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Plant Pathology Field Trial Results 2009
Plant Diagnostic Clinic Report
Nematode Assay Service Report

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- Thanks to Emmalea Ernest for input on lima bean and cucumber production and harvesting.
- Mr. Dwight Myer and Delaware State University for a sentinel plot at the Smyrna Outreach and Research Center.

The enclosed reports are a compilation of the plant pathology experiments conducted in Delaware during the 2009 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*

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Evaluation of fungicides available for homeowners for the control of black spot of hybrid tea rose, 2009.

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 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 two applications of carbaryl (Sevin SC) as needed. Fungicides were applied to run-off with a CO_2-powered backpack sprayer equipped with a single-hollow cone nozzle (D4 and D-45 core) at 50 psi. Fungicide applications were initiated on 12 May and repeated every 12-14 days ending 3 Jul when the unsprayed plots were almost defoliated for a total of 5 sprays. Latron-B1956 spreader-sticker was added to all treatments except Daconil which contains an adjuvant already. There were no symptoms of black spot at the time of the first application. The plots were rated on 23 Jun and 7 Jul..

The growing season was cool and wet which was very favorable for black spot. At this two week spray interval only Infuse, Funginex, Daconil, and Dithane provided acceptable control of black spot. The best treatments Spectracide Immunox contains the systemic fungicide myclobutanil, Ortho RosePride contains the systemic fungicide triforine, and Infuse contains the systemic fungicide propiconazole while Daconil and Dithane are protectant, non-systemic, broad spectrum fungicides. Daconil and Dithane T/O applications left an unsightly residue that might be considered objectionable by some gardeners. Wettable sulfur and the Bonide Liquid Copper fungicide left a residue initially but it did not persist until the next treatment. Wettable sulfur and copper are two treatments that would be considered organic but did not control black spot using the two week spray interval. All the treatments were significantly better than the unsprayed control. No phytotoxicity was observed for any treatment in this test.

Treatment and rate/ gallon	% Defoliation and black spot infected foliage	
	23 Jun	7 Jul
Spectracide Immunox 1 fl oz.	2.5 a *	12.5 ab
Daconil Weather Stik 1 tsp.	2.5 a	8.7 ab
Dithane T/O 75WP 1 tbl.	12.5 b	17.5 b
Bonide Wettable Sulfur 2.0 tbl.	41.7 c	77.5 cd
Ortho RosePride Disease Control 1.0 tbl. .	5.3 ab	13.3 ab
Bonide Liquid Copper Fungicide 1.5 tbl. . .	38.3 c	75.0 c
Bonide Infuse 2.0 tbl.	0.0 a	3.7 a
Untreated control	63.3 d	90.0 d

* 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 applied curatively for the control of downy mildew of baby lima bean, 2009.

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 6 Jul with a commercial four-row Monosem planter in the same field planted in lima bean the previous year. 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. Nitrogen (30 lb/A) was applied as a side-dressed application on 27 Jul. Seeding rate was 4-5 seeds/ft. 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. Supplemental trickle irrigation was needed only once early after planting. Naturally infected plants were observed on 26 Aug. Infection was initiated from overwintering oospores from the previous season's epidemic before the first treatments were applied. In previous testing seasons, infection never occurred unless inoculated intentionally but the cooler and wetter season was very favorable for natural infection. Fungicides were applied curatively four times on 26 Aug, and 2, 8 and 15 Sep using a backpack CO_2 pressurized sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with four hollow cone nozzles (ConeJet TXVS-18) spaced 18 in. apart. On 7 and 8 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. Fresh weight was determined by measuring the fresh weight of harvested pods that had harvestable seed or what would have had harvestable seed. On 9 Oct the pods were shelled and the shelled weight of the lima beans was recorded.

The disease severity in the field was very high and uniform due to cooler ideal temperatures and above normal rainfall in Aug, Sep, and Oct. The best treatments for downy mildew control were Omega 500F at both rates, Ranman 400SC, Presidio 4SC and Revus 2.08SC. In most cases, the level of control was reflected in the increased fresh weight and shelled weight of beans. This was the second season of testing of Omega, Ranman and Revus and the first trial with Presidio. Omega has a section 3 label for use on lima bean to control white mold and the addition of downy mildew would provide one fungicide that would control two of the most important diseases in this region. This was the first trial looking at the effectiveness of Tanos 50DF alternating with Kocide 3000 46DF and it was not as effective as the previously mentioned products but significantly better than the control. Previcur Flex 6F provided no control of downy mildew under the conditions of this test. Copper fungicides alone have never provided adequate control of downy mildew under very high disease pressure especially when applied curatively. Ridomil Gold/Copper is the industry standard in the region and did not perform as well curatively in this test as the best products mentioned previously. No phytotoxicity was observed for any of the fungicides tested.

Treatment, rate/A and application timing[z]	Incidence (%) of downy mildew[y] Plants	Pods	No. pods/10 ft	Fresh weight of pods/10ft (lbs)	Shelled Weight Lbs/A
Tanos 50DF 8.0 oz + Kocide 3000 46DF 1.25 lb/A (A,C) Kocide 3000 46 DF 1.25 lb (B,D)	91.6 b[x]	27.5 bc	513 d	1,764.3 d	1,563.9 cd
Tanos 50 DF 10.0 oz + Kocide 3000 46DF 1.25 lb/A (A,C) alt. w Kocide 3000 46DF 1.25 lb (B,D).	92.7 b	35.7 c	516 d	1,728.3 d	1,458.4 cd
Kocide 3000 46DF 1.25 lb (A,B,C,D).	90.7 b	37.3 c	376 d	1,173.5 d	970.7 de
Ridomil Gold/Copper 65WP 2.0 lb (A,C) . .	88.3 b	24.1 b	689 c	2,694.3 c	2,579.4 b
Omega 500F 5.5 fl oz. (A,B,C,D).	16.2 a	1.0 a	861 ab	3,515.3 ab	3,068.7 ab
Omega 500F 8.0 fl oz (A,B,C,D)..	17.0 a	0.7 a	924 ab	3,641.3 ab	2,758.5 ab
Ranman 400SC 2.75 fl oz + Silwet 2.0 fl oz (A,B,C,D)	17.3 a	1.2 a	1,007 a	3,943.5 a	3,486.1 a
Presidio 4SC 4.0 fl oz (A,B,C,D)..	34.4 a	2.7 a	810 bc	3,085.8 bc	2,253.2 bc
Revus 2.08SC 5.5 fl oz + NIS .25% (A,B,C,D). . . .	29.7 a	2.4 a	818 bc	3,303.3 bc	2,558.6 b
Previcur Flex 6F 1.2 pt (A,B,C,D)..	74.9 b	56.3 d	145 e	308.0 e	175.9 e
Control	96.5 b	67.2 d	216 e	345.5 e	228.7 e

[z]Application dates A=26 Aug, B=2 Sep, C= 8 Sep, D= 15 Sep
[y] 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.
[x]Means followed by the same letter are not statistically different from each other (Fisher's Protected LSD, P=0.05).

