

Plant Pathology Field Trial Results 2007

Plant Diagnostic Clinic Report Nematode Assay Service Report

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The enclosed reports are a compilation of the plant pathology experiments conducted in Delaware during the 2007 growing season. The data presented in these reports are not to be used as disease control recommendations. Some of the fungicides or varieties tested are not currently labeled or available commercially. Contact your local Extension office for current information on disease control recommendations.

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ROSE (*Rosa* sp. 'Tropicana')
 Black spot; *Diplocarpon rosae*
 Powdery mildew; *Podosphaera pannosa*

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Evaluation of fungicides for the control of black spot and powdery mildew of rose, 2007.

This field trial was conducted at the University of Delaware Botanic Garden in Newark, DE. Bare root hybrid tea roses were planted in the spring of 2001 in a Matapeake silt loam soil, 4 ft apart on center. Each plot consisted of two plants; pairs were 8 ft apart on center and rows were spaced 10 ft apart. Experimental design was a randomized complete block with three two-plant replications per treatment. Weeds were controlled with glyphosate and Surflan as needed, and the beds were mulched with composted woodchips for additional weed control and water conservation. No supplemental irrigation was supplied. Each rose plant was fertilized twice during the season, spring and mid-summer with 6 oz 10-20-20. Japanese beetles were controlled by five annual applications of lamdacyhalothrin (Battle WP) or carbaryl (Sevin SC) as needed. Fungicides were applied to run-off with a CO₂-powered backpack sprayer equipped with a single-hollow cone nozzle (D4 and D-45 core) at 50 psi. Fungicide applications were initiated on 15 May and repeated every 14 days ending 20 Aug. There were no symptoms of black spot or powdery mildew at the time of the first application. The plots were rated on 25 Jun, 16 and 31 Jul, and 24 Aug. Disease assessments were made by rating the percent leaves infected or defoliated for each disease for each plant per replication and taking an average of the two plants per replication. .

The growing season was dry with low humidity early in the season and returned to normal in May, before the test was initiated. The weather was favorable for black spot except July through mid- August when it became very dry. Powdery mildew developed early in June and severity fluctuated the rest of the season depending on the weather conditions. BAS 516 was very effective for control of black spot. BAS 595 controlled black spot early in the season but by the last rating black spot control had reached an unacceptable level. All the BAS 516 treatments for black spot were better than the unsprayed control. Eagle 40 WP provided the best powdery mildew control on 31 Jul. Although the foliage ratings reflect some of the infection, powdery mildew was present on many of the new shoots, leaves and flower pedicels at an objectionable level. No phytotoxicity was observed for any treatment in this test, but the 12.5 oz rate of BAS 516 did leave a noticeable white residue on the treated leaves.

Treatment and rate /100 gal	% black spot infected leaves			% powdery mildew infected leaves	
	16 Jul	31 Jul	24 Aug	25 Jun	31 Jul
BAS 516 04 F 38WG 12.5 oz.	0.0 a *	0.0 a	0.7 ab	5.3 a	8.0 bc
BAS 516 04 F 38WG 8 oz + 4 fl oz					
Latron B-1956	0.0 a	0.3 a	4.0 bc	2.0 a	5.0 ab
BAS 516 04 F 38WG 12.5 oz + 4 fl oz					
Latron B-1956	0.0 a	0.0 a	3.3 abc	3.3 a	8.6 bc
BAS 516 08 F 28WG 7 oz	0.0 a	0.0 a	5.0 c	5.0 a	6.3 bc
BAS 516 08 F 28WG 9 oz	0.0 a	0.0 a	4.0 bc	5.6 ab	7.3 bc
BAS 595 16 F 1.67 SC 6 fl oz.	2.0 a	7.6 a	65.6 d	14.0 c	10.7 c
Eagle 40WP 6 oz + 4 fl oz Latron B-1956	0.0 a	0.0 a	0.0 a	1.7 a	1.7 a
Control	29.3 b	53.3 b	89.6 d	11.7 bc	8.0 bc

* Means within a column followed by the same letter are not significantly different, Fischer Protected LSD (P=.05)

BEAN (BABY LIMA) (*Phaseolus lunatus* 'Eastland')
Downy Mildew; *Phytophthora phaseoli* race E

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Evaluation of fungicides for the control of downy mildew of baby lima bean, 2007.

Fungicides were tested for control of downy mildew of baby lima bean at the University of Delaware's Experiment Station Farm in Newark, DE. The baby lima bean cultivar Eastland was planted on 18 Jul with a commercial four-row Monosem planter. Dual Magnum 7.62E (1.75 pt/A) and Pursuit 2SC (1.0 oz/A) were applied pre-emergence for weed control. The soil type was a Matapeake silt loam soil and nitrogen (30 lb/A) was side-dressed after seedling emergence on 3 Aug. Seeding rate was 4-5 seeds/ft but the final stand was 19 plants/ 10 ft. This stand was half of the recommendation for commercial fields, but like soybeans, lima beans will compensate for reduced plant numbers without yield loss. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of three sprayed rows, 20 ft long and spaced 30 in. apart. A single border row separated each plot. On 7 and 17 Sep each 20 ft row was inoculated with 100 ml of a sporangial suspension (10^3 /ml) of *Phytophthora phaseoli*, race E, in the evening using a Solo backpack sprayer. After the first inoculation the plots were misted daily with a low pressure misting system equipped with low volume misting nozzles. The system was operated intermittently from 4 PM until nightfall daily to increase leaf wetness duration and favor infection. Supplemental drip irrigation was provided when needed throughout the growing season. Fungicides were applied five times on 6, 14, 24 Sep and 1, 8 Oct using a backpack CO₂ pressurized sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with four hollow cone nozzles (D4 disks, no. 45 cores) spaced 18 in. apart. On 16 and 17 Oct, the middle 10 ft of the center row of each plot was hand pulled and evaluated for percentage of infected plants (presence of infection on the raceme, petiole or pod). Pods were removed from those plants and the percentage of infected pods, total number of pods/10 ft, and yield were determined. Yield was determined by measuring the fresh weight of harvested pods that had harvestable seed or would have had harvestable seed. Shriveled infected pods without seeds that would have been shelled were discarded before weighing.

The disease severity in the field was high and uniform this season due to ideal temperatures after inoculation plus added misting and irrigation. The best control of downy mildew was provided by the fungicides Revus, Revus plus Ridomil Gold/Copper, MetaStar plus Kocide 3000, Phostrol, and Fungi-Phite and the calcium product Calci-Phite. All the copper hydroxide treatments provided better control of downy mildew on the pods than the control. The top fungicides for downy mildew control also had the highest fresh weights, followed by the copper fungicides (Kocide 101, Kocide 2000, Kocide 3000 and Champ DP), which were significantly better than the control. Phytotoxicity was observed at harvest on all the copper treatments as dark mottling of foliage especially on the oldest leaves.

Treatment and rate/A	Incidence (%) of downy mildew ^z		No. pods/10 ft	Wt. of pods/10 ft (grams)
	Plants	Pods		
Untreated control	100.0 a ^y	78.50 a	732 f	1062 e
Kocide 2000 54 DF 2.0 lb (A,B,C,D,E ^x)	97.8 a	25.87 bc	963 e	3023 d
Kocide 3000 46 DF 1.3 lb (A,B,C,D,E)	96.6 a	28.75 b	1014 cde	3375 d
Kocide 101 77W 2.4 lb (A,B,C,D,E) . . .	89.5 b	14.22 d	991 de	3341 d
Champ DP 2.0 lb (A,B,C,D,E)	100.0 a	21.02 c	1062 bcde	3555 cd
Revus SC 5.5 fl oz + 16 fl oz NIS (A,B,C,D,E)	7.4 ef	0.40 gh	1182 abcd	4751 ab
Revus SC 5.5 fl oz + 16.0 fl oz NIS (A,C,E), Ridomil Gold/Cu 65WP 2.0 lb (B,D)	17.4 de	0.70 gh	1210 abc	4651 ab
MetaStar 2 EC 6.4 fl oz + Kocide 3000 1.3 lb (A,B,C,D,E)	45.1 c	3.65 e	1215 ab	4873 ab
Fungi-Phite 2.0 qt (A,B,C,D,E)	1.2 g	0.05 h	1331 a	5234 a
Calci-Phite 4 qt (A,B,C,D,E)	25.6 d	2.52 ef	1095 bcde	4212 bc
Fungi-Phite 2 qt (A), Calci-Phite 4.0 qt (B,C,D,E)	15.3 de	0.85 fg	1312 a	5212 a
Phostrol 6.69L 2.0 pt (A,B,C,D,E)	3.8 fg	0.25 gh	1258 ab	4870 ab

^zData were transformed from percentages by arcsin√, analysis of variance was performed and means were converted back to the percentages which are represented in the table.

