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2013 Potato Disease Control Trials Summary

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Introduction: In 2013, three disease control trials were conducted at the Intermountain Research and Extension Center (IREC) in Tulelake, CA. One trial compared fungicides applied at planting (in-furrow or seed treatment) for control of *Rhizoctonia solani*. Another study compared foliar-applied fungicides for controlling *Colletotrichum coccodes* (black dot) sclerotia on tubers. Black Dot tuber blemish is a common problem in the Tulelake area that reduces tuber marketability especially for red and yellow skinned varieties. The third study investigated the influence of nematacides on potato early-dying symptoms and yield in a field infested with lesion nematode (*Pratylenchus neglectus*) and Verticillium wilt. Previous research documented lesion nematode increases the severity of potato early-dying when growing susceptible varieties. This study evaluated if growers obtain a dual benefit from nematicides by suppressing potato early-dying symptoms along with lesion nematode. All trials were located in soil not fumigated prior to planting.

In-Furrow Fungicide Comparison Trial for *Rhizoctonia solani*

Location:	IREC, Tulelake, CA
Soil Type:	Tulebasin mucky silty clay loam with 4.5% organic matter
Seed Spacing:	Yield Harvest Area: Yukon Gold 9.1 inch spacing Destructive Harvest Area: Russet Norkotah 9.1 inch spacing
Planting Date:	May 20, 2013
Destructive Harvest:	July 26, 2013
Vine Kill Date:	August 30, 2013
Harvest Dates:	September 26, 2013
Days to Vine Kill:	100 days
Irrigation:	Solid-set sprinklers
Plot Size:	2 rows (6 ft) wide by 20 ft long for yield harvest area; 2 rows (6 ft) wide by 10 ft destructive sample area
Number of Reps:	5 replications
Fertilizer per Acre:	139 lbs N; 40 lbs P205; 100 lbs K20; 36 lbs S
Weed Control:	Prowl, Outlook, Roundup (pre-emergence), and Matrix (post-emergence)
Insecticides:	None
Vine Kill Method:	Rolling and Reglone

Treatments and Application Timings are detailed in Table 1.

Foliar Fungicide Comparison Trial for Suppression of *Colletotrichum coccodes* Tuber Infection

Location: IREC, Tulelake, CA
Soil Type: Tulebasin mucky silty clay loam with 4.5% organic matter
Seed Spacing: Yukon Gold 9.1 inch
Planting Date: May 20, 2013
Vine Kill Date: August 30, 2013
Harvest Dates: September 25th
Days to Vine Kill: 100 days
Irrigation: Solid-set sprinklers
Plot Size: 2 rows (6 ft) wide by 20ft long
Number of Reps: 5 replications
Fertilizer per Acre: 139 lbs N; 40 lbs P205; 100 lbs K20; 36 lbs S
Weed Control: Prowl, Outlook, Roundup (pre-emergence), and Matrix (post-emergence)
Insecticides: None
Vine Kill Method: Rolling and Reglone
Treatments and Application Timings are detailed in Table 2.

Nematicide/Lesion Nematode/Potato Early-Dying Trial

Location: IREC, Tulelake, CA
Soil Type: Tulebasin mucky silty clay loam with 4.5% organic matter
Seed Spacing: Russet Norkotah 9.1 inch
Planting Date: May 20, 2013
Vine Kill Date: August 30, 2013
Harvest Dates: September 25, 2013
Days to Vine Kill: 100 days
Irrigation: Solid-set sprinklers
Plot Size: 2 rows (6 ft) wide by 20ft long
Number of Reps: 5 replications
Fertilizer per Acre: 139 lbs N; 40 lbs P205; 100 lbs K20; 36 lbs S
Weed Control: Prowl, Outlook, Roundup (pre-emergence), and Matrix (post-emergence)
Vine Kill Method: Rolling and Reglone
Treatments and Application Timings are detailed in Table 3.

