widespread Alberta survey tested 2,721 samples and no PCN was detected. Another

801 soil samples from the 2006 seed potato crop were analyzed and no PCN was detected. This PCN was identified as the golden nematode, so it differs from the species found in Idaho.

**Impact on Washington**

As a result of PCN discovery, import of Alberta seed potatoes into the U.S. was banned. This caused difficulties for the Washington industry as about 30% of our seed potatoes come from Alberta and alternative sources had to be identified. There are concerns about the potential for soil clinging to Alberta seed potatoes introducing PCN into fields where they were planted. A soil survey is currently underway in Washington. Seed potatoes from PCN infested fields are an alarming scenario for the spread of PCN. However, the very low numbers detected in Alberta is a plus and may reduce the risk of spread. Furthermore, in a strange twist *M. chitwoodi* could end up benefitting growers, because fumigation is practiced routinely by Washington growers to control the root-knot nematode. This routine fumigation along with the very low numbers found thus far in Alberta give hope that PCN has not been spread.

In May of 2008 the USDA and the Canadian Food Inspection Agency (CFIA) announced modified guidelines to allow for the continued trade of potatoes should there be future detections of potato cyst nematodes in either the U.S. or Canada. New export certification requirements include full grid soil sampling of all fields used to produce seed potatoes for trade between Canada and the U.S. Previous soil sampling would no longer meet the requirements. All potato shipments between the two countries also must include a phytosanitary certificate with a declaration confirming that the seed potatoes originated from fields tested and found free of PCN.

**Eradication**

The fact that PCN in Idaho is limited to 8 nearby fields suggests eradication may be possible. One difficulty in eradicating PCN is that the cyst stage of the life cycle is resistant to many treatments, including chemical fumigation. Indeed, the ability of PCN to form tough cysts that can persist in the soil for more than three decades is a major reason PCN is such a formidable pest and is difficult to eradicate.

**Research at Prosser**

No PCN has been brought into Washington for research, but several Prosser scientists are assisting in the eradication effort and are working with colleagues at the University of Idaho, Cornell, and USDA-APHIS. The Navarre group is using some of the same techniques they developed to analyze potato vitamins and phytonutrients in previous WSPC funded work to search for compounds secreted by potato roots that stimulate PCN to hatch. Typically a cyst will not hatch until it senses environmental conditions favorable for reproduction, which includes the presence of a suitable host. Roots of potato and a few other solanaceous plants, but not most other plants, produce exudates that stimulate the eggs in cysts to hatch. We have already conducted substantial metabolic profiling of diverse potato genotypes during our phytonutrient work. During this profiling we identified numerous compounds that seem unique to solanaceous crops and these are good candidates to be examined as potential hatching factors. If eggs can be tricked into hatching in the absence of a suitable host, then the nematode will die. Other ways to induce hatching, including the use of trap crops, are being explored. Thus, a critical point in controlling PCN is to identify the chemicals that stimulate the eggs to hatch.

The Riga group is studying the depth of kill of various nematicides and assessing the survival and parasitic potential of PCN from deep soil locations. A grower workshop will be held in the fall at Prosser. In addition, the efficacy of numerous nematicides and biofumigants will be tested. Green manures will also be evaluated. For example, the bio-nematicides DiTera, QL and NatureCur will be studied on PCN along with the impact of biofumigant green manures like mustard, arugula, the combination of mustard and arugula, and white mustard. Other crops tested will include fodder radish, ryegrass, lupin, phacelia, French marigolds,

persian clover, common vetch, white clover, spurry, forage rape, red clover, and Sudangrass. It is well documented that brassicaceous plants contain precursors of isothiocyanates (ITCs; e.g., allyl, methyl forms), and glucosinolates which are released in the soil and have negative impact on nematodes. In addition, the green manures will be combined with the synthetic and bio-nematicides to study the combined effect on PCN.

The Boydston group, which includes Dr. Mojtahedi, is assessing whether weeds found in the Pacific Northwest can act as hosts for PCN. In temperate climates, PCN populations decline by about 30% per year in the absence of a host crop. However, if weed hosts are present in the rotation crop, one can expect multiplication of PCN on those weeds. PCN is reported to have a narrow host range that includes several weeds in the genus *Solanum* and several wild species in the genus *Lycopersicon*. Weeds are highly heterogeneous and weed biotypes from different geographic regions may not result in similar host status for Idaho PCN. Three common annual nightshade species; black nightshade, hairy nightshade, and cutleaf nightshade, exist in Idaho and other potato growing regions in the Pacific Northwest. These nightshade species and the most common weed species found in the PNW potato production region will be tested for host suitability for PCN collected from Idaho, so that local weed hosts of the nematode are identified and can be targeted for control during eradication efforts.