^y Application timings. A= 6 Sep, B=14 Sep, C=24 Sep, D= 1 Oct and E= 8 Oct

^x Means followed by the same letter are not statistically different from each other (Fisher's Protected LSD, P=0.05).

Evaluation of fungicides for control of downy mildew on pickling cucumbers, 2007.

The experiment was conducted on a Pepperbox loamy-sand soil at the Carvel Research and Education Center near Georgetown, DE. The experiment was arranged as a randomized complete block design with four replications. Plots were 7.5 ft wide and 20 ft long. Cucumbers were direct seeded in rows spaced 30 - in. apart with 3-in. between plants within the row on 5 Aug. Fungicide applications were initiated on 14 Aug (first true leaf expanded) before any symptoms were seen on the plants, but present in an adjacent field. Downy mildew was observed at low incidence on 23 Aug. Subsequent applications were made on 23, 30 Aug and 10 Sep using a CO₂ pressurized backpack sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with 4 hollow cone nozzles (D4 disks, no. 45 cores) spaced 18 in. apart. Each plot was bordered by three untreated rows. Disease severity was measured on 9 Sep and at harvest on 17 Sep by estimating the percent of infected leaf area per plot. A 15 ft-long section of the middle row of each plot was hand harvested once on 17 Sep to simulate mechanical harvest which is the standard harvest method in the region. Cucumbers were graded according to size and quality. The weight of crooks and nubs (small and misshapen fruit) was subtracted from the total yield weight to obtain marketable yield. The average minimum and maximum temperatures during the trial were 64°F and 85°F respectively. The plot received a total 3.8 inches of rainfall, and supplemental overhead irrigation was provided as necessary.

Despite periods of hot, dry weather during the trial, downy mildew severity was very high by harvest and the yields of the untreated control plots reflected that. All of the fungicide programs except Bravo Weather Stik 6SC 3.0 pt provided significant control of downy mildew compared to the untreated control. All treatments except Phostrol and Bravo Weather Stik produced marketable yields greater than the untreated control. It was interesting to note that there was a significant difference in yield for Previcur Flex + Bravo alternated with Tanos plus Manzate depending on which fungicide pair was applied first. There were no symptoms of phytotoxicity for any treatment.

Treatment and rate/A	Marketable Yield (bu/A)*	Total Yield (bu/A)*	% Crooks & Nubs*	% Infected leaves**	
				9 Sep	17 Sep
Tanos 50 DF 8 oz + Manzate Prostick 75 DG 3.0 lbs alt. w/ Previcur Flex 6F 1.2 pts + Bravo Weather Stik 6SC 2.0 pt	177 a	268 a	36.1 ab	3.0 ab	18.8 ab
Previcur Flex 6F 1.2 pts + Bravo Weather Stik 6SC 2.0 pts alt. w/ Ranman 3.33 SC 2.75 fl oz + Bravo Weather Stik 6 SC 2.0 pt	158 ab	233 ab	31.2 a	1.7 ab	16.3 ab
Ranman 3.33 SC 2.75 fl oz + Manzate Prostick 75DF 3.0 lbs alt. w/ Bravo Weather Stik 6SC 3.0 pts	114 abc	219 ab	51.7 abc	10.0 cd	26.8 ab
Tanos 50 DF 8.0 oz + Manzate Prostick 75 DF 3.0 lb alt. w/ Curzate 70 DF 3.2 oz + Bravo Weather Stik 6 SC 1.5 pt	106 abc	192 abc	49.0 ab	0.5 a	21.3 ab
Previcur Flex 6F 1.2 pts + Bravo Weather Stik 6 SC 2.0 pts alt. w/ Tanos 50 DF 8.0 oz + Manzate Prostick 75DF 3.0 lb	75 bc	169 bc	58.1 bc	4.5 abc	31.3 bc
Phostrol 6.69L 4.0 pt + Bravo Weather Stik 6SC 2.0 pt	57 cd	117 cd	52.1 abc	7.5 bc	21.3 ab
Bravo Weather Stik 6SC 3.0 pt	51 cd	163 bc	70.5 c	13.7 d	41.3 c
Untreated control	3 d	70 d	97.5 d	22.5 e	75.0 d
LSD				5.9	12.6
p-value	0.0056	0.0023	0.0013	<0.0001	<0.0001

*Mean values separated using multiple t-tests, means within the column followed by the same letter are not significantly different.

**Mean values within a column followed by the same letter are not significantly different according to Fisher’s protected least significant difference (LSD) test.

Southern Region IPM Downy Mildew Project
Gerald Holmes NCSU
Project Director

Cooperators:

Delaware: Bob Mulrooney, Ed Kee and Emmalea Ernest,
Cooperative Extension
Dept of Plant and Soil Sciences

Other cooperating states included Florida, Georgia, South Carolina, New York and Michigan

Two Part Project:

- Pathotype determination of *Pseudoperonospora cubensis*, the causal agent of downy mildew of cucurbits
- Determination of fungicide resistance in this new strain which infects cucumbers

Pathotype Determination

Objective: To determine which cucurbit hosts are infected and to pinpoint the time of infection on these hosts.

Methods:

Seed of 12 cucurbit differentials was sown (Table 1) in peat pots soil-less potting mix in early June. Depending on the number of seeds we had per differential we planted extra seeds to give us enough for 5 good transplants per differential. Transplants were set in the field when plants had 2 true leaves in late June. Plants were spaced 2 ft apart within rows and rows were spaced 20 ft apart with 20 ft alleys between plots. The plots were established in Newark on the Experimental Station Farm and in Georgetown at the Carvel REC.

Results:

Newark

Infection on cucumber 'Marketer 430' - September 7

Georgetown

Infection on cucumber 'Marketer 430' - Aug 6

Infection on Cucurbita pepo var. Texana- Sept 6

Infection on Curcurbita maxima var. Goliath- Sept 6

Table 1. Cucurbitaceae differential set for the determination of pathogenic variability in *Pseudoperonospora cubensis* (from Lebeda , A. and Widrlechner, M.P. 2003)

No.	Taxon	Cultivar name	Common name	Expected growth habit	Country of origin
1	<i>Cucumis sativus</i>	Marketer 430	Slicing cucumber	Compact	USA
2	<i>C. melo</i> subsp. <i>melo</i>	Ananas Yokneam	Cantaloupe	Compact	Israel
3	<i>C. melo</i> var. <i>conomon</i>	Baj-Gua	Honeydew	Compact	Japan
4	<i>C. melo</i> var. <i>acidulous</i>		Bitter melon	Compact	Myanmar
5	<i>Cucurbita pepo</i> var. <i>pepo</i>	Dolmalik	Squash	Med. Vine	Turkey
6	<i>Cucurbita pepo</i> var. <i>texana</i>	NA	Squash	Med. Vine	USA
7	<i>C. pepo</i> var. <i>fraterna</i> *	NA	Squash	Med. Vine	Mexico
8	<i>C. maxima</i>	Goliáš	Winter squash	Med vine	Czechoslovakia
9	<i>Citrullus lanatus</i>	Malali	Watermelon	Med vine	Israel
10	<i>Benincasa hispida</i>	NA	Wax gourd	Long vine	USA
11	<i>Luffa cylindrica</i>	NA	Luffa	Long vine	?
12	<i>Lagenaria siceraria</i>	NA	Bottle gourd	Long vine	?

NA = Not available; ? = Unknown

Fungicide Resistance :

Objective: To document the field performance of pyraclostrobin- and mefenoxam-based fungicides. Laboratory studies are being conducted towards the same end.

Results: full report follows.

CUCUMBER (*Cucumis sativus* ‘Lafayette’)
Downy mildew; *Pseudoperonospora cubensis*

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Evaluation of fungicides for control of downy mildew on hand-harvested pickling cucumbers, 2007.

