Potato Progress

Research and Extension for Washington's Potato Industry
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2007 Commercial Seed Lot Trial Information

Mark J. Pavek, WSU Pullman

Commercial potato seed samples are requested for the 2007 Washington Seed Lot Trial. Two to three hundred whole (single drop) seed is an acceptable sample size, or **50 lbs of 4 oz single drop seed**. This seed should not be treated with insecticide or fungicide. Seed tubers need to be uniformly small (not larger than 4 oz) because no seed cutting is done and a cup-type planter is used. A sample that represents the entire seed lot received is most desirable. Sampling the first (or last) 300 seed from the truck is not likely to provide a representative sample of the lot. Sample tags may be obtained by calling the Potato Commission at 509-765-8845.

Your assistance with collection and drop off of seed samples is needed. Seed samples may be taken to the WSU Othello Research Unit (509-488-3191), located on Booker Road ¼ mile south from State Highway 26 and about five miles east of Othello. For South Basin sample pickup and any questions regarding the seed lot trials, please call Mark Pavek at 509-335-6861 or Ed Driskill at 509-335-6859.

In the North Basin, one seed "drop-off" has been established. It is located at Qualls Ag Labs (Mick Qualls, 509-787-4210 ext 16) on the corner of Dodson Road and Road 4; come to front office between 8 am and 5 pm. Please call the numbers below to arrange additional pickup sites. Samples will be picked up at 2:00 pm the day before each planting date (below) to be included. Growers planting in early March should drop their samples off at the Othello Research Center or store the samples and call the numbers below for pickup. For all alternative pickup locations or questions please call Mark Pavek at 509-335-6861 or Ed Driskill at 509-335-6859.

The remaining seed lot planting dates for 2007 are:

2nd	**April 10**
3rd	**April 24**
4th (Late)	**May 8**

This year's virus reading of the seed lots will take place on June 12 and 26.

The 2007 Potato Field Day is scheduled for Friday June 29.

Leafhopper and Tuberworm Trapping Data for 2007

Starting April 10, the potato commission website will once again bring you weekly counts of beet leafhoppers and tuberworm moths from the Washington and northern Oregon trapping network. The trapping program will not be quite as extensive as in the past two years, but will still serve the industry by alerting you to high populations of the insects, and something about where they are most abundant. We encourage all growers concerned about these insects to monitor for them in and around each field – our trapping system should not be relied upon to determine if and when the insects are in any particular field. The link to trapping data can be found at:

www.potatoes.com/research.cfm

Pesticide Labels and Plant-Back Restrictions

In recent weeks two important pesticide plant-back restrictions have come to our attention. These issues have to do with Vydate and Oberon. If you use either of these products, be sure to review the labels of these products to ensure the plant-back restrictions are not a problem. The relevant label language for Vydate reads:

> *"Do not plant crops other than cotton, carrots, celery, cucumber, cantaloupe, honeydew melon, watermelon, squash, pumpkin, eggplant, pepper, potatoes, sweet potatoes, tomatoes, peanuts, soybeans or tobacco within 4 months after the last application."*

The label language for Oberon reads:

> ***"Rotational Plant-Back Intervals[1]***
> *Immediate plant-back: Cotton, field corn, fruiting vegetables, leafy vegetables, cucurbits, tuber vegetables (potatoes), strawberry.*
> *30-day plant-back: Alfalfa, barley, sugar beets, wheat.*
> *12-month plant-back: all other crops.*
>
> *[1]Cover crops for soil building or erosion may be planted at any time, but do not graze or harvest for food or feed."*

It is possible that the registrants for these products could resolve these restrictions in the coming months or years, but it is important that growers and others are aware of the situation as it currently stands.

Resistance of Potato Breeding Lines to Columbia Root-Knot Nematode Undermined by Hairy Nightshade Presence

Rick Boydston, Hassan Mojtahedi, & Chuck Brown, USDA-ARS, Prosser, WA

Columbia root knot nematode (CRN), *Meloidogyne chitwoodi*, is a serious pest of potato throughout the western United States. The soil inhabiting second stage juveniles of CRN invade potato roots and complete the first generation in the root system before invading tubers. Female nematodes mature in tubers and deposit eggs resulting in brown blemishes, making tubers unmarketable. CRN can complete 3-5 generations on potato roots during the growing season in the Columbia Basin, with each new generation continuously attacking tubers. The damage threshold for this nematode is very low.