RESULTS

Seed Piece and In-furrow Applied Fungicides for *Rhizoctonia* Control

Potato yield and potato stand did not differ between fungicide treatments and the untreated control. *Rhizoctonia* has caused significant stand reduction and yield loss in untreated plots in previous years at the same site, but conditions were not conducive to losses in 2013. All fungicide treatments reduced the incidence and severity of *Rhizoctonia* on belowground stems two months after planting (Table 1). All fungicides also reduced the severity and coverage of *Rhizoctonia* (black scurf) on tubers compared to the untreated control (Table 1). Penthiopyrad, a new fungicide from DuPont labeled under the name Vertisan or Fontelis, and Emesto Silver a new seed treatment from Bayer, provided similar reduction in

Rhizoctonia on belowground stems and black scurf severity on tubers compared to Maxim MZ seed treatment and Quadris in-furrow (Table 1).

Foliar Fungicides for Suppression of *Colletotrichum coccodes* (Black Dot) Tuber Blemish Results
Fungicides had little influence on Black Dot tuber infection in previous years at IREC. This study evaluated three newly labeled fungicides applied foliar 6.5 and 12 weeks after planting (WAP) used in rotation with a Bravo Weatherstik applied 9 WAP. Yukon Gold yield for all fungicide treatments was similar compared to the untreated control (Table 2). The incidence, severity, and coverage of black dot on tubers did not differ between fungicides treatments and the untreated control (Table 2).

Nematicide/Lesion Nematode/Potato Early-Dying Trial Results
Three oxamyl (Vydate) nematicide programs were tested for their influence on early dying symptoms and Russet Norkotah yield (Table 3). Treatment one substituted spirotetramat (Movento), an insecticide/nematicide, for two mid-season oxamyl applications. Treatment four served as the nematicide-free control and only included fungicides. All oxamyl treatments had a noticeable effect on reducing foliar early-dying symptoms compared to the fungicide only control (Table 3). Two oxamyl treatments increased average tuber size compared to the control (Table 3). Total yield and US # 1 yield for all oxamyl treatments were numerically higher compared to the control, but yield differences were not statistically significant (Table 3). Additional research will be conducted in 2014 to verify results.

Table 1. Influence of Fungicides applied to the Potato Seed Piece and In-Furrow at Planting on Yukon Gold Yield and *Rhizoctonia solani* symptoms at IREC in 2013.

Trt #	Product	Product Rate	Potato Stand %	Total Yield cwt/A	US # 1 Yield cwt/A	Average tuber size oz	Tubers per plant #	Rhizoctonia lesion incidence on belowground stems %	Rhizoctonia lesion incidence on belowground stolons %	Rhizoctonia severity on stems & stolons 1-10 scale	Belowground stem and root weight kg	Rhizoctonia incidence on tubers %	Rhizoctonia severity on tubers 1-5 scale	Rhizoctonia coverage over tuber surface %
1	Vertisan EC - In-furrow	1.15 fl oz/1000ft of row	83	397	324	6.14	6.56	37.7	13.5	2.3	0.54	1	4.8	0.02
2a	Fontelis SC- Seed Piece	0.30 fl oz/ 100 lbs of seed	90	445	374	6.14	6.75	44.3	12.9	2.8	0.50	5	4.3	0.24
2b	Manzate F- Seed Piece	0.9 fl oz/ 100 lbs of seed												
3a	Fontelis SC- Seed Piece	0.45 fl oz/ 100 lbs of seed	88	425	349	6.21	6.53	31.1	8.6	2.2	0.61	0	5.0	0
3b	Manzate F- Seed Piece	0.9 fl oz/ 100 lbs of seed												
4a	Fontelis SC- Seed Piece	0.60 fl oz/ 100 lbs of seed	93	470	384	6.20	6.83	40.4	11.4	2.6	0.55	2	4.8	0.14
4b	Manzate F- Seed Piece	0.9 fl oz/ 100 lbs of seed												
5	Quadris In-furrow at planting	0.8 fl oz/1000 ft of row	88	424	358	6.40	6.31	43.3	16.8	2.9	0.52	3	4.6	0.06
6	Maxim MZ- Seed Piece	8 oz/ 100 lbs of seed	84	421	350	6.21	6.74	29.4	9.7	2.2	0.59	3	4.7	0.12
7	Emesto Silver- seed piece	0.31 oz/100 lbs seed	87	427	363	6.52	6.32	41.7	10.0	2.4	0.54	6	4.5	0.14
8	Untreated Control	n/a	90	440	367	6.34	6.48	58.0	22.7	4.5	0.53	29	3.9	0.92
95% Confidence Interval (NS = trts were not different at p ≤ 0.05)			NS	NS	NS	NS	NS	11.8	NS	0.8	NS	6	0.4	0.28