The experiment was conducted on a Pepperbox loamy-sand soil at the Carvel Research and Education Center near Georgetown, DE. The experiment was arranged as a randomized complete block design with four replications. Cucumbers were direct seeded in rows spaced 5 ft apart and 20 ft long with 3 in. between plants within the row on 5 Aug. Fungicide applications were initiated on 14 Aug (first true leaf expanded) before any symptoms were seen on the plants, but present in an adjacent field. Downy mildew was observed at low incidence on 23 Aug. Subsequent applications were made on 23, 30 Aug and 6, 11, 17 Sep using a backpack CO₂ pressurized sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with 4 hollow cone nozzles (D4 disks, no. 45 cores) spaced 18 in. apart. Each plot was bordered by an untreated row. Disease severity was measured on 11 Sep and at the last harvest on 26 Sep by estimating the percent of infected leaf area per plot. A 15 ft-long section of the plot was hand harvested on 17 and 26 Sep. Cucumbers were graded according to size and quality. The weight of crooks and nubs (small and misshapen fruit) was subtracted from the total yield weight to obtain marketable yield. The average minimum and maximum temperatures during the trial were 64 °F and 85 °F respectively. The plot received a total 3.8 inches of rainfall, and supplemental overhead irrigation was provided as necessary.

Despite periods of hot, dry weather during the trial, downy mildew severity was very high by harvest time and the yields of the untreated control plots reflected that. One of the goals of the test was to verify that the new strains of downy mildew that are present in DE are resistant to mefenoxam (Ridomil Gold) and pyraclostrobin (Cabrio). This test was conducted in conjunction with other cooperating states in the US to ascertain the distribution of these fungicide resistant strains of *P. cubensis*. There was no control provided by either of these two fungicides. The other two fungicide alternations tested were very effective in protecting plants and producing good yields and are industry standards where these resistant strains are present. There were no symptoms of phytotoxicity for any treatment.

Treatment and rate/A	Marketable Yield (bu/A)	Total Yield (bu/A)	% Crooks & nubs *	% Infected foliage	
				11 Sep	26 Sep
Previcur Flex 6F 1.2 pts + Bravo Weather Stik 6SC 2.0 pts alt. w/ Ranman 3.33 SC 2.75 fl oz + Bravo Weather Stik 6 SC 2.0 pt	203.8 a **	281.9 a	40.0 b	16.2 a	23.7 a
Tanos 50 DF 8 oz + Manzate Prostick 75 DG 3.0 lbs alt. w/ Previcur Flex 6F 1.2 pts + Manzate Prostick 75 DG 3.0 lbs . .	225.0 a	306.5 a	40.0 b	12.5 a	25.0 a
Ridomil Gold 4EC 4.0 fl oz	0.5 b	43.2 b	99.5 a	43.7 c	82.5 b
Cabrio 20 EG 14.0 oz	2.3 b	49.7 b	96.2 a	32.5 b	83.7 bc
Control	0.2 b	31.3 b	99.2 a	43.7 c	88.7 c
LSD (P=.05)	31.5	41.2	4.8	5.8	5.0

* Data were transformed from percentages by arcsin√, analysis of variance was performed and means were converted back to the percentages which are represented in the table.

**Mean values within a column followed by the same letter are not significantly different according to Fisher’s protected least significant difference (LSD) test.

Fungicide Trial for Control of Asian Soybean Rust, 2007.

This test was conducted at the University of Delaware Research and Education Center near Georgetown, DE. The test was conventionally planted Jun 4 at a rate of 150,000 seeds/A in an Ingleside sandy loam soil. Each plot consisted of eight 15 in. rows, 30 ft long. Plots were arranged in a randomized complete block design with six replications. Fungicide applications were made on 7 Aug at R3 growth stage with a CO₂ back pack sprayer, 9 ft boom equipped with Tee-Jet DG 8002-VS nozzles applying 20 gal/A at 52 psi. A foliar health rating was made at late R6 and no differences could be detected visually between treatments. There was some Septoria brown spot present at the time the evaluation was made. A maturity rating was made 27 Sep at R7 to see if any of the fungicide treatments would delay maturity, which has been observed with strobilurin fungicides applied at R3. The harvest stem rating was made 15 Oct prior to harvest and rated the amount of discolored stems and pods caused by anthracnose and Phomopsis pod and stem blight. Soybean rust did not occur in DE in 2007. Thirty feet of the middle six rows of each plot were combine-harvested on 17 Oct and yields adjusted to 13% moisture. Seed samples were collected at harvest to determine if there were any differences in the occurrence and severity of seed diseases, but the seed quality was excellent for all treatments.

The entire season was very dry. The plot area was irrigated as needed to maintain growth and maximize yields. Weather was not favorable for foliar or seed disease development in this test. There were no significant differences in yield. All the strobilurin fungicides (Headline, Quadris, Evito) caused a delay in maturity compared to the control plots. Punch, a triazole fungicide, did not delay maturity. All the fungicides provided significantly better control of stem discoloration compared to the control. No phytotoxicity was observed for any of the treatments.

Treatment and rate/A	% Mature Pods	Harvest stem rating ^a	Yield (bu/A)
Punch 400 EC 4 fl oz	52.5 a ^b	3.2 b	75.6
Punch 400EC 3 fl oz + Headline EC 4.5 fl oz	36.1 b	2.0 a	73.8
Headline EC 6 fl oz + 0.125% NIS	36.1 b	2.2 a	71.8
Quadris SC 6.2 fl oz + 1% COC	32.1 b	3.3 b	73.7
Evito 480SC 5.7 fl oz + 0.25% NIS	36.2 b	2.2 a	74.9
Control	51.7 a	5.8 c	73.6
LSD (P=.05)	12.69	0.53	NS ^c

^a Harvest stem rating. Southern Soybean Disease Workers (0-9) 0= no disease, 9= severely infected

^b Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^c NS= not significantly different

PERFORMANCE EVALUATION OF SOYBEAN CYST NEMATODE RESISTANT ROUND-UP READY SOYBEAN - 2007

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Eight cultivars were evaluated in 2007 for adaptation to Delaware growing conditions and resistance to race 1 of the soybean cyst nematode (SCN). Variety evaluations were conducted at the Research and Education Center near Georgetown in Sussex County. Plots were planted June 6 and followed a previous soybean crop. Plots consisted of five rows, 23 feet long, spaced 15 inches apart. The plots were arranged in a randomized, complete block design with four replications. SCN egg counts were determined by taking soil samples from the middle three rows of each replicate of each variety the day after planting, and taking a 250 cc sample for the sample for each replication. The field was disked before the final soil samples could be taken. Those numbers are not included as well as the reproductive index as was intended. Nineteen feet of all five rows of each plot were combine- harvested November 29.

The season was normal at planting but the rest of the season was very hot and dry. Wet weather late in the season delayed harvesting. The site received some irrigation during the season.

Race1. Soybean Cyst Nematode RoundUp Ready Soybean Variety Performance Summary. Research and Education Center, Sussex County, Georgetown, DE.2007.

Brand	Variety	Yield (bu/A)	Plant height (in.)	Lodging*	SCN egg counts at planting**	SCN Reaction
DeltaPine	J02-11990RR	59	36.4	1.0	1272	R 3,14
DeltaPine	J02-11943RR	52	29.6	1.0	4099	R 3,14
DeltaPine	DP 5634RR	45	32.2	1.0	6581	R 1,3,5
DeltaPine	07- 4950RR	37	27.0	1.0	5861	R 3,14
Unisouth	USG 75M16	36	28.4	1.0	2046	SUS
DeltaPine	DP 5915RR	29	27.4	1.0	4843	R 3,14
DeltaPine	DP 7330RR	21	24.8	1.0	3211	SUS
DeltaPine	DP 6568RR	21	21.6	1.0	4375	R 3,14
DeltaPine	DP 5914RR	12	18.4	1.0	6830	R 3,14
	Average	34.6	27.3	1.0		
	LSD	6.8	1.8			
	% CV	15	5.1			

* Lodging score: 1= all plants erect, 9= all plants lodged

** number of eggs/ 0.5 pt (250 cc) of soil

SOYBEAN (*Glycine max*)
 Soybean cyst nematode:
Heterodera glycines, race 1

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UNIFORM ROUND-UP READY SOYBEAN CYST NEMATODE VARIETY EVALUATIONS, GROUP IV, 2007: Ten numbered lines and two named cultivars were evaluated for adaptation to Delaware growing conditions and resistance to race 1. Variety evaluations were conducted at the Research and Education Center near Georgetown in Sussex County on land known to be infested with race 1 of the soybean cyst nematode (SCN). Plots were planted in a loamy sand soil (sand 82 percent, silt 9 percent, and clay 9 percent) on June 6 following a previous soybean crop. Plots consisted of five rows, 23 feet long, spaced 15 inches apart. The plots were arranged in a randomized, complete block design with four replications. Plots were harvested on Nov 28.