BEAN (BABY LIMA) (*Phaseolus lunatus* 'C-elite Select')
Downy Mildew; *Phytophthora phaseoli* race F

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Evaluation of fungicides for the control of downy mildew of baby lima bean, 2009.

Fungicides were tested for control of downy mildew of baby lima bean at the University of Delaware's Carvel Research and Education Center in Georgetown, DE. The baby lima bean cultivar C-elite Select was planted on 7 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 loamy sand soil and nitrogen (30 lb/A) was side-dressed three weeks after seedling emergence. Seeding rate was 4-5 seeds/ft. 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 3 Sep each 20 ft border row was inoculated and on 15 Sep each center treatment row was inoculated by spraying to saturation with a sporangial suspension (10^3/ml) of *Phytophthora phaseoli*, race F, in the evening using a Solo backpack sprayer. After the first inoculation the plots were misted nightly with a low pressure misting system equipped with low volume misting nozzles. The system was operated intermittently from 4 PM until midnight daily to increase leaf wetness duration and favor infection. Once the epidemic was established, misting was applied during periods of low rainfall and low humidity only. Supplemental overhead irrigation was provided when needed throughout the growing season. Fungicides were applied four times on 1, 9, 15, and 21 Sep using a backpack CO_2 pressurized sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with four hollow cone nozzles (ConeJet TXVS-18) spaced 18 in. apart. On 5 and 6 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. On 6 Oct the pods were shelled and the fresh shelled weight of the lima beans was recorded.

The disease severity in the field was moderate and uniform in 2009 due to ideal cool temperatures after inoculation, added misting, and regular rainfall. All the treatments provided good control of downy mildew and significantly better control than the unsprayed control. No phytotoxicity was observed for any of the fungicides tested.

Treatment, rate/A and application timing[z]	Incidence (%) of downy mildew[y]			Shelled Weight
	Plants	Pods	No. pods/10 ft	Lbs/A
Tanos 50DF 8.0 oz + Kocide 3000 46DF 1.25 lb (A,C) Kocide 3000 46 DF 1.25 lb (B,D)	51.3 ab[x]	4.4 b	720 a	3,548.4 a
Tanos 50 DF 10.0 oz + Kocide 3000 46DF 1.25 lb (A,C) alt. w Kocide 3000 46DF 1.25 lb (B,D) .	40.7 b	3.7 b	735 a	3,582.0 a
Kocide 3000 46DF 1.25 lb (A,B,C,D).	49.2 b	5.0 b	583 b	3,319.8 a
Ridomil Gold/Copper 65WP 2.0 lb (A,C)	36.2 b	2.4 b	747 a	3,868.3 a
Forum 4.17F 6.0 fl oz (A,B,C,D).	46.6 b	3.6 b	773 a	3,769.1 a
Control	79.1 a	23.8 a	393 c	1,725.4 b

[z] Application dates A=1 Sep, B=9 Sep, C= 15 Sep, D= 21 Sep

[y] 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.

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

2009 Delaware Legume ipmPIPE Sentinel Plot Survey for Diseases and Insects

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Joanne Whalen, Extension IPM Specialist, University of Delaware

Five legume (non-soybean) sentinel plots were identified for disease and insect 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 each in Kent and Sussex County of snapbean and lima bean. One lima bean plot was planted in New Castle County on the Newark Experimental Station Farm in Newark. 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 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 on snap bean and lima bean: bean yellows mosaic (BYMV) and cucumber mosaic (CMV). At each location sampled, leaves were taken once at random from 45 plants at either 4 – 6 weeks post planting or at early to 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. Additional testing kits were available for bean pod mottle, therefore several soybean samples with possible symptoms were also included in this project.

Snap beans and lima beans sampled in the statewide survey did not test positive for bean yellows mosaic virus (BYMV) but a few leaves did test positive for cucumber mosaic virus (CMV). The Newark (New Castle County) lima bean plot (baby lima bean cultivar 'Eastland') had a very low incidence of plants with virus symptoms which were negative when tested by TBIA. Leaf samples from these same plants were sent to Agdia, Inc. for ELISA testing using their bean screen. Two viruses, alfalfa mosaic virus (AMV) and peanut stunt virus (PSV) were identified singly from different plants in the Newark plot sampled on November 11, 2009. Leaves with mosaic and mottle were submitted to Agdia and AMV and PSV were confirmed.

Diseases that were observed were noted and recorded in the data base. Bacterial blight and bacterial brown spot were observed on snapbean and lima bean. Lima beans were infected with low levels of anthracnose, Cercospora blight, and Cercospora leafspot. Downy mildew caused by Phytophthora phaseoli occurred naturally in the Newark research plot. Phytophthora capsici was identified from several fields in Kent and Sussex lima bean fields as well as P. phaseoli. Only race F of P. phaseoli was identified in 2009 in DE.

Insect Survey

Two legume sentinel plots in Sussex County, DE (one snap bean and one lima bean) and three commercial fields in Kent County, DE (two snap bean and one lima bean field) were sampled for soybean aphids for a 4 week period from mid-July through mid-August. Data collected included plant growth stage and number of aphids per plant. Data was also collected on commonly occurring bean insect pests twice per season (late vegetative and early/mid pod-fill stages). Insects detected including thrips, lygus bugs and potato leafhopper. Data collected included plant growth stage and presence/absence of insect pests. Standard sampling protocols were used including observation of leaf samples and sweep samples. Soybean aphids were not detected in any of the sentinel plots or commercial fields. Low levels of thrips and leafhoppers were detected in all locations.