# Time to Clean Up Cull Piles and Spills

In a recent edition of this newsletter (Volume VII No. 2) we discussed the importance of cull piles and spilled potatoes in disease and pest issues for the commercial crop. Cull piles and other waste potatoes pose little or no threat during the winter, but with the growing season underway and the crop emerged, it is past time to clean up cull piles and maintain good sanitation around storages and other places where it might be tempting to pile culls. Some of the problems associated with cull piles, such as late blight, are community problems and must be handled by the whole community working together.

# Hotlines and Pest Updates

There are several resources available to the Washington potato industry regarding pests and disease through the season. These are sponsored and conducted by both Washington State University and the potato commission.

1. Late blight hotline – presented by Dennis Johnson, Plant Pathologist at Washington State University. This hotline is update regularly through the season, and is used to alert industry when late blight is found in Washington potatoes. The number to call: 1-800-984-7400.

2. Aphid hotline – presented by Keith Pike, Entomologist at Washington State University. Dr. Pike tracks aphid populations throughout the season via in-field sampling of a set of about 40 fields throughout the Columbia Basin. He updates the industry on aphid activity throughout the season. Call: 1-888-673-6273.

3. Beet leafhopper and tuberworm regional trapping – a cooperative effort managed by Andy Jensen at the potato commission. This program presents seasonal and geographical abundance information on beet leafhopper and tuberworm moths throughout most of the Columbia Basin. See maps and graphs on the potato commission website at: www.potatoes.com/research.cfm.

# WSU Potato Field Day – June 27, 2008

**Located at WSU Othello Research Unit**

(6 miles East of Hwy. 26/17 Junction, On Booker Rd, ¼ Mile South of Hwy. 26)

8:30 - 9:00 am Coffee and rolls

9:00 - 10:20 am Visit Seed Lot Trial

## Concurrent Session I: Potato Cultural Practices Field Tour

10:30 am **PVMI – Where is my money going?**
*Jeanne Debons* – Potato Variety Management Institute, Bend, OR

10:45 am **How to Monitor for Tuberworm Using Pheromone Traps**
*Andrew Jensen* – Washington State Potato Commission – Moses Lake

11:00 am **Seed Productivity, Tuber Maturity & Postharvest Quality Studies**
*Rick Knowles, L. Knowles, D. Zommick, G.N.M. Kumar, M. Pavek, N. Fuller* – WSU, Pullman

11:15 am **Screening New Potato Cultivars for Water Use Efficiency**
*Mark Pavek, Zach Holden, Rudy Garza, Josh Rodriguez* – WSU, Pullman

11:30 am **Defining In-Season Nitrogen Rates and Application Timing to Maximize Potato Profits**
*Chris Hiles, Mark Pavek, Zach Holden, Rudy Garza, Josh Rodriguez* – WSU, Pullman

11:45 am **Manipulating Source/Sink Relationships & Profit Potential through N Management**
*Rick Knowles, Mark Pavek, Lisa Knowles, Zach Holden* – WSU Pullman

12:00 pm - 1:30 pm **HOSTED LUNCH**

## Concurrent Session II: Potato Pest Management Field Tour

10:30 am **PVMI – Where is my money going?**
*Jeanne Debons* – Potato Variety Management Institute, Bend, OR

10:45 am **How to Monitor for Tuberworm Using Pheromone Traps**
*Andrew Jensen* – Washington State Potato Commission – Moses Lake

11:00 am **Developing Management Tactics for Soil-borne Diseases: Powdery Scab, Black Dot, & Verticillium**
*Tom Cummings, Dennis Johnson* -- WSU, Pullman

11:15 am **Potato Variety Resistance to Black Dot and Powdery Scab**
*Nadav Nitzan, Chuck Brown* – USDA/ARS - Prosser

11:35 am **Insect Pathogens and Predators in Biocontrol**
*Ricardo Ramirez, Bill Snyder* - WSU, Pullman

11:50 am - 1:30 pm **HOSTED LUNCH**

## Concurrent Session III: Potato Pest Management Workshop

10:30 am **Searching for Rainbows Without the Rain**
*Tom Hoffmann* – Washington State Department of Agriculture – Moses Lake

11:00 am **Double Fumigation to Control Root Knot Nematodes in Potatoes Destined for International Markets: Bio-fumigation in Combination with Synthetic Nematicides** *Ekaterina Riga* – WSU, Prosser

11:25 am **Loopers, Armyworms, and Cutworms as Potato Pests**
*Peter Landolt* – USDA-ARS, Wapato

11:50 am **The Diverse Community of Beneficial Predators, Parasitoids, and Insect Pathogens in Potatoes**
*Bill Snyder* – WSU, Pullman

12:30 - 1:30 pm **HOSTED LUNCH**

*CCA and pesticide recertification credits have been applied for (WA, OR, & ID)*