The season was very dry and high preplant SCN egg numbers were responsible for very low yields.

Entry	Yield		Lodging score	Height inches
	bu/a	rank		
AG4103	4.8	8	1	16
DKB 38-52 (SCN)	3.9	9	1	17.3
AG4403 (SCN)	12.5	1	1	18.7
K04-3234RR	5.7	7	1	15.3
S04-3962RR	1.7	12	1	18
SS02- 2176	12.3	2	1	19
SS02- 3770	2.7	10	1	17.5
SS02- 6857	10.9	3	1	18.5
SS03-6903	2.7	10	1	14
SS03-6997	8.5	4	1	15.5
SS03-9235	6.6	5	1	17
SS03-9639	6.6	5	1	17
Average	6.8		1	17.03
LSD (.05)	2.9			1.9
CV %	22.68			5.99

2007 Delaware ipmPIPE Sentinel Plot Survey for Soybean Rust, Soybean Aphid and Legume Viruses

Bob Mulrooney, Extension Plant Pathologist, University of Delaware
Nancy Gregory, Plant Diagnostician, University of Delaware
Joanne Whalen, Extension IPM Specialist
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Sentinel Sites

Seven soybean sentinel plots were established through out the state during early to mid- May (see attached map). These sentinel plots were part of the ipmPIPE and funded through USDA/APHIS/ RMA. The seven sites were the University of Delaware Experiment Station Farm in Newark, the New Castle county Extension Demonstration Farm near Middletown; the Delaware State University Smyrna Outreach and Research Center; a soybean variety testing plot near Felton, which was moved to another field near Harrington due to drought damage; RC Willin Farm, near Seaford; the University Carvel REC near Georgetown, and Murray Farms near Selbyville, DE.

Survey Activities

All sentinel plots were surveyed once per week or every two weeks as soon as the plants had produced leaves. In addition, 100 leaflets were taken from each sentinel site once per week once flowering began. These leaflets (700 total/week) were brought to the Plant Diagnostic Clinic at the University of Delaware where they were incubated for 3 days and examined under a microscope for soybean rust pustules. Surveying of all sentinel plots continued until the soybeans had matured and dropped their leaves. At that time, several full season commercial fields were replaced with late season, double-cropped soybeans to extend the survey season. This year's sentinel sites were planted with both a group III (SS RT3851N) as well as a later maturing Group V variety (SS RT5130N). A Syngenta Spore Tracker Station was also established at the Georgetown REC in the sentinel plot. Slides from that station were sent to the University of Arkansas weekly beginning in July. No soybean rust-like spores were detected in that spore trap. During September and October leaf samples were taken by personnel from the Delaware Department of Agriculture and this contribution is gratefully acknowledged.

Delaware Lab Detection Efforts for Soybean Rust

Asian soybean rust was not detected on soybean or any other host in Delaware in 2007. Leaf samples from sentinel plots in each county were collected over 15 weeks from July 2, 2007 to October 8, 2007. Five to seven sentinel plots were visited each week. Samples consisted of 100 leaflets taken from each plot in the lower canopy of plants. Leaves were incubated in plastic bags at room temperature for a minimum of three days, and then the underside of each leaf was examined under low power of a dissecting microscope. Growth stage was recorded as well as well as foliar diseases and insects present. Data was entered weekly into the ipmPIPE database and the NPDN database.

Early in the season, *Septoria* brown spot, downy mildew and thrips were common. As the weather became drier at the end of July, mites were very prevalent and fungal leaf diseases diminished. Aphids were first noted in the second week in August. Frogeye leaf spot and downy mildew were noted in September, following rain, but *Septoria* was consistently present all season.

Data observations were entered for 94 samples from sentinel plots, consisting of 9400 leaves. Twelve samples were received in the UD Plant Diagnostic Clinic with various symptoms and diagnoses, and soybean rust was not detected in any of those samples. The total number of soybean samples processed was 105 for 2007.

Soybean Aphid (SBA) Survey – 2007

The 2007 Soybean Aphid survey included both sentinel plots and commercial fields (repeated samples). Fields were visited on a weekly basis from early June through mid-August in 2007. Six sentinel plots and five-ten commercial fields were visited each week. When scouting for SBA, twenty plants were selected at random from each plot or field and examined for the presence of soybean aphids. In commercial fields Data collected included plant growth stage and the number of aphids per plant. When populations were at or below 250 aphids per plant, the number per plant was counted. When populations were above 250 per plant, aphid numbers were estimated and categorized as follows: (a) 250-499 per plant; or (b) 500 or more per plant. Data was entered weekly into the IPM PIPE database.

Soybean aphids were first detected during the first week in August in New Castle County. Populations were extremely low due to the extremely dry summer weather conditions. Economic levels were not detected in any of the survey sites. Statewide, approximately one percent of the soybean acreage was sprayed for soybean aphid, primarily as a part of the complex of insect pests present in soybeans. Results of the survey were used to convey information in newsletters regarding soybean aphid populations affecting approximately 60 % of the statewide soybean acreage.

Legume PIPE Survey

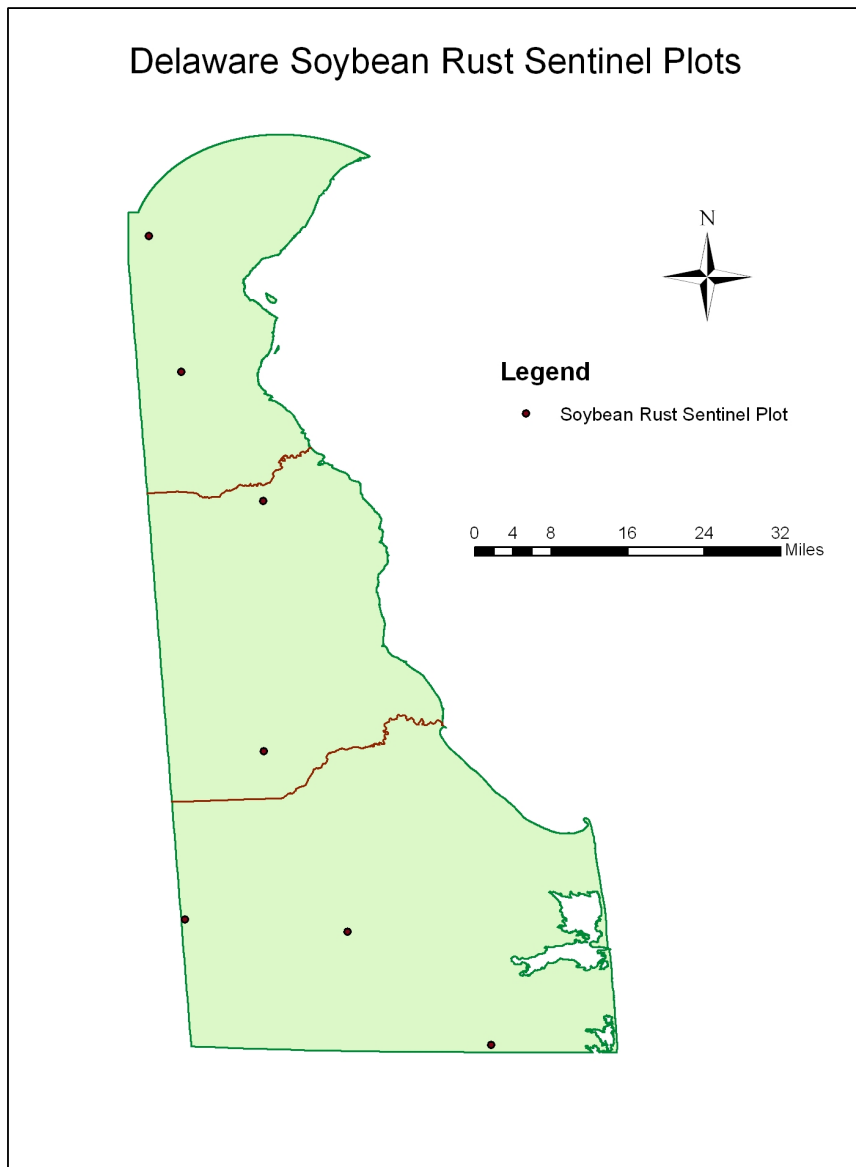
In addition to the soybean rust efforts the ipmPIPE was expanded to include virus detection in soybeans that included 2 sentinel plot sites. Leaf samples for virus detection were taken twice during the growing season. In addition five legume (non-soybean) sentinel plots were identified for disease monitoring during the growing season. One of the objectives was to survey these five legume plots for the occurrence of virus diseases.