CRN resistant breeding lines have been developed to race 1 of the nematode utilizing a resistant gene from a wild relative of potato, *S. bulbocastanum* (Brown et al. 2006). CRN, which rely on specialized "giant cells" for feeding, can penetrate roots of resistant breeding lines, but fail to establish a feeding site. Subsequently, either they exit from roots or die (Mojtahedi et al. 1995). Therefore, no nematode reproduction takes place and tubers escape nematode damage (Brown et al. 2006).

In several field trials, some resistant breeding lines were injured by CRN race 1 (CRN-1) and limited tuber infection took place. It was observed that some of these field plots contained late season weeds, including hairy nightshade. These weeds may act as nematode reservoirs, allowing tuber infection in some breeding lines that are otherwise resistant to nematode reproduction on the root system. CRN has a wide host range among crops and weeds including nightshade (*Solanum sp*.) (Santo et al. 1980). O'Bannon et al. (1982) and Zoon et al. (2004) reported black nightshade (*Solanum nigrum*) as a suitable host of CRN, but the host status of hairy nightshade (*S. sarrachoides*) has not previously been reported.

Greenhouse and field trials were conducted to test the hypothesis that hairy nightshade in the presence of potato could act as a nematode reservoir and present a threat to some potato breeding lines that lack tuber resistance to CRN-1 infection, while tubers of other breeding lines remain unblemished.

Procedures

Two *M. chitwoodi* resistant clones, PA95B4-67 and PA99N82-4, and a susceptible cultivar, Russet Burbank, were grown in field and greenhouse trials with and without hairy nightshade and in the presence of CRN-1. Nematode damage on tubers was assessed by counting the browned infection sites on the flesh of peeled tubers.

The host status of hairy nightshade was tested by inoculating seedlings with 5,000 eggs of CRN-1, and maintained on greenhouse for 2 months before the roots were freed from soil and eggs were extracted and counted. The reproductive factor (RF) of the nematode was then determined.

Results - Greenhouse tests

Hairy nightshade was a suitable host for CRN-1 with RF value of >50. The nematodes successfully parasitized Russet Burbank roots, and caused typical external and internal symptoms on tubers. CRN-1 failed to reproduce on PA95B4-67 and PA99N82-4 and did not cause any damage to tubers of these two breeding lines when grown without hairy nightshade. These breeding lines appear to escape tuber damage because the nematode fails to reproduce on their root system. However, when hairy nightshade was grown in pots with the resistant potato breeding lines, the number of eggs recovered from combined roots of the two species was dramatically increased. The increased pest pressure only impacted the tubers of PA95B4-67 and not PA99N82-4. When an exogenous source of nematodes was provided by hairy nightshade, the resistance failed in PA95B4-67 and some tubers became infected, while in PA99N82-4, all tubers remained unscathed.

Results - Field tests

At harvest time, CRN-1 populations were greatest in plots planted with Russet Burbank, ranging from 2245 to 9642 J2 per 250 cm^3 soil, and presence or absence of hairy nightshade did not influence the post harvest population of the nematode significantly (Table 1). Conversely, final CRN-1 populations were significantly lower in plots planted to resistant potato lines, PA95B4-67 or PA99N82-4 grown in the absence of hairy nightshade compared to those grown in presence of hairy nightshade (Table 1).

Russet Burbank tubers were seriously damaged by CRN-1with nearly all tubers exhibiting infection regardless of hairy nightshade presence (Table 2 and Fig. 1). Field trials confirmed the greenhouse observations that resistant breeding lines escape tuber damage because the nematode fails to reproduce on their root system. When grown without hairy nightshade, resistant breeding lines had a low percentage of infected tubers and produced no tubers classified as culls (Table 2). However, when grown in the presence of hairy nightshade, a greater percentage of PA95B4-67 tubers were infected resulting in 10% culls (Table 2). PA99N82-4 had low numbers of tubers infected and no tubers classified as culls in either year regardless of hairy nightshade presence (Table 2). Some tubers of PA99N82-4 exhibited slight infection, but likely would have met the strictest inspection standards in most processing plants.