Delaware ipmPIPE Legume Virus TBIA Analysis 2009

Site Name		Crop	Date Sampled	# Leaves	SMV	BPMV	BYMV	CMV
1.	DESussex04snapbean	Snapbean	7/29/2009	25			0	0
2.	DENewCastle02Lima	Lima bean	9/10/2009	45			0	2
3.	DESussex05Lima	Lima bean	9/9/2009	45			0	0
4.	DEKent_Berg_soybean	Soybean	9/21/2009	45	0	0		
5.	DENewCastle_Outten_soybean	Soybean	9/15/2009	45	0	0		
6.	DEKent04snapbean	Snapbean	9/15/2009	45			0	0
7.	DEKent03Lima	Lima bean	9/22/2009	45			0	2
8.	DENewCastle_Baker_soybean	Soybean	9/25/2009	50	0	0		
9.	DESussex Tatman soy	Soybean	10/11/2009	15	0	5		
10.	DEKent Stites_soy	Soybean	10/11/1009	10	0	0		
11.	DEKent-SORC-soy	Soybean	10/16/2009	41	0	0		
12.	DENewCastle	Lima bean	11/11/2009	8	Pos AMV			
13.	DENewCastle	Lima bean	11/11/2009	8	Pos PSV			

CUCUMBER (*Cucumis sativus* 'Palamino')
Downy mildew; *Pseudoperonspora cubensis*

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Evaluation of fungicides for control of downy mildew on pickling cucumbers, 2009.

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 11 Aug. This is a very late planting date for picking cucumbers in the region. Fungicide applications were initiated on 21 Aug (one true leaf present) but no visible lesions were present. Infected cucurbits were present in other fields on the research station. Downy mildew was observed at low incidence on 28 Aug at the 3-leaf stage. Subsequent applications were made on 28 Aug and 4, 12, 21 Sep using a backpack CO_2 pressurized sprayer that delivered 30 gal/A at 52 psi. Applications were made with a broadcast boom equipped with 4 hollow cone nozzles (ConeJet TXVS-18) spaced 18 in. apart. Each plot was bordered by an untreated row. By the third fungicide application 4 Sep noticeable stunting was evident on the untreated plots. A subjective plant health rating (6= very good, 1= poor) was made to assess the amount of healthy foliage present at the time of the rating on 21 Sep. A 15 ft-long section of the middle row of each plot was hand harvested once on 2 Oct to simulate mechanical harvest which is the standard harvest method in the region. Cucumbers were graded according to size and quality. The plot was irrigated as necessary to maintain growth, but not excessively, to avoid promoting fruit rot and foliar infection.

The severity of downy mildew and the late planting date resulted in very low yields and very poor plant growth. The best yields, vine length, and plant fresh weight were recorded for the treatments that began at the one-true leaf stage and were followed with the most effective fungicide, Presidio, applied consecutively. Under the conditions of this test Previcur Flex appears to be losing effectiveness when alternated with Tanos. Ranman appears to have activity but at a reduced level compared to Presidio. The best treatments were the two that included Presidio or Tanos at the one true leaf stage followed by Presidio. The data would suggest that initial infection occurred prior to or shortly after the one true- leaf stage. There were no symptoms of phytotoxicity for any treatment.

Treatment, rate/A and timing**	**Marketable Yield (g/15 row ft)**	**Vine Rating***	**Vine length (inches)**	**Plant fresh wt (grams)**
Presidio 4SC 4 fl oz + Bravo Weather Stik 6SC 2 pts (A,B,D), Previcur Flex 6F 1.2 pt + Bravo Weather Stik 2 pt (C,E)	969.0 a***	5.0 b	19.1 a	1979.0 a
Presidio 4SC 4 fl oz + Bravo Weather Stik 6SC 2 pt (B,C,E) Previcur Flex 6F 1.2 pt + Bravo Weather Stick 6SC 2 pt (D)	319.5 c	4.25 cd	16.9 b	1658.0 b
Tanos 50DF 8 oz + Manzate Prostick 75DG 1.5 lb (A,D), Presidio 4SC 4 fl oz + Bravo Weather Stik 6SC 2 pts (B,C,E)	913.4 a	5.75 a	20.8 a	2169.0 a
Ranman 6F 2.75 fl oz + Bravo Weather Stik 6SC 2 pt (A,C,E) Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (B,D) . . .	0.0 c	3.25 ef	13.3 de	858.0 d
Ranman 6F 2.75 fl oz + Bravo Weather Stik 6SC 2 pt (B,D) Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (C,E) . . .	69.5 bc	4.0 d	14.6 cd	1205.0 c
Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (A,C,E), Ranman 6F 2.75 fl oz + Bravo Weather Stik 6SC 2 pt (B,D)	53.0 bc	3.75 de	16.4 b	1324.0 c
Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (A,D), Previcur Flex 6F 1.2 pt + Bravo Weather Stick 6SC 2 pt (B,C,E).	0.0 c	2.75 fg	12.0 ef	751.0 d
Previcur Flex 6F 1.2 pt + Bravo Weather Stick 6SC 2 pt (A,C,E) Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (B,D)	2.5 c	2.0 h	10.8 f	663.0 d
Previcur Flex 6F 1.2 pt + Bravo Weather Stick 6SC 2 pt (B,D) Tanos 50DF 8 oz + Manzate Prostick 75DF 1.5 lb (C,E)	0.0 c	2.25 hg	12.0 ef	738.0 d
Ranman 6F 2.75 fl oz + Bravo Weather Stik 6SC 2 pt (A-E)	83.0 bc	4.75 bc	16.2 bc	1290.0 c
Untreated control	0.0 c	1.0 i	7.5 g	169.0 e

*Vine health rating 1-6 (1= poor, 6= very good)
**Treatment applications: A= 21 Aug, B= 28 Aug, C= 4 Sep, D= 12 Sep, E= 21 Sep.
***Mean values within a column followed by the same letter are not significantly different according to Fisher's protected least significant difference (LSD) test.

2009 ipmPIPE Downy Mildew on Cucurbits Project

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Project Objective

Our primary objective is to document when and where cucurbit downy mildew occurs. Our secondary objective is to determine which hosts are infected by the downy mildew fungus and at what level of severity.

Pathotype Determination

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

Methods:

Seed of seven cucurbit differentials was sown (Table 1) into peat pots with soil-less potting mix in early June to produce 15 good transplants per differential. Transplants were set in the field in late June when plants had 2 true leaves. Plants were spaced 2 ft apart within rows and rows were spaced 10 ft apart. The plots were established on black plastic mulch with drip irrigation at the Experimental Station Farm in Newark, and at the Carvel REC near Georgetown in early June.

Results:

Newark Sentinel Plot:

7/29- 'Straight Eight' cucumber, 7/31- 'Poinsett 76' cucumber, 8/6 – butternut squash, watermelon, 8/16 – acorn squash, yellow summer squash

Georgetown Sentinel Plot

7/13- Cucumber Straight Eight, 7/20 – Poinsett 76, 8/12- butternut squash, 8/15- watermelon, 8/24- acorn squash, yellow summer squash.

No infection was detected on 'Big Max' pumpkin or 'Hales Best Jumbo' cantaloupe.

Table 1. Cucurbits for ipmPIPE sentinel plots 2009.