Five total plots were established statewide: two in Kent and Sussex County, two of snapbean and two of lima bean. One lima bean plot was planted in New Castle County on the Newark Experimental Station Farm in Newark. Several samples were taken from various legumes at the end of the season that were exhibiting virus-like symptoms and included in the survey. The methodology was a new variation of the ELISA tests that have been commonly used for virus detection. The Tissue Blot Immunosassay (TBIA) for viruses on legumes (soybean and other beans) in 2007 was a modified method piloted (Va Tech & Agdia) to test samples directly from the field. It used a test card containing a nitrocellulose membrane and data recording fields. Solutions of antibody, enzyme conjugates, substrate, and buffer solutions were supplied, along with trays for processing. Each card was used to test for two viruses (bean pod mottle (BPMV) and soybean mosaic (SMV), or bean yellows mosaic (BYMV) and cucumber mosaic (CMV)) depending on host. At each location sampled, leaves were taken at random from 45 plants at early flowering and again at mid-pod. Leaves were blotted onto the membranes after returning to the lab. Each membrane was processed through all solutions and incubation times, then dried and evaluated visually using magnification.

Results from soybean plots from Kent and Sussex in June and August did not indicate either bean pod mottle virus (BPMV) or soybean mosaic virus (SMV) present. However, soybean leaves from two fields in Kent County, Delaware in October, with obvious symptoms of mosaic and mottle, did test positive for BPMV. **This was the first confirmed report of BPMV in Delaware.** Snap bean and lima bean in Sussex County did not test positive for either bean yellows mosaic virus (BYMV) or cucumber mosaic virus (CMV) at either sample time in August or September. Snap bean in Kent County showed a slight positive color reaction at the

second sampling for BYMV and CMV on Sept 21, 2007. Lima bean in New Castle and Kent counties had a slight positive reaction for BYMV and CMV in September, and a strong reaction from the New Castle plot in October for both viruses. The Kent County lima bean plot was not sampled a second time. Late in the season, symptomatic pole lima from the DSU farm in Kent and scarlet runner bean on the Newark, DE farm in New Castle county were sampled. The scarlet runner bean had a strong reaction to both BYMV and CMV, while a faint reaction to BYMV was noted in only one leaf from the DSU pole limas. Results indicate that virus was present in legume fields in Delaware in September and October, and timing of sampling in subsequent years should be adjusted.

2007 Soybean Sentinel Plots



2007 Delaware Plant Diagnostic Clinic Report
UD Cooperative Extension
Department of Plant and Soil Sciences
University of Delaware

Nancy F. Gregory, Plant Diagnostician
Bob Mulrooney, Extension Plant Pathologist

The Plant Diagnostic Clinic at the University of Delaware is housed in the Department of Plant and Soil Sciences, and is located in Townsend Hall, Room 151. The clinic serves the public through Delaware Cooperative Extension and the Master Gardener program, serving commercial growers, nurserymen, gardens, and private homeowners. Some clients are also served directly by the clinic. The clinic is the National Plant Diagnostic Network (NPDN) laboratory for Delaware. The lab is also the plant pathology laboratory for USDA/APHIS CAPS diagnostics and the ipmPIPE lab for Delaware. The clinic operates with two staff, the Plant Diagnostician, the Extension Plant Pathologist, and some part-time student help.

During 2007, the Plant Diagnostic Clinic processed over 650 samples. Those sample numbers include some survey samples for Asian soybean rust and potato cyst nematode. There were 408 routine clinic samples processed. Some samples were diagnosed in field situations, and not brought in for analysis. Phone responses and email requests for information concerning plant problems numbered around 45, in addition to physical specimens submitted to the lab. Soil samples for nematode assays were also processed in the lab, but are not included here. A late freeze in April (following drought in the fall of 2006) and wet spring weather stressed some plants and opened avenues for some pathogens early in the season. Dry weather late in the season exacerbated plant stress, and favored pathogens on many hosts.

Of the 408 routine samples received, the sources were as follows:

Extension*	391	95.8%
Delaware Department of Ag	7	1.7%
University	10	2.5%

*Extension category included all commercial, homeowner, and public garden samples

There were many different diagnoses, from six different crop areas. The crop sources for those were:

Field crops	41	10%
Fruit	19	5%
Ornamentals	262	64%
Turf	22	5%
Vegetables	51	13%
Other*	13	3%

*Other includes greenhouse, home/office, marsh grass, insect, fungus, plant/weed ID

Of the varied diagnoses, pest and pathogen incidence was approximately as follows:

Fungal Diseases	164
Bacterial Diseases	21
Viral Diseases	15
Nematodes	10
Environmental/Physiological	126
Insect (Damage and ID's)	64
Plant/Weed ID	15
Fungal ID	5

Percentages were not determined due to many specimens having more than one diagnosis. For example, insect damage and fungal dieback were common on physiologically stressed trees.

New reports for the year 2007 include Chrysanthemum white rust caused by *Puccinia horiana* on container stock in September. Downy mildew was seen for the first time on *Buddleia* caused by *Peronospora harti*, as well as a leaf spot on sunflower caused by *Septoria helianthi*, and an *Alternaria* leaf spot on collards. The urediniospore and teliospore stage of a *Puccinia* was found on marsh grass (*Spartina patens*). This observation may have been the teliospore stage representing the alternate host for ash rust. A ringspot symptom was observed on ash leaves in July, and presumed to be tobacco ringspot virus, but could not be confirmed by ELISA. *Phomopsis* was found causing a zonate lesion on pepper fruit, similar to that on eggplant. Foliar nematodes were found on interrupted fern (*Osmunda claytoniana*), *Scutellaria*, *Tiarella*, *Trillium* and *Actaea*. Bacterial leaf scorch was confirmed on southern red oak (*Q. falcata*) in the Tabor State Forest. In November, green house micro-green kohlrabi seedlings were diagnosed with downy mildew (*Hyaloperonospora*) and red amaranth seedlings were diagnosed with *Pythium* root rot.

Asian soybean rust was not found in Delaware on any host. Bean pod mottle virus (BPMV) was confirmed on soybean as a part of the national ipmPIPE legume virus survey. This is a **new report** for this virus in Delaware. Foliage diseases on soybean such as brown spot (*Septoria*), downy mildew, and frogeye leafspot caused by *Cercospora soja* were common, but severity was low. Mite damage was extremely high in mid-season as weather became hot and dry. In August, *Alternaria* leaf spot, *Phyllosticta (phaseolina?)* leaf spot and other fungal leaf spots were seen on soybean in conjunction with drought stress and nutritional problems.

Only one sample of ash anthracnose caused by *Puccinia sparganioides* was brought into the clinic, following the large outbreak in 2006. Salt marsh grass (*Spartina*) was examined for the telial stage of ash rust, with one find in a Lewes, DE private yard. A number of samples of *Spartina* were submitted by DE Natural Resources personnel investigating dieback in Delaware coastal zones, but very little was found except some *Pythium*.

Weather conditions in the spring of 2007 were favorable for seedling diseases in row crops and vegetables, with unusually wet conditions promoting bacterial infections. In June, irrigation of corn from pond water led to severe bacterial stalk rot caused by *Pectobacterium (Erwinia)* on young corn plants 1 to 2 foot in height. Stalk rots were common on corn late in the season, and *Colletotrichum* was found associated with the lower nodes of lodged stalks. Fungal leaf spots on corn were at a low level. Wheat leaf rust (*P. recondita*), virus (wheat spindle streak), and *Septoria tritici* were seen in April and May along with barley rust, powdery mildew and spot blotch. In June, *Pythium* root and stem rot was found on peppers and squash, as well as *Verticillium* wilt of okra. In July, bacterial stem and root rot was diagnosed on sweet potato, pith necrosis on tomato, followed by *Cercospora* leaf spot on spinach and basil in September and scurf on sweet

potato in October. Downy mildew on cucurbits appeared in early August but was not as severe as in past seasons.