We hypothesize that PA95B4-67 roots are resistant to CRN-1, whereas tubers remain somewhat susceptible to infection. When grown in the presence of a suitable host of CRN-1, such as hairy nightshade, CRN-1 populations were maintained on nightshade and eventually were able to infect PA95B4-67 tubers. The significantly lower tuber infection of PA99N82-4 when grown in the presence of hairy nightshade suggests that PA99N82-4 possesses both root and tuber resistance to CRN-1. The mechanism of this differential resistance in roots and tubers of breeding lines is not yet understood.

Hairy nightshade is the most prevalent annual weedy nightshade species present in the potato growing region of the Pacific Northwest and is particularly problematic as it hosts a plethora of potato pathogens and insect pests (Alvarez and Srinivasan 2005; Boydston et al. 2004; Dandurand et al. 2006; Mojtahedi et al. 2003; Thomas 2002, 2004; and Xu and Long 1997). These findings further exemplify hairy nightshade as a troublesome weed in potato rotations. These results also demonstrate the importance of weed presence on Columbia root knot nematode populations. Previous researchers have emphasized the importance of weed control on management of plant parasitic nematodes and this work further demonstrates that weed management should play an integral role in IPM of plant parasitic nematodes.

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Dr. Boydston is an agronomist with assignment on irrigated cropping systems research. Dr. Mojtahedi is a research affiliate scientist and Dr. Brown is a geneticist with assignment on improvement of potato germplasm. **This research was funded by the USDA - ARS base funds.**

Table 1. Number of second stage juveniles (J2) of race 1 of Columbia root knot nematode per 250 cm^3 soil at harvest from field plots planted to Russet Burbank and two potato breeding lines in presence or absence of hairy nightshade in 2004 and 2005.

Potato lines	Presence of hairy nightshade	2004 No. of J2	2005 No. of J2
Russet Burbank	-	2777 ± 1260 a	9642 ± 5380 a
Russet Burbank	+	2245 ± 595 a	3787 ± 3369 a
PA95B4-67	-	47 ± 47 b	15 ± 6 b
PA95B4-67	+	268 ± 126 a	577 ± 153 a
PA99N82-4	-	17 ± 14 b	136 ± 72 b
PA99N82-4	+	205± 163 a	628 ± 177 a

Pairs of means for each potato line followed by the same letter are not significantly different according to Student 't' test.

Table 2. Tuber infection index, percent infected tubers, and percentage of cull tubers for Russet Burbank and two potato breeding lines harvested from soil infested with race 1 of Columbia root knot nematode, and grown in the presence or absence of hairy nightshade in field trials in 2004 and 2005.

		2004			2005		
Potato lines	Presence of hairy nightshade	Infection index	% tubers infected	% tubers culled	Infection index	% tubers infected	% tubers culled
Russet Burbank	-	4.5 a	90 a	77 a	4.5 a	100 a	91 a
Russet Burbank	+	3.6 a	97 a	72 a	4.0 a	100 a	83 a
PA95B4-67	-	0.22 a	16 a	0 b	0.1 c	9 b	0 b
PA95B4-67	+	0.54 a	23 a	10 a	0.9 b	54 a	10 a
PA99N82-4	-	0.04 c	2 a	0 a	0.1 c	8	0 a
PA99N82-4	+	0.06 c	6 a	0 a	0.2 c	15	0 a

Means followed by the same letter do not differ according to student 't' test at p> 0.05.
Tuber infection index based on the number of browned infection sites on peeled tuber flesh and consisted of 0 = 0; 1 = 1-5; 2 = 6-10; 3 = 11-30; 4 = 31-49, and 5 = > 50 browned infection sites caused by nematodes.

Figure 1. Columbia root knot nematode, race 1, damage to Russet Burbank and two potato breeding lines grown in presence (+NS) or absence (-NS) of hairy nightshade in field trials near Prosser, WA.