No.	Species	Cultivar name	Common name	Description
1	*Cucumis sativus*	Straight Eight	Slicing cucumber	DM senstivie
2	*Cucumis sativus*	Poinsett 76	Slicing cucumber	DM resistant
3	*Cucumis melo*	Hales Best Jumbo	Cantaloupe	
4	*Cucurbita pepo*	Table Queen	Acorn squash	
5	*Cucurbita maxima*	Big Max	Giant pumpkin	
6	*Cucurbita moschata*	Waltham butternut	Butternut squash	
7	*Citrullus lanatus*	Micky Lee	Watermelon	Round, seeded

Basil Downy Mildew Monitoring Program- 2009

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Introduction

Downy mildew of basil is a new, destructive disease that is expected to occur routinely in the USA as it has been doing in Europe since first occurrence. Downy mildew was reported as severe at many farms in the northeast USA in 2008, the first year it was observed in this region. Growers generally did not realize their basil had a disease because the most noticeable symptom on affected plants was yellowing, which was assumed to be the result of a nutritional problem.

With basil downy mildew now established in Florida, a monitoring program was started conducted starting in 2009 to determine whether this pathogen can move northward through the eastern USA as can occur with the cucurbit downy mildew pathogen, and whether a monitoring program can assist growers to be prepared for downy mildew occurrence in their basil crop. The success of this activity depends on reports from anyone growing basil.

2009 Results

In 2009 a formal monitoring activity was conducted as an add-on to the ipmPIPE cucurbit downy mildew monitoring program **(http://cdm.ipmpipe.org)**. For this program, sentinel plots with various cucurbit crop types are grown throughout the eastern USA, from FL and TX to NY and WI, and routinely examined for symptoms of downy mildew. There were 83 sentinel plots in 2008. Basil was grown at many of the sentinel plots in 2009 including Delaware.

Two monitoring sites were established in Delaware in 2009, one near Redden, DE in Sussex County and the other on the Newark Experimental Station Farm in New Castle County. Transplants were grown in the greenhouse in Newark and 10 plants were planted at the two sites in early June. The plants were monitored weekly for the presence of downy mildew. Downy mildew was never detected at the Sussex County site, but detected in Newark August 10, 2009.

In addition to the sentinel plots several other sites in DE reported downy mildew on basil. Basil plants from a retail store near Lewes, DE were confirmed with basil downy mildew (BDM) on June10. Another reliable report of BDM from the Lewes area in Sussex County was made on July 15.

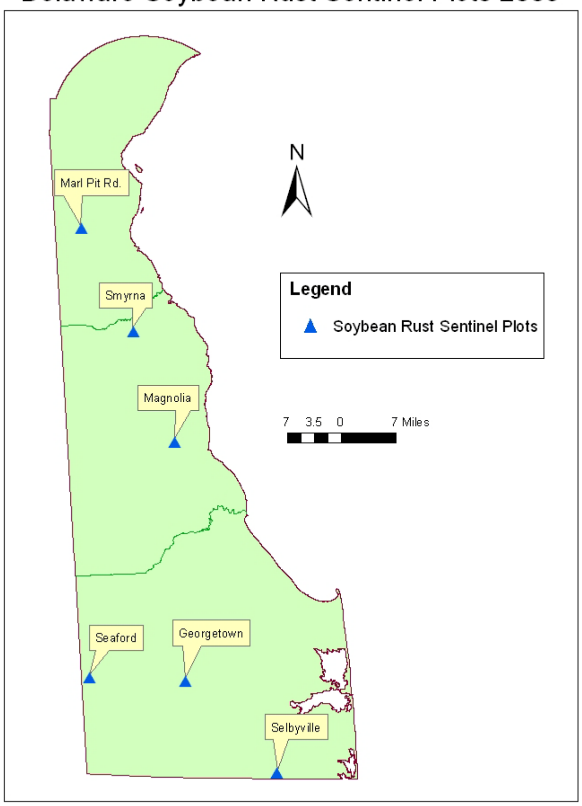
2009 Delaware ipmPIPE Sentinel Plot Survey for Soybean Rust and Soybean Aphid

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

Sentinel Sites

Six soybean sentinel plots were established throughout the state during early June (see attached map). These sentinel plots were part of the ipmPIPE and funded through North Central Soybean Research Project (NCSRP). The six sites were, a soybean variety testing plot near Middletown, DE; the Delaware State University Smyrna Outreach and Research Center; a soybean variety testing plot near Magnolia; a grower field near Seaford; the University Carvel REC near Georgetown, and a soybean variety testing plot near Selbyville, DE.

Delaware Soybean Rust Sentinel Plots 2009



Survey Activities

All sentinel plots were surveyed every two weeks when the plants began flowering, 100 leaflets were taken from each sentinel site. These leaflets (600 total/week) were brought to the Plant Diagnostic Clinic in Newark, where they were incubated for 3 days and then examined under a dissecting microscope for soybean rust pustules. Surveying of all sentinel plots continued until the soybeans had matured and dropped their leaves. The plots were planted with various Group IV RR and SCN resistant varieties and two sites one near Seaford and another at the REC, were planted with a Group VII variety 'USG7732NRR'.

Delaware Lab Detection Efforts for Soybean Rust

Asian soybean rust was not detected on soybean or any other host in Delaware in 2009. Leaf samples from sentinel plots in each county were collected over ten weeks from August 8, 2009 through October 12, 2009. Five to six sentinel plots were visited every other week. Samples consisted of 100 leaves 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 into the ipmPIPE database and into the NPDN database at the end of the season.

Early in the season, Septoria brown spot, downy mildew and thrips were common. Due to the cool and wet season, mites were not prevalent. Bacterial blight (*Xanthomonas*) and soybean aphid were observed beginning in the end of August. Phyllosticta leaf spot and downy mildew continued to be noted in September along with some Cercospora blight and frogeye leaf spot. *Septoria* brown spot was consistently present all season.

Data observations were entered for 32 samples from sentinel plots, or approximately 3200 leaves. Twenty one (21) 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 53 (32 sentinel plus the 21 Clinic). The cooperative survey and detection system planned in 2004 and implemented yearly has been a valuable tool for Delaware soybean growers, communicated through Weekly Crop Update. If soybean rust appeared in Delaware in a given season, it would be detected at low incidence and proper action taken. No control measures were necessary in 2009.

Soybean Aphid Survey

The 2009 Soybean Aphid survey included both sentinel plots and commercial fields. Six sentinel plots and forty one commercial fields were visited on a weekly basis from mid June through the third week in August. Data collected included plant growth stage and the number of aphids per plant. Data was entered into the ipmPIPE database on a weekly basis. Survey results, scouting information and control recommendations were also included in our state wide Weekly Crop Update which was received each week by over 300 clientele.