Notable diseases on ornamentals included evergreens with tip dieback following winter injury. This was often difficult to accurately diagnose, but *Phomopsis*, *Pestalotiopsis*, *Kabatina* and *Seiridium* were among the pathogens found. Rhabdocline was seen on Douglas fir in May, when bacterial blight was diagnosed on lilac, and fire blight became prevalent on pear. From a public garden pest walk, *Alternaria* leaf spot on *Petasites*, *Mycosphaerella* leaf spot on *Leucothoe*, and *Coniothyrium* leaf spot on yucca were all confirmed. *Cylindrocladium* root rot was found on blueberry, as well as *Xanthomonas campestris* causing a leaf spot on oakleaf hydrangea. Later in the season, *Cercospora* leaf spot was found on hydrangeas (including oakleaf), as well as black spot on elm, *Puccinia* on hibiscus and hollyhock, *Coleosporium* rust on goldenrod and bluestar (*Amsonia*), CMV on cardinal flower (*Lobelia*), *Phytophthora* root rot on *Heuchera* and *Leucothoe*, and *Verticillium* wilt of smoke tree (*Cotinus*).

The survey for bacterial leaf scorch (BLS) was continued in 2007 in cooperation with the Delaware Forest Service, and concentrated on state forest lands. The survey revealed that *Xylella fastidiosa* is widespread throughout forest sites in Delaware. Over 20 samples were tested in the Clinic lab by ELISA and all symptomatic samples were positive. Urban species most commonly affected were northern red oak and pin oak. Rural and forest species most commonly affected include northern red oak, black oak, and scarlet oak. Southern red oak was confirmed with *Xylella* for a **new report** in 2007. Willow oak did not appear to be susceptible.

The fifth year survey for rose rosette disease (RRD) indicated the disease to be widespread throughout Delaware on multiflora rose. The find near Milford in Sussex County that marked the southernmost incidence of RRD continues to spread slowly. The 2007 survey concentrated on cultivated plantings of *Rosa* in city street islands and home gardens. RRD was not found in any of the cultivated rose inspected. The disease limits the multiflora host, but doesn't eradicate it, due to the vigorous sprouting of new shoots and new seedlings. RRD may provide some biological control in areas where physical control and herbicides are used.

The UD Plant Diagnostic Clinic gratefully acknowledges the following University of Delaware colleagues who assisted with diagnoses and identifications as Advisory Consultants for samples in 2007:
Brian Kunkel, Tom Pizzolato, Joanne Whalen, John Frett, and Caroline Golt

Nematode Assay Service 2007 Report
Cooperative Extension Service
Department of Plant and Soil Science
University of Delaware

Bob Mulrooney, Extension Plant Pathologist
Nancy Gregory, Extension Plant Diagnostician

The Nematode Assay Service (NAS) at the University is housed in the Department of Plant and Soil Sciences, and is located in Room 151 Townsend Hall. The NAS provides nematode identification and enumeration for soil and plant samples submitted by consultants, growers, researchers, and the gardening public. The NAS provides this service to residents of Delaware and the surrounding states. The clinic operates with two staff, the Extension Plant Pathologist and the Plant Diagnostician, Nancy Gregory, who prepares samples for reading and does soybean cyst egg counts. Currently our fee structure is \$10.00 for either a full larvae screen or soybean cyst nematode (SCN) egg count for both in-state and out-of-state clients.

In addition to our regular soil and root extractions of nematodes, we provide race testing of the soybean cyst nematode, as well as foliar nematode, and pinewood nematode extractions from suspect plant parts.

In 2007, the NAS processed 342 samples, of which 170 were fee samples submitted for analysis. The remainder included 45 research samples, 12 USDA/APHIS CAPS survey samples for False Colombia root knot nematode in potatoes, and 115 USDA/APHIS CAPS survey samples for potato cyst nematode. Ten soil or plant samples came in through the Diagnostic Clinic routine sample queue and 5 (50 %) had damaging levels of plant parasitic nematodes, including pinewood nematode and soybean cyst nematode.

Of these 170 for fee samples submitted for analysis, the crop sources for these were:

Field crops	33	19 %
Fruit	102	60 %
Ornamentals	12	7 %
Vegetables	13	8 %
Turf or Marsh Grass	10	6 %

Twenty-seven (27) or 16% of the samples submitted had nematode levels that were determined to require some control measure.

Nematode species detected in numbers that required control were the soybean cyst nematode, *Heterodera glycines*; southern root knot nematode, *Meloidogyne incognita*; lesion nematode, *Pratylenchus penetrans*; and stubby root nematode, *Trichodorus* sp. Foliar nematode was confirmed for the first time on interrupted fern, *Scutellaria*, *Tiarella*, *Trillium* and *Actaea*. *Meloidogyne arenaria* was found in the soil of Traveler palms shipped to Longwood Gardens. Final reports were saved in a new fill-in pdf form that could be saved on the computer, and printed or e-mailed to the submitter. Control recommendations and fact sheets when appropriate, were included with the report to the submitter.

FY 2007 Delaware Potato Cyst Nematode Survey Final Report

Cooperators: University of Delaware, Delaware Department of Agriculture, USDA-APHIS, PPQ

Project Coordinators:

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Introduction:

The potato cyst nematode (PCN), *Globodera pallida*, is a major pest of potato crops in temperate areas, and is widely distributed in Europe and other potato growing regions in the world. Other affected crops include tomato, eggplant, and some weeds. Losses of up to 80% are possible, on potatoes that exhibit yellowing and wilting of foliage. In North America, the nematode is established in Newfoundland, Canada. In April of 2006, PCN was found in a soil sample collected from a potato processing facility in Idaho. The nematode has the potential to infect potato growing areas in the Eastern U.S. if introduced on soil or seed potatoes. Seed potatoes are the greatest risk source for introduction and contamination. The potato industry requested that USDA-APHIS PPQ supervise a national survey for PCN on certified seed potato and commercial acreage. For this reason, the University of Delaware, in cooperation with Delaware Department of Agriculture (DDA) and PPQ personnel, surveyed field soils with a history of planted potatoes throughout Delaware and will sample any trace forward seed piece sources. The University of Delaware Plant Diagnostic Clinic lab provided nematode assays and diagnostics services.

Methods:

A state-wide survey was conducted beginning July 1, 2007, for the presence of cysts of *Globodera pallida*. Early detection at very low incidence would be crucial to demonstrate areas as free from infestation by *Globodera*. Delaware had an estimated 3700 acres of potatoes planted in 2006. No seed certification potato acreage currently exists in Delaware. Commercial production potato fields were sampled representing the potato-growing counties of New Castle and Kent. A minimum of 10% of acreage based on 2006 planting sites (approximately 3700 acres) was sampled by staff of the Delaware Department of Agriculture (DDA) and PPQ. The CAPS technician and seasonal personnel collected representative soil samples of three 5 lb samples per acre, taken as dips every three feet across a grid. A total of 115 samples were taken. Samples were transported to the University of Delaware Plant Diagnostic Clinic in Newark for testing for the presence of cysts of *Globodera* spp. by centrifugation and sugar flotation. All field sampling and laboratory testing followed the methods approved in the USDA-APHIS, PPQ approved national survey protocols. Any sample with suspect cysts was to be sent to the appropriate confirmatory laboratory (USDA-APHIS, National Identification Services or ARS Nematology Lab, Beltsville) or the regional identifier Grace O'Keefe, at Penn State University. Reports were submitted to the USDA-APHIS State Plant Health Director and included progress reports in the frequency and time frame specified. All survey data was entered into the NPAIS database, as well as the national database for NPDN.