6 ft (2 rows) X 20 ft yield plots planted to Yukon Gold and 6 ft (2 rows) X 10 ft destructive harvest plots planted to Russet Norkotah; 5 replications in RCB design

Planted on 5/20/2013; 36 inch rows with 9.1 inch seed spacing; Harvested on 9/26/2013; Graded on 9/27/2013

10 Russet Norkotah plants per plot were pulled and washed on 7/26/2013 to evaluate the incidence and severity of Rhizoctonia lesions on belowground stems and stolons.

Rhizoctonia severity was a composite evaluation of all 10 Russet Norkotah plants using a 1-10 scale; 10= most severe.

Rhizoctonia (black scurf) symptoms were evaluated on 20 Russet Norkotah tubers per plot post-harvest. Tubers were washed before evaluation.

Rhizoctonia severity was a composite evaluation of all 20 Russet Norkotah tubers using a 1-5 scale with 5 = no symptoms and 1 = high severity.

There were no signficant differences in the percentage of cull potatoes between treatments.

Soil type: mucky silty clay loam soil with 4.5% organic matter

Table 2. Influence of Foliar Fungicides on Yukon Gold Yield and Black Dot Symptoms at IREC in 2013.

			Foliar Treatment Application			Potato	Total	US # 1	Average	Tubers	8/26/2013	Black Dot	Attached	Black Dot	Black Dot
			6.5	9	12	stand	Yield	Yield	tuber size	per plant	Early-Die severity	incidence on tubers	stems on tubers	severity on Tubers	coverage on tuber surface
Trt #	Product	Product Rate	WAP	WAP	WAP	%	cwt/A	cwt/A	oz	#	0-9 scale	%	%	1-5 scale	%
1	Maxim 4FS	0.08 oz/100 lbs seed				82	473	403	6.62	7.26	8.8	100	80	2.6	14.22
1	Quadris- in-furrow	0.6 fl. oz/1000 ft													
2	Maxim 4FS	0.08 oz/100 lbs seed				82	505	432	7.04	7.37	8.8	100	86	2.9	12.12
2	Quadris- in-furrow	0.6 fl. oz/1000 ft													
2	Quadris + Tops (foliar) Broadcast at 20 GPA	12 fl. oz/A	X		X										
2	Bravo Weatherstik (foliar) Broadcast at 20 GPA	1 pt/A		X											
3	Maxim 4FS	0.08 oz/100 lbs seed				78	511	442	6.82	8.00	8.6	100	77	2.9	12.20
3	Quadris- in-furrow	0.6 fl. oz/1000 ft													
3	Vertisan (foliar) Broadcast at 20 GPA	20 fl. oz/A	X		X										
3	Bravo Weatherstik (foliar) Broadcast at 20 GPA	1 pt/A		X											
4	Maxim 4FS	0.08 oz/100 lbs seed				86	522	453	6.75	7.54	8.8	100	70	3.0	12.60
4	Quadris- in-furrow	0.6 fl. oz/1000 ft													
4	Luna Tranquility (foliar) Broadcast at 20 GPA	11.2 fl. oz/A	X		X										
4	Bravo Weatherstik (foliar) Broadcast at 20 GPA	1 pt/A		X											
	95% Confidence Interval (NS = trts were not different at p ≤ 0.05)					NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

WAP = weeks after planting; Foliar broadcast treatments were applied with a CO_2 Backpack sprayer at 20 gallons per acre.

6 ft (2 rows) X 20 ft plots; 5 replications in RCB design

Planted on 5/20/2013; 36 inch rows with 9.1 inch seed spacing; Harvested on 9/25/2013; Graded on 9/26/2013

Early-Dying (Verticillium wilt) Susceptibility Rating- 0= 0 Symptoms, 1= Trace, 2= 1-5% of plants show symptoms of disease, 3= 5-10%, 4= 10-20%, 5= 20-40%, 6= 40-60%, 7= 60-75%, 8= 75-90%, 9= 90-100%

Black dot symptoms were evaluated on 20 tubers per plot post-harvest. Tubers were washed before evaluation.