Soybean aphids were detected the first week in July in New Castle and Sussex Counties. Soybean aphids were found in 46% of the fields surveyed across all 3 counties. The highest populations occurred in New Castle County and the southwestern corner of Sussex County. Economic threshold levels (250 aphids per plant) were detected in two of the sentinel plots and in 5% of the fields surveyed. Cool, wet weather conditions resulted in a greater percentage of late planted soybeans. These conditions were also favorable to soybean aphid development. Information from this survey was used to alert grower to the higher potential for soybean aphids in 2009 compared to past seasons. This information was used by producers and consultants to intensify scouting on 60% (100,000 acres) of the total statewide acreage. Informal surveys of consultants and growers indicated that although the potential was higher in 2009, approximately 10% of the statewide acreage (18,000 acres) was treated for soybean aphid. In past outbreak years, acres treated where soybeans aphids are part of the insect complex have been as high as 40,000 acres. In many cases, soybeans were in the R-5 stage of crop development when economic levels occurred. In addition, an increase in beneficial activity occurred in many fields. Information from this survey assisted producers to both reduce losses from aphids in areas where economic levels occurred as well as save approximately $10 per acre in reduced insecticide use by using survey information generated as part of the ipmPipe survey and field scouting to determine if populations were increasing in individual fields.

Extension Outreach

A soybean rust update was included in our weekly crop newsletter (24 issues) aptly named "Weekly Crop Update". This is emailed and posted to the web as well as mailed to subscribers. Information from the ipmPIPE website along with our local sentinel plot information was included in the update.

2009 Soybean Cyst Nematode Survey Results

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

Introduction

The soybean cyst nematode (*Heterodera glycines*) is the most limiting biotic factor of soybean production in Delaware. In 1993 and 1994 a major effort was made to survey the soybean acreage for the soybean cyst nematode (SCN) and determine the race composition of the SCN populations present at the time. The Delaware Soybean Board funded this project and the results demonstrated that roughly 60% of the populations that were race tested were race 3 and 30% race 1 and the remainder a mix of races 5, 7, and 9. Since that time Round-Up Ready soybeans were introduced with a single source of resistance to SCN derived from a soybean plant introduction referred to as PI88788. At the time of the first survey we demonstrated a significant yield reduction in one variety trial where race 3 resistant soybeans were planted in a field known to be infested with race 1. This was the first indication that not all race 1 populations could be controlled with a race 3 or 3, 14 resistant soybean variety. For the past 10 years SCN has not been identified as causing much yield loss because symptoms that were seen previously, namely severe stunting and chlorosis, only seem to be present when a susceptible variety is grown or high egg numbers combined with dry weather at planting occurs when a resistant variety is planted. During the 2008 growing season a small number of soybean fields had stunted plants, chlorosis, and SCN was present on the roots. All of these fields were planted with a Round-Up Ready variety with resistance to SCN. The difference in 2008 was that is was dry from planting through the first thirty days after planting. High SCN egg numbers and dry weather early are known to be very detrimental to early soybean growth and can produce stunting, chlorosis and yield loss.

Within the last 5 years there are indications that race 3 is no longer the predominant race. A small set of samples tested here and those sent to other institutions have tested as race 1. Since the majority of resistance in Round-Up Ready soybeans is from PI88788 which allows reproduction of race 1 populations, these varieties may have reduced effectiveness in suppressing current SCN populations. Other control measures may be needed if the current population structure is no longer predominately race 3. No surveys of SCN have been conducted in Delaware since 1996.

Materials and Methods

Sixty-three soil samples from fields with known history of soybean production with or without known SCN infestations were sampled during the spring summer and fall. Thirteen samples were taken from New Castle County, 22 from Kent and 28 from Sussex. Fields were sampled randomly by taking approximately 25 soil cores in a zigzag pattern to a four to six inch depth and within the row if soybean stubble was present. Samples were placed in plastic bags and stored at 40°F until processed. *H. glycines* cysts were separated from the soil by the wet sieving method. A 250-cm³ sub-sample was taken from the well- mixed soil sample and suspended in water. The suspension was poured through nested 595-over 250- µm pore sieves. Cysts and debris retained on the 250 µm pore (60 mesh) sieve were washed into a large 100-ml polypropylene test tube and the water level increased to 40 ml. A stainless steel bit with 1-mm helical ridges attached to a variable speed stirrer was used to crush the cysts: the stirrer's rheostat was turned to 6,000 rpm while the test tube containing the cysts was held gently against the rotating bit for 60 seconds. Contents of the tube were washed through nested 75-µm-pore (200 mesh) over 25-µm-pore (500 mesh) sieves. Eggs collected on the 25-µm-pore sieve were stained with acid fuchsin. After staining, the egg suspensions were standardized to 100 ml, stirred, and a 5 ml subsample was removed with a pipette for counting. Results were reported as number of eggs per 250 cm³ soil.

For race and HG typing, 14 samples were selected from Kent (4) and Sussex (10) Counties where there were at least >1,000 eggs/250 cm³ of soil (except for one sample from Kent County). Samples were sent by 2-day express to the University of Missouri Extension Nematology Laboratory for analysis. Populations were reared on susceptible soybean for 30 to 40 days in a water bath at 27°C to increase egg numbers and break any egg dormancy. Plant root systems were removed from pots, cysts were collected, and eggs were extracted for use in race and HG Type test. Female Index (FI) was calculated for each soybean line as follows: FI = (mean number of females on test soybean line divided by the mean number of females on the susceptible variety ‘Lee’ X 100.

Results

In this study, 63 soil samples were processed for egg counts. In all, 35 (55.6%) of the samples had detectable populations of SCN. The highest number of eggs detected was 11,448 eggs/ 250cm³ soil, and the lowest was 72 eggs/ 250cm³ soil.

Table 1. Frequency distribution of soil samples among classes of egg counts per 250 cm³ soil (0.5 pt)

Egg Rating	NCC	%	Kent	%	Sussex	%	Statewide %
None 0 eggs	13	100	14	63.8	1	4.0	44.4 (28)
Low 1-499 eggs	0	0	2	9.0	3	10.7	8.0 (5)
Moderate 500-1,499	0	0	1	4.6	6	21.4	11.1 (7)
High 1,500-4,999	0	0	3	13.6	8	28.6	17.5 (11)
Very high 5,000-50,000	0	0	2	9.0	10	35.7	19.0 (12)

Fifteen soil samples(42.8%) of the 35 samples that had cysts were sent for race and HG Typing.

Table 2. Table of Race/HG Tests for SCN populations collected as part of the SCN Survey. 2009.