Each field sample was mixed and split, and processed as four laboratory samples representative of 1000 cc of soil from the original. Soil was processed using sieving, centrifugation, and sugar flotation according to the following flow chart protocol:

Centrifugation and Sugar Flotation for *Globodera* Cysts Delaware 2007

- a. Prepare 680 g sucrose dissolved in 1 liter of water (340 g/500)
- b. 1000 cc soil mixed in bucket with water, soak 20 min. Each sample produces 4 sub-samples
- c. Mix, pour over No. 20 sieve over clean bucket, separate into 2 buckets, rinse
- d. Allow to settle 10 sec, pour half over No. 60 sieve
- e. Wash from No. 60 into a clean labeled 50 ml beaker, repeat with other half
- f. Pour from 50 ml beaker into clean 50 ml centrifuge tube, even levels
- g. Centrifuge at 400 g (1410 rpm) for 5 min
- h. Carefully decant supernatant from tubes and discard
- i. Add 25 ml sucrose solution and mix thoroughly
- j. Centrifuge at 400 g for 1 min
- k. Decant over a No. 70 sieve, rinse off sucrose thoroughly
- l. Rinse from sieve into lined filter paper and put in petri dishes
- m. Examine samples under dissecting scope, look for nematode cysts, and count. Maintain sample ID and record keeping. Rinse and clean thoroughly between samples.

Results and Discussion:

No suspect cysts of *Globodera pallida* were found in any Delaware potato soil debris recovered from processing of soil samples. It was not necessary to send any samples for verification by the regional identifier. Results data was entered into an Excel data file (Table 1). Results included numbers of cysts observed of *Heterodera* that were presumed to be soybean cyst nematode (SCN), *Heterodera glycines*. Specific identification would have required examination of larvae or DNA analysis. Information was sent to cooperating growers regarding *Heterodera* cysts found, as that may impact soybean variety planting decisions. No cysts resembling *Globodera* were observed in any of the soils. The data indicates that this representative sampling of potato acreage finds no infestation by the potato cyst nematode in Delaware.

Table 1.

<u>Potato Cyst Nematode 2007</u>			
<u>Sample Number</u>	<u>County</u>	<u>Results</u>	<u>Date Completed</u>
PCN07DE001-B-001	New Castle	Negative	Aug-07
PCN07DE001-B-002	New Castle	Negative	Aug-07
PCN07DE001-B-003	New Castle	Negative	Aug-07
PCN07DE001-B-004	New Castle	Negative	Aug-07
PCN07DE001-B-005	New Castle	Negative	Aug-07
PCN07DE001-B-006	New Castle	Negative, 1 <i>Heterodera</i> (empty)	Aug-07
PCN07DE001-B-007	New Castle	Negative	Aug-07
PCN07DE001-B-008	New Castle	Negative	Aug-07
PCN07DE001-B-009	New Castle	Negative, 1 <i>Heterodera</i> (empty)	Aug-07
PCN07DE001-B-010	New Castle	Negative, 2 <i>Heterodera</i> (empty)	Aug-07
PCN07DE001-B-011	New Castle	Negative	Aug-07
PCN07DE001-B-012	New Castle	Negative, 2 <i>Heterodera</i> (empty)	Aug-07
PCN07DE001-B-013	New Castle	Negative	Aug-07
PCN07DE001-B-014	New Castle	Negative	Aug-07
PCN07DE001-B-015	New Castle	Negative	Aug-07
PCN07DE002-E-001	Kent	Negative, 9 <i>Heterodera</i>	9/10/2007
PCN07DE002-E-002	Kent	Negative	9/10/2007
PCN07DE002-E-003	Kent	Negative, 12 <i>Heterodera</i>	9/10/2007
PCN07DE002-E-004	Kent	Negative, 11 <i>Heterodera</i>	9/10/2007
PCN07DE002-E-005	Kent	Negative, 6 <i>Heterodera</i>	9/10/2007
PCN07DE002-E-006	Kent	Negative, 9 <i>Heterodera</i>	9/10/2007
PCN07DE002-E-007	Kent	Negative, 15 <i>Heterodera</i>	9/12/2007
PCN07DE002-E-008	Kent	Negative, 19 <i>Heterodera</i>	9/12/2007
PCN07DE002-E-009	Kent	Negative, 36 <i>Heterodera</i>	9/12/2007
PCN07DE002-E-010	Kent	Negative, 16 <i>Heterodera</i>	9/24/2007
PCN07DE002-E-011	Kent	Negative, 9 <i>Heterodera</i>	9/24/2007
PCN07DE002-D-001	Kent	Negative, 14 <i>Heterodera</i>	10/10/2007
PCN07DE002-D-002	Kent	Negative, 4 <i>Heterodera</i>	10/10/2007
PCN07DE002-D-003	Kent	Negative, 5 <i>Heterodera</i>	10/10/2007
PCN07DE002-D-004	Kent	Negative, 5 <i>Heterodera</i>	10/10/2007
PCN07DE002-D-005	Kent	Negative, 7 <i>Heterodera</i>	10/22/2007
PCN07DE002-D-006	Kent	Negative, 5 <i>Heterodera</i>	10/22/2007
PCN07DE002-D-007	Kent	Negative, 2 <i>Heterodera</i>	10/22/2007
PCN07DE002-D-008	Kent	Negative	10/22/2007
PCN07DE002-D-009	Kent	Negative, 11 <i>Heterodera</i>	10/24/2007
PCN07DE002-D-010	Kent	Negative, 2 <i>Heterodera</i>	10/24/2007
PCN07DE002-D-011	Kent	Negative, 4 <i>Heterodera</i>	10/24/2007
PCN07DE002-D-012	Kent	Negative	10/24/2007
PCN07DE002-D-013	Kent	Negative, 2 <i>Heterodera</i>	10/29/2007
PCN07DE002-D-014	Kent	Negative, 1 <i>Heterodera</i>	10/29/2007
PCN07DE002-D-015	Kent	Negative, 3 <i>Heterodera</i>	9/17/2007
PCN07DE002-D-016	Kent	Negative	9/17/2007
PCN07DE002-D-017	Kent	Negative, 5 <i>Heterodera</i> , weed seeds	9/19/2007
PCN07DE002-D-018	Kent	Negative	9/17/2007
PCN07DE002-D-019	Kent	Negative	9/24/2007
PCN07DE002-D-020	Kent	Negative, 4 <i>Heterodera</i>	9/19/2007
PCN07DE002-D-021	Kent	Negative, 2 <i>Heterodera</i>	10/3/2007
PCN07DE002-D-022	Kent	Negative, 2 <i>Heterodera</i>	10/3/2007

PCN07DE002-D-023	Kent	Negative, 6 <i>Heterodera</i>	10/3/2007
PCN07DE002-D-024	Kent	Negative	10/8/2007
PCN07DE002-D-025	Kent	Negative	10/8/2007
PCN07DE002-D-026	Kent	Negative	10/8/2007
PCN07DE002-D-027	Kent	Negative	10/8/2007
PCN07DE002-D-028	Kent	Negative	10/29/2007
PCN07DE002-D-029	Kent	Negative, 5 <i>Heterodera</i>	10/29/2007
PCN07DE002-D-030	Kent	Negative, 4 <i>Heterodera</i>	10/29/2007
PCN07DE002-D-031	Kent	Negative, 8 <i>Heterodera</i>	10/29/2007
PCN07DE002-D-032	Kent	Negative, 2 <i>Heterodera</i>	10/30/2007
PCN07DE002-D-033	Kent	Negative, 6 <i>Heterodera</i>	11/19/2007
PCN07DE002-D-034	Kent	Negative, 3 <i>Heterodera</i>	11/19/2007
PCN07DE002-D-035	Kent	Negative	11/19/2007
PCN07DE002-D-036	Kent	Negative	11/20/2007
PCN07DE002-D-037	Kent	Negative, 2 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-038	Kent	Negative, 3 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-039	Kent	Negative, 9 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-040	Kent	Negative	11/20/2007
PCN07DE002-D-041	Kent	Negative, 4 <i>Heterodera</i>	11/6/2007
PCN07DE002-D-042	Kent	Negative, 4 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-043	Kent	Negative	11/20/2007
PCN07DE002-D-044	Kent	Negative, 5 <i>Heterodera</i>	11/14/2007
PCN07DE002-D-045	Kent	Negative, 8 <i>Heterodera</i>	11/14/2007
PCN07DE002-D-046	Kent	Negative	11/14/2007
PCN07DE002-D-047	Kent	Negative	11/16/2007
PCN07DE002-D-048	Kent	Negative, 1 <i>Heterodera</i>	11/16/2007
PCN07DE002-D-049	Kent	Negative	11/16/2007
PCN07DE002-D-050	Kent	Negative	11/19/2007
PCN07DE002-D-051	Kent	Negative, 4 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-052	Kent	Negative, 1 <i>Heterodera</i>	11/20/2007
PCN07DE002-D-053	Kent	Negative, 5 <i>Heterodera</i>	11/26/2007
PCN07DE002-D-054	Kent	Negative	11/26/2007
PCN07DE002-D-055	Kent	Negative, 2 <i>Heterodera</i>	11/26/2007
PCN07DE002-D-056	Kent	Negative	11/19/2007
PCN07DE002-D-057	Kent	Negative	11/26/2007
PCN07DE002-C-001	Kent	Negative	10/31/2007
PCN07DE002-C0-02	Kent	Negative, 2 <i>Heterodera</i>	11/2/2007
PCN07DE002-C-003	Kent	Negative	10/31/2007
PCN07DE002-C-004	Kent	Negative	11/2/2007
PCN07DE002-C-005	Kent	Negative	11/2/2007
PCN07DE002-C-006	Kent	Negative	10/31/2007
PCN07DE002-C-007	Kent	Negative	10/31/2007
PCN07DE002-C-008	Kent	Negative	10/31/2007
PCN07DE002-C-009	Kent	Negative	11/6/2007
PCN07DE002-C-010	Kent	Negative	11/6/2007
PCN07DE002-C-011	Kent	Negative	11/12/2007
PCN07DE002-C-012	Kent	Negative	11/6/2007
PCN07DE002-C-013	Kent	Negative	11/12/2007
PCN07DE002-C-014	Kent	Negative, 1 <i>Heterodera</i>	11/12/2007
PCN07DE002-C-015	Kent	Negative	11/12/2007