Black Dot Severity was a composite evaluation of all 20 tubers using a 1-5 scale with 5 = no symptoms and 1 = high severity.

There were no signficant differences in the percentage of cull potatoes between treatments.

Soil type: mucky silty clay loam soil with 4.5% organic matter

Table 3. Influence of Nematacide/Insecticide/Fungicide Treatments on Russet Norkotah Yield and Disease Symptoms at IREC in 2013.

			Foliar Treatment Application Times				Potato	8/7/2013 Early-Die	8/16/2013 Early-Die	8/26/2013 Early-Die	9/27/2013 Total	9/27/2013 US #1	Average tuber	Tubers per	Rhizoctonia incidence
			4-8 inch	just prior	14 days after	28 days after	Stand	Severity	Severity	Severity	Yield	Yield	size	plant	on tubers
Trt #	Product	Product Rate	rosette	to row close	row closure	row closure	%	0-9 scale	0-9 scale	0-9 scale	cwt/A	cwt/A	ounces	#	%
1	Maxim 4FS	0.08 oz/100 lbs seed													
1	Vydate C-LV- In-furrow	2.1 pt/A													
1	Quadris- in-furrow	0.8 fl. oz/1000 ft													
1	Vydate C-LV- Chemigated	2.1 pt/A	X												
1	Quadris- Chemigated	12 fl. oz/A		X			97	5.1	6.4	8.2	456	353	6.39	6.2	1
1	Movento + MSO 0.5% v/v- broadcast sprayed 20 GPA	5 oz/A		X											
1	Movento + MSO 0.5% v/v- broadcast sprayed 20 GPA	5 oz/A			X										
1	Vydate C-LV- Chemigated	2.1 pt/A				X									
2	Maxim 4FS	0.08 oz/100 lbs seed													
2	Vydate C-LV- In-furrow	2.1 pt/A													
2	Vydate C-LV- Chemigated	2.1 pt/A	X												
2	Vydate C-LV- Chemigated	2.1 pt/A		X			96	4.7	5.9	7.4	478	355	7.04	5.9	8
2	Vydate C-LV- Chemigated	2.1 pt/A			X										
2	Vydate C-LV- Chemigated	2.1 pt/A				X									
3	Maxim 4FS	0.08 oz/100 lbs seed													
3	Vydate C-LV- In-furrow	2.1 pt/A													
3	Vertisan- in-furrow	1 pt/A													
3	Vydate C-LV- Chemigated	2.1 pt/A	X	X			96	5.0	6.4	8.0	497	374	6.67	6.5	2
3	Vertisan- Chemigated	1 pt/A		X											
3	Vydate C-LV- Chemigated	2.1 pt/A			X										
3	Vydate C-LV- Chemigated	2.1 pt/A				X									
4	Maxim 4FS	0.08 oz/100 lbs seed													
4	Quadris- in-furrow	0.8 fl. oz/1000 ft					98	5.9	7.3	8.4	449	339	6.18	6.2	2
4	Quadris- Chemigated	12 fl. oz/A		X											
		LSD (NS = no significant differences at a p-value ≤ 0.05)					NS	NS	0.6	0.5	NS	NS	0.41	NS	NS

Chemigation treatments were applied in 1 acre-inch of water using a small-plot overhead irrigation unit. (0.2 acre inches pre-injection; 0.3 acre inches-injection; and 0.5 acre inches- post-injection flush)

6 ft (2 rows) X 20 ft plots; 5 replications in RCB design

Planted on 5/20/2013; 36 inch rows with 9.1 inch seed spacing; Harvested on 9/25/2013; Graded on 9/27/2013

Early-Dying (Verticillium wilt) Susceptibility Rating- 0= 0 Symptoms, 1= Trace, 2= 1-5% of plants show symptoms of disease, 3= 5-10%, 4= 10-20%, 5= 20-40%, 6= 40-60%, 7= 60-75%, 8= 75-90%, 9= 90-100%

The field site test positive for moderate to high levels of Verticillium wilt (198 cfu Vert. per gram of soil) an Root Lesion nematode (P *ratylenchus at 240 per 500 cc soil*) in the soil before planting.