Sample #	**Indicator Line – Female Index : FI = (mean number of females on test soybean line divided by the mean number of females on the susceptible variety ‘Lee 74’ X 100**								**HG type**	**Race**
	HG 1	HG 2	HG 3	HG 4	HG 5	HG 6	HG 7			
	Peking	PI88788	PI90763	PI437654	PI209332	PI89772	PI548316	Pickett		
30	0%	70%	0%	0%	65%	0%	64%	7%	2.5.7	1
31	18%	65%	0%	0%	81%	0%	64%	73%	1.2.5.7	2
33	1%	67%	0%	0%	70%	0%	67%	15%	2.5.7	5
42	1%	63%	0%	0%	46%	0%	73%	18%	2.5.7	5
44	0%	59%	0%	0%	63%	0%	61%	0%	2.5.7	1
48	0%	80%	0%	0%	46%	0%	67%	1%	2.5.7	1
49	2%	68%	0%	0%	41%	1%	58%	10%	2.5.7	1
50	2%	76%	0%	0%	77%	0%	63%	9%	2.5.7	1
51	11%	75%	1%	0%	66%	0%	90%	27%	1.2.5.7	2
52	7%	62%	0%	0%	66%	0%	74%	29%	2.5.7	5
54	2%	70%	0%	0%	79%	0%	72%	12%	2.5.7	5
57	1%	75%	0%	0%	73%	0%	61%	8%	2.5.7	1
58	0%	63%	0%	0%	72%	0%	85%	3%	2.5.7	1
59	7%	44%	1%	0%	51%	0%	67%	36%	2.5.7	5
63	15%	67%	0%	0%	84%	0%	68%	52%	1.2.5.7	2

The race composition has changed dramatically since 1996. Seven race 1 populations (47%) have been identified, 5 race 5 populations (33%) and 3 race 2 populations (20%). The other alarming result is the high female index (FI) for these populations on PI88788. The range is from 44- 80% of the susceptible variety. The average FI is 67.

Discussion

These results indicate that under adverse growing conditions and high initial egg numbers, stunting and yield loss would be expected if a race 3, 14 resistant variety with PI88788 as its source of SCN resistance is grown here in Delaware. Consequently, growers may need to plant soybean cultivars derived from non-PI88788 resistance sources to successfully manage soybean cyst nematode in the future. This is a problem since there are none that are Round-Up Ready that can be planted at this time. There is little interest in growing conventional soybeans and the varieties that could be grown here are not available in sufficient quantities to satisfy the immediate need. Growers are going to have to manage SCN by judicious variety selection and rotations with non-host crops for the immediate future.

Acknowledgements

This work was supported in part by a grant from the Delaware Soybean Board and is gratefully acknowledged. We thank also Bill Cissel and Joanne Whalen for identifying fields for sampling and collecting samples. Consultants Tom Coleman and Rob Ekholm also provided several soil samples and we thank them as well. We would like to acknowledge the excellent work that Bob Heinz, lab director of the University of Missouri Extension Nematology Laboratory, did performing the race/HG testing on the Delaware SCN populations.

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WHEAT (*Triticum aestivum* 'Southern States SS8302')
Tan spot; *Pyrenophora tritici-repentis*

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Evaluation of fungicides for control of wheat diseases on soft red winter wheat, 2009.

The experiment was conducted on a Matapeake silt loam soil in southern New Castle county near Middletown, DE. The experiment was arranged as a randomized complete block design with four replications. Plots were 10 ft wide and 40 ft long. The wheat cultivar, 'Southern States SS8302', was seeded the previous fall with a grain drill on 7.5 in. spacing following corn. The Feekes growth stage (GS) 6 (jointing) applications were made on 9 Apr and the remaining treatments were made at GS 10 (heads in the boot) on 7 May. Fungicide applications were made using a backpack CO_2 pressurized sprayer that delivered 20 gal/A at 52 psi with a 9 ft boom equipped with Tee-Jet DG 8002-VS nozzles. Disease severity was measured on 8 Jun (late-milk to early dough stage) by assessing the percent of infected leaf area on the flag leaf and the leaf below the flag leaf (F-1). The only disease symptoms present at the time of rating were tan spot caused by *Pyrenophora tritici-repentis.* The plots were trimmed to 34 ft and the center 9 rows were harvested on 7 Jul. Total rainfall for the months of April, May and June was 14.93 in. which is 3.3 in. above the 30 year normal. Trace levels of powdery mildew and late season leaf rust developed. Fusarium head blight (FHB) symptoms were present at 0.5% to 1% severity. There was no apparent treatment effect on the occurrence of FHB that could be assessed visually.

All of the treatments except Kocide 3000 applied at jointing provided significant control of tan spot. The most effective fungicides for control of tan spot were those applied at heading (GS 10). Only Proline significantly increased yield compared to the unsprayed check. The rate of Proline applied in this test is greater than the current labeled rate. There were no significant differences in test weights or symptoms of phytotoxicity for any treatment.

Treatments, timing and rate/A	Symptoms on flag leaf (%) [z]	Symptoms on F-1 (%) [y]	Yield bu/A	Test weight (lb/bu)
Unsprayed control	4.5 d [x]	98.0 d	68.2 bcde	55.0
Kocide 3000 46.1DF 0.75 lb + NIS 0.25% (GS 6)	5.4 d	96.6 cd	66.6 cde	56.8
Headline 2.09EC 3.0 fl oz (GS 6)	3.2 c	86.4 b	68.6 bcde	56.8
Headline 2.09EC 6.0 fl oz (GS 6)	1.9 b	84.6 b	67.5 bcde	56.5
Headline 2.09EC 9.0 fl oz (GS 6)	1.7 b	89.9 bc	71.4 ab	56.5
Kocide 3000 46.1DF 0.5 lb + NIS 0.25% (GS 6) fb[w] Kocide 3000 46.1DF 0.5 lb + NIS 0.25% + Quilt 1.66SC 10.5 fl oz (GS 10)	0.1 a	7.2 a	64.9 e	55.1
Kocide 3000 46.1DF 0.5 lb + NIS 0.25% (GS 6) fb Kocide 3000 46.1DF 0.5 lb + NIS 0.25% (GS 10)	2.0 b	81.5 b	66.3 de	57.4
Tilt 3.6EC 2.0 fl oz (GS 6) fb Quilt 1.66SC 14.0 fl oz (GS 10)	0.0 a	0.6 a	69.2 bcde	56.1
Quilt 1.66SC 14.0 fl oz (GS 10)	0.0a	0.4 a	69.9 bcd	55.2
Proline 4SC 8.2 fl oz + Induce 0.125% (GS 10)	0.0 a	3.9 a	75.0 a	56.6
USF 0731 500SC 2 fl oz + Induce 0.125% (GS 10)	0.0 a	20.1 a	67.5 bcde	54.3
Stratego 2.1EC 10.0 fl oz (GS 10).	0.0 a	1.7 a	68.2 bcde	55.1
Twinline 1.753 EC 9.0 fl oz (GS 10)	0.0 a	0.3 a	70.9 abc	56.2
P value	0.0001	0.0001	0.0006	0.7538
C.V.%	12.4	26.7	4.6	4.2

[z] Data were transformed from percentages by arcsin√, analysis of variance was performed and means were converted back to percentages which are represented in the table.
[y] F-1 = leaf below the flag leaf
[x] Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).
[w] fb = followed by

WHEAT (*Triticum aestivum* 'Southern States SS8302')
Tan spot; *Pyrenophora tritici-repentis*

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Evaluation of Prosaro applied at flowering for control of wheat diseases on soft red winter wheat. 2009.