PCN07DE002-C-016	Kent	Negative	11/6/2007
PCN07DE002-C-017	Kent	Negative	11/12/2007
PCN07DE002-C-018	Kent	Negative	11/5/2007
PCN07DE002-C-019	Kent	Negative, 2 <i>Heterodera</i>	11/5/2007
PCN07DE002-C-020	Kent	Negative	11/5/2007
PCN07DE002-C-021	Kent	Negative	11/5/2007
PCN07DE002-C-022	Kent	Negative	11/7/2007
PCN07DE002-C-023	Kent	Negative	11/7/2207
PCN07DE002-C-024	Kent	Negative, 1 <i>Heterodera</i>	11/7/2007
PCN07DE002-C-025	Kent	Negative	11/7/2007
PCN07DE002-C-026	Kent	Negative	11/14/2007
PCN07DE002-C-027	Kent	Negative	11/14/2007
PCN07DE002-A-001	Kent	Negative	11/28/2007
PCN07DE002-A-002	Kent	Negative	11/28/2007
PCN07DE002-A-003	Kent	Negative	11/28/2007
PCN07DE002-A-004	Kent	Negative	11/28/2007
PCN07DE002-A-005	Kent	Negative	11/28/2007

**USDA/APHIS CAPS Fiscal Year 2007
Delaware Karnal Bunt of Wheat Survey
Final Report**

Cooperators: University of Delaware
State: Delaware
Project: Karnal Bunt of Wheat Survey

Project Coordinators:

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I. Introduction

Karnal bunt is a fungal disease of wheat and triticale (a hybrid of wheat and rye). The disease is caused by the fungus *Tilletia indica* Mitra. Typically, only a portion of the wheat kernel is affected, hence the disease is also called partial bunt. The disease is most severe when the weather is cool and wet at the time the wheat is heading out. The first discovery of Karnal bunt in the United States was in Arizona in March, 1996. Additionally, limited wheat growing areas of California, New Mexico, and Texas were regulated because of association with Karnal bunt infected seed or grain produced in the infested areas in Arizona. In 1997, Karnal bunt was also discovered in San Saba County, Texas. In succeeding years in the regulated areas, Karnal bunt was found at low levels. Karnal bunt was not found in national surveys conducted annually in other wheat growing counties in the United States. In the harvest season of 2001, wheat fields in additional Texas counties were found to be infected. Regulatory quarantines were further imposed to protect US wheat export markets. Karnal bunt has minimal effect on quality and yield of wheat. The disease can be managed by use of clean seed treated and appropriate agricultural practices. The processing of grain used for consumption often kills *Tilletia* spores and grain used for consumption is not a risk for the spread of Karnal bunt. A survey in Delaware of harvested grain was done to detect any possible infestation with *Tilletia*, and support the ability of Delaware to grow and ship grain not infected.

II. Methods and Results:

Wheat grain harvested in all three counties of Delaware was sampled for the presence of Karnal bunt between July 1 and July 30, of 2007. The protocol for wheat grown for grain in Delaware called for an examination of the grain for bunted kernels. Four samples representative of the three Delaware counties were collected by the staff of the Delaware Department of Agriculture at the grain mills, comprising a composite of all wheat from Delaware growers. Processing of samples within Delaware was done by the University of Delaware Plant Diagnostician in Newark. The protocol found in the most recent APHIS-PPQ Karnal Bunt Survey Procedures Manual was followed. The protocol included handling of samples in a reception area, followed by analysis in a lab under clean conditions. One 500

ml aliquot of grain from each 4 pound sample was examined using a stereomicroscope for the presence of bunted kernels. No kernels were found that appeared bunted. Dry weather resulted in very low levels of any fungi found on the grain. No samples were sent to the PPQ National Identifier (Mary Palm) in Beltsville. All results were recorded and the State Survey Coordinator entered data into NAPIS database on August 21, 2007. All material was disposed of as per project guidelines.

No *Tilletia indica* infected kernels or spores were observed in any of the wheat sampled. Individual sample specimens were recorded as follows:

Sample DE-S-07-701 – Perdue Farms, Seaford, Sussex County - **no Karnal bunt**, < 1% black point and scab

Sample DE-S-07-702 – Mountaire Farms, Millsboro, Sussex County – **no Karnal bunt**, < 1% black point and scab

Sample DE-K-07-703 – Mountaire Farms, Harrington, Kent County – **no Karnal bunt**, very clean overall

Sample DE-N-07-704 – Peavey Grain Company, Townsend, New Castle County – **no Karnal bunt**, < 1% black point and scab

USDA/APHIS CAPS Delaware Survey FY 2006-2007
False Colombia Root Knot Nematode (*Meloidogyne fallax*)
University of Delaware

Cooperators: University of Delaware, Delaware Department of Agriculture, USDA/APHIS PPQ

Project Coordinator:

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Introduction:

The false Colombia root knot nematode (*Meloidogyne fallax*) is a pest of potato and other crops, primarily in Europe. Due to the wide host range and geographic distribution of this pest, introduction into the United States is a possibility. A survey was done in 2006 and 2007 to detect possible presence of this nematode pest on potato acreage in Delaware. Potato production has declined in Delaware in recent years, with only five active growers remaining on 3,500 acres.

Methods and Results:

Soil sampling was done at the end of the growing season in potato fields that had been vine-killed or newly harvested. Samples were taken by personnel from the Delaware Department of Agriculture and the CAPS coordinator. Multiple cores were taken in rows close to the potato root zone. Twenty-one samples were taken in 2006 and twelve samples taken in 2007 for a total of thirty-three samples, representative of the potato acreage in all three Delaware counties. Composite samples from each 20 acre field section were placed in a cooler and transported to the lab at the University of Delaware Plant Diagnostic Clinic and Nematode Assay Program in Newark Delaware. Samples were split and half reserved for submission to expert identifiers if suspicious *Meloidogyne* larvae were found.

In the lab, 250 cc of soil was mixed with water in a bucket and sieved through #40 over #325 sieves, to capture larvae. Larvae and debris were then washed into a modified Baermann funnel apparatus and allowed to settle for 48 hours. After that time, larvae that had migrated and settled were examined in a dish under the dissecting microscope. Larval counts were done and documented in the standard nematode assay report from the University of Delaware. Four samples contained larvae suspected to be *Meloidogyne* species. For those four samples, the remaining split soil sample was sent to the lab of Dr. Thomas Powers at the University of Nebraska for further determination. No *Meloidogyne* juveniles were confirmed in any of the four samples. A report on other nematode species and numbers present in the soil was received from Nebraska.

The 2006-2007 survey and soil sampling indicated no detection of the False Colombia root knot nematode, *Meloidogyne fallax*, in Delaware potato acreage.