The experiment was conducted on a Matapeake silt loam soil in southern New Castle county near Middletown, DE. The experiment was arranged as a randomized complete block design with four replications. Plots were 10 ft wide and 90 ft long. The wheat cultivar, 'Southern States SS8302' , was seeded the previous fall with a grain drill on 7.5 in. spacing following corn. The application was made at Feeks GS 10.5 (early flowering) on 20 May. Application was made using a backpack CO_2 pressurized sprayer that delivered 20 gal/A at 52 psi with a 9 ft boom equipped with Tee-Jet DG 8002-VS nozzles. Disease severity was measured on 8 Jun (late-milk to early dough stage) by assessing the percent of infected leaf area on the flagleaf. The only disease present at the time of rating was tan spot caused by *Pyrenophora tritici-repentis.* The plots were trimmed to 85 ft and the center 6.5 ft was harvested on 7 Jul. Temperatures were cooler than normal, and rainfall was abundant during most of the season. Low levels of powdery mildew and some late season leaf rust appeared but were too low to assess. Scab was also present at a low visible amount 0.5% to 1% infected heads. There was no apparent treatment effect on the occurrence of scab that could be assessed visually. DON levels were assessed on samples of the harvested wheat from each plot by ELISA conducted at the Delaware Department of Agriculture.

Prosaro significantly reduced the amount of tan spot on the flag leaves but there was no significant difference in yield, test weight or DON level. The visual level of control with Prosaro 421S compared to the unsprayed control was very dramatic. There was no apparent control of scab at this site. There were no symptoms of phytotoxicity for this treatment.

Treatments and rate/Acre	% Flag leaf infected *	Bu/A (13.5% Moisture)	Test Weight (lb/bu)	DON (ppm)
Unsprayed control	10.67 a **	70.7 a	53.2 a	3.75 a
Prosaro 421S 6.5 fl oz	0.03 b	78.7 a	55.7 a	3.37 a
C.V.%	6.19	6.59	2.75	

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

2009 Delaware Plant Diagnostic Clinic Report
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, including commercial growers, nurserymen, gardens, and private homeowners. 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 employees.

During 2009, the Plant Diagnostic Clinic processed over 700 samples. Those sample numbers include 32 survey samples for Asian soybean rust. There were 625 routine clinic samples processed. Other samples were diagnosed in field situations, and not brought in for analysis. Phone inquiries and email requests for information concerning plant problems numbered around 30, in addition to physical specimens submitted to the lab. Soil samples for nematode assays were also processed in the lab, but are not included in this report. Drought in 2007 and 2008 along with wet weather in 2009 stressed some plants and opened avenues for pathogens early in the season. Excessive rainfall, ten inches above the normal for the season, contributed to plant stress, and favored pathogens, especially bacteria on many hosts.

Of the 625 routine samples received, the sources were as follows:

Extension Non-commercial	329	55%
Extension Commercial	287	44%
Non-extension	5	<1%
Regulatory	4	<1%

Delaware samples accounted for 561 of the total, with 109 from Kent, 162 from New Castle, and 290 from Sussex.

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

Field crops	60	10%
Fruit	71	11%
Ornamentals	322	52%
Turf	23	4%
Vegetables	115	18%
Other*	24	5%

*Other includes home habitat, insect, fungus, plant/weed ID

Of the varied diagnoses, pest and pathogen incidence ranked* as follows:

Environmental/Physiological
Fungal Diseases
Bacterial Diseases
Viral Diseases
Nematodes
Insect (Damage and ID's)
Plant/Weed ID
Fungal ID

*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.

Two USDA quarantine pests were detected. Japanese apple rust caused by *Gymnosporangium yamadae* was confirmed in the telial stage on *Juniperus chinensis* as well as in the aecial stage on crabapple and domestic apple in New Castle County. This was a new report for North America and is under review by the USDA/APHIS New Pest Advisory Group. Chrysanthemum white rust (*Puccinia horiana*), was identified on 7/23/09. Plants were eradicated from an established planting; to date CWR is not established in the United States.

New reports for the year 2009 included downy mildew on basil caused by *Peronospora belbahrii*, *Phoma* causing black rot on beet, CMV and *Septoria* on *Echinacea*, downy mildew on *Rudbeckia*, downy mildew on rose, Cladosporium leaf spot on ginkgo, Kutilakesa (Nectriella) canker on greenhouse gardenia, and cedar quince rust on fruit of Bradford pear. Wheat basal glume rot caused by *Pseudomonas savastanoi* was identified, as well as powdery mildew on mustard and turnip.

Foliage diseases on soybean such as brown spot (*Septoria*) and downy mildew were common. Sudden death syndrome caused by *Fuarium virguliforme* was confirmed in five fields in New Castle County during the last week in August. Bacterial blight, Alternaria leaf spot, Phyllosticta leaf spot, frogeye leaf spot and Cercospora blight were seen during the season. Charcoal rot was found late in the season, along with stem anthracnose. None of these soybean diseases were estimated to be yield limiting.

Weather conditions in the spring of 2009 were favorable for seedling diseases in row crops and vegetables. Cold wet weather in March and April followed by wet conditions in May and June resulted in slow seedling growth, bacterial infections and root rots such as *Ascochyta* on barley and Pythium root rot on corn. Wheat and barley viruses (wheat spindle streak and wheat soil-borne mosaic) were seen in April and May. Also in May, tan spot on wheat caused by *Pyrenophora tritici-repetis* was found and take-all was diagnosed the first week in June. *Cladosporium* was common on spinach. In June, *Pythium*, *Fusarium*, *Ascochyta*, and

Phytophthora root and stem rots were found on peas, tomatoes, peppers and squash. Black rot was diagnosed on cabbage along with Fusarium crown rot. Pythium stem rot continued on tomato throughout the season. Bacterial leaf spot as well as TSWV were confirmed on pepper. Bacterial stalk rot on corn was confirmed. Fungal leaf spots on corn were at a high level, especially leaf rust, gray leaf spot and Northern corn leaf blight. There were numerous samples of head scab on wheat, as well as one severe example of scab on barley. Stalk rots and red root rot (*Phoma terrestris*) were common on corn late in the season, along with ear rots caused by *Diplodia* and *Fusarium*. Late blight was found in two potato fields in July, followed by numerous reports on tomato throughout the remainder of the season. Late blight was prevalent due to favorable weather conditions (cool and wet), but was also due to the sale and distribution of infected tomato plants throughout the Eastern states. Downy mildew on cucurbits appeared in early August. Phytophthora capsici fruit rot was severe on watermelon and pumpkin. Fusarium fruit and crown rot on pumpkins appeared in several locations in August and September. Downy mildew was noted on lima beans and pole limas late in the season, as well as peanut stunt virus and alfalfa mosaic virus.

Notable diseases on fruit included rusts, Blumeriella leaf spot on sweet and sour cherry, anthracnose on grape, and peach leaf curl and scab on peaches. Fire blight was severe on pear. Septoria leaf spot, yellow rust, anthracnose, and virus samples were received on brambles.

Evergreen ornamentals comprised over half of the ornamental samples received, with tip and twig dieback prevalent following two seasons of fluctuating temperatures and drought. This was often difficult to accurately diagnose, but *Phomopsis* and *Pestalotiopsis* were among the pathogens found. Seiridium canker continues to affect Leyland cypress, as over-crowded trees mature. Bacterial blight was diagnosed on lilac, willow, almond, cherry, apple, plum, and crape myrtle. Fire blight became very prevalent on flowering pear, and continued to show up as brown terminals late into the fall. Phytophthora root rot was diagnosed on juniper, arborvitae, and Douglas fir that were situated in areas with poor drainage. Rhizosphaera needle cast was diagnosed on blue spruce and Norway spruce. Douglas fir was most affected by *Rhabdocline* and Swiss needle cast caused by *Phaeocryptopus*.

Septoria leaf spots were very common on numerous hosts including pear, *Prunus*, birch, poplar, sunflower and *Rudbeckia*. Powdery mildew was common on flower spikes of crape myrtle, and numerous other hosts. Bacterial leaf scorch was noticeable in the landscape; most commonly affected were northern red oak and pin oak. Hypoxylon canker appears to be prevalent in Delaware, occurring on red oak, white oak, beech, maple, and sycamore.

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 2009: Brian Kunkel, Tom Pizzolato, Joanne Whalen, John Frett, Caroline Golt, Richard Taylor and Charles Bartlett.

Nematode Assay Service 2009 Report
Cooperative Extension Service
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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 screen for foliar nematode, and pinewood nematode using extractions from suspect plant parts.

In 2009, the NAS processed 141 samples, of which 76 were fee samples submitted for analysis. The remainder included 65 research samples that were a part of the soybean cyst nematode survey project for 2009 sponsored by the Delaware Soybean Board. Twelve soil or plant samples came in through the Diagnostic Clinic routine sample queue with damaging levels of plant parasitic nematodes, including pinewood nematode (3), soybean cyst nematode (5) and root knot nematode (4).

Of these 76 for fee samples submitted for analysis, the crop sources for these were:

Field crops	26	34 %
Fruit	18	24 %
Ornamentals	15	22 %
Vegetables	17	25 %

Twenty-three (23) or 33% 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, *Hederodera glycines*; southern root knot nematode, *Meloidogyne incognita*; lesion nematode, *Pratylenchus penetrans*; dagger nematode, *Xiphinema* sp., and stubby root nematode, Trichodorus sp. Root knot nematodes continue to be detected in large numbers causing stunting and yield loss on lima beans and cucurbit crops. Dagger nematodes (*Xiphinema* sp.) were found at damaging levels in several samples that were to be planted to wine grapes. We have seen an increase in the number of soil samples submitted from fields to be planted to wine grapes. 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.

Delaware and the National Plant Diagnostic Network 2008-09
Nancy F Gregory, Plant Diagnostician
University of Delaware Cooperative Extension

Impact Nugget:

The establishment of the National Plant Diagnostic Network (NPDN) and the associated regional centers has greatly enhanced national agricultural security by linking diagnostic programs. Delaware has become better prepared for detecting new pests and pathogens, and providing a rapid response.

Background, Mission, and Delaware's Role:

In 2002, the Animal and Plant Disease and Pest Surveillance and Detection Network was established within USDA CSREES and the Department of Homeland Security. Worldwide, damage from invasive pests and pathogens exceeds $100 billion annually, and intentional introduction could have significant impacts. The mission of the NPDN is to enhance national agricultural security by quickly and accurately detecting outbreaks of pests and pathogens. To achieve the mission, specific objectives included i)establishing a national communications system, ii)upgrading diagnostic infrastructure, iii)training in standard protocols for diagnosticians, iv) training of a network of "First Detectors", and v)database analysis to detect unusual outbreaks. The Network is composed of diagnostic facilities at Land Grant Universities in 50 states, some territories and state labs. There are five regions in the U.S., each with a regional center and director. Delaware is a member of the Northeast Plant Diagnostic Network, with a regional center at Cornell University.

Accomplishments and Impact 2008-09:

1. Over 625 samples were processed in 2009, with 32 additional soybean rust survey samples. All data was uploaded to the National Repository. Delaware cooperated with the national ipmPIPE to enter data for soybean rust and legume viruses.
2. Training was attended at USDA in Beltsville, MD for diagnosis and detection of pests of regional and national concern (Nancy – *Phytophthora kernoviae*). Information sharing and networking was achieved through meetings and conference calls. Nancy attended the annual Diagnostician/IT meeting representing the northeast region, and serves as secretary of the National Database subcommittee. Nancy attended the 2nd National Meeting of the NPDN, including workshops.
3. Over 85 First Detectors have been trained for the state of Delaware, with 38 in 2009 as a part of Advanced Master Gardener Training.
4. Cooperation between Delaware Department of Agriculture, USDA/APHIS PPQ and University of Delaware pathologists has increased. A new pathogen causing Japanese apple rust was confirmed in Delaware and a pest alert was issued jointly by Nancy and collaborators at USDA/APHIS. Distribution to NPDN members resulted in several northeastern states finding this pathogen in the first few weeks.
5. Communication Efforts include web site development and updates, presentations, posters, and public education efforts such as news articles and a brochure.

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