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Influence of Fungicides and Biological Products on Potato Diseases and Yukon Gold Yield and Quality in 2013

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Introduction: This study investigated the effectiveness of fungicides and biological products for controlling *Rhizoctonia solani* (black scurf) *Colletotrichum coccodes* (black dot), and potato early-dying. Similar studies were conducted at the Intermountain Research and Extension Center (IREC) in 2011 and 2012. The report summarizes 2013 results along with discussion of results for treatments tested multiple years. All treatments were applied to a potato crop grown in soil that was not fumigated prior to planting. Disease evaluations included the incidence and severity of *Rhizoctonia* lesions on belowground stems and stolons at tuber initiation, foliar early-dying symptoms in mid-August, and black scurf and black dot on tubers post-harvest. Potato stand, yield, tuber size, and tuber defects were evaluated for all treatments. No fungicides besides those listed in the treatment list were applied to the study site. The entire trial area was fertilized with synthetic fertilizers to assure nutrients were available in sufficient supply.

2013 Trial Information

Soil Type:	Tulebasin mucky silty clay loam with 4.5% organic matter
Seed Spacing:	Yield Harvest Area: Yukon Gold 9.1 inch
	Destructive Harvest Area: Russet Norkotah 9.1 inch
Planting Date:	May 20, 2013
Harvest Date:	September 25, 2013
Vine Kill Date:	August 30 2013
Days to Vine Kill:	100 day
Irrigation:	Solid-set sprinklers
Plot Size:	Yield Harvest Area: 2 rows (6 ft.) wide by 20 ft. long
	Destructive harvest area: 2 rows (6ft.) wide by 10 ft. long
In-Row Spacing:	9.1 inches
Row Spacing:	36 inches
Number of Reps:	5 replications
Fertilizer per Acre:	139 lbs N, 40 lbs P2O5, 100 lbs K2O, 36 lbs S
Weed Control:	Prowl, Outlook, Roundup (pre-emergence), and Matrix (post-emergence)
Vine Kill Method:	Roll and Reglone

Treatments and Application Timings are detailed in Table 1.

Results

Potato Stand, Yield, and Tuber Quality

There was no difference in potato stand density between biological and fungicide treatments in 2013 (Table 1). In 2012, Yukon Gold seed appeared healthy at planting, but stand emergence in the untreated control and biological treatments was less than 65%. In comparison, potato stand in fungicide-treated plots was 86% in 2012. *Rhizoctonia* and a sprout inhibitor applied during seed storage appear to be the reason for poor stand emergence in 2012. There was no difference in total potato yield, US No. 1 yield, cull yield, and tubers per plant between treatments in 2013. Compost, chicken manure, steer manure, and one fungicide treatment (trt 10) increased average tuber size compared to the untreated control in 2013 (Table 1).

In-Season *Rhizoctonia* Suppression

Fungicides reduced the incidence and severity of *Rhizoctonia* lesions on belowground stems compared to the untreated control in 2013 (Table 2). Fungicides also reduced lesion severity in 2012 and 2011. Biological treatments with Serenade, compost tea, and pelleted chicken manure reduced the incidence or severity of *Rhizoctonia* lesions on stems and stolons compared to the untreated control, but the biological treatments were not as effective as fungicides (Table 2). This treatment trend was also similar in 2012 and 2011.

Suppression of Tuber *Rhizoctonia* Black Scurf and Black Dot

The incidence and severity of *Rhizoctonia* black scurf on tubers was low and variable in 2013 preventing statistical differences (Table 2). Averaged across 2012 and 2013, fungicides, Serenade, and pelleted chicken manure lowered *Rhizoctonia* coverage over the tuber surface compared to the untreated control. Fungicides had the lowest *Rhizoctonia* tuber symptoms averaged across years.

Fungicides, Serenade, compost, and pelleted chicken manure slightly reduced *Colletotrichum coccodes* (black dot) on tubers compared to the untreated control in 2013 (Table 2), but these treatments did not reduce black dot in 2012 and 2011. Averaged across years, biological treatments and fungicides had similar tuber black dot coverage compared to the untreated control.

Table 1. Influence of Biological & FungicideTreatments on Potato Stand and Yield at IREC in 2013

			Foliar Treatment Application Times											
			5 WAP	5-15 WAP	6.5 WAP	9 WAP	12 WAP	13 WAP						
Trt #	Product	Product Rate	Early Vegetative Growth	Every Two Weeks	Late Vegetative Growth	Tuber Initiation	Tuber Bulking	Tuber Bulking	Potato stand %	Total yield cwt/A	US # 1 yield cwt/A	Tubers per plant	Average tuber size (oz)	Cull potatoes % of total
1	Untreated Control								89	463	390	6.6	6.6	5.2
2	Serenade in furrow *(Bacillus subtillis)*	4qt/A							88	459	390	6.4	6.8	5.1
2	Optiva foliar *(Bacillus subtillis)*	16 oz/A	X			X		X						
3	Compost pre-plant	10 ton/A							92	481	407	6.1	7.1	6.6
4	Compost tea in furrow	10 gal/A							89	466	391	6.6	6.6	5.5
4	Compost tea foliar	5 gal/A	X			X		X						
4	Fish emulsion	2.5 gal/A	X			X		X						
5	Compost pre-plant	10 tons/A							91	489	401	6.5	6.9	7.9
5	Compost tea in furrow	10 gal/A												
5	Compost tea foliar	5 gal/A	X			X		X						
5	Fish emulsion	2.5 gal/A	X			X		X						
6	Nutri-Rich Pelleted Chicken Manure 4-3-3 pre-plant	3 ton/A							94	481	402	6.2	6.9	6.5
7	Steer Manure pre-plant	10 ton/A							87	486	415	5.9	8.0	7.7
8	Compost pre-plant	1 ton/A							91	477	408	6.2	7.2	5.8
8	Nutri-Rich Pelleted Chicken Manure 4-3-3 pre-plant	1 ton/A												
8	Serenade in furrow (Bacillus subtillis)	4 qt/A												
8	Optiva foliar *(Bacillus subtillis)*	16 oz/A	X			X		X						
8	Compost tea foliar	5 gal/A	X			X		X						
8	Fish emulsion	2.5 gal/A	X			X		X						
9	Maxim 4FS	0.08 oz/100 lbs seed							86	454	375	6.7	6.5	5.7
9	Moncut in furrow	1.1 lb/A												
9	Vertisan	20 fl. oz/A			X									
9	Quadris	12 fl. oz/A				X								
9	Luna Tranquility	11.2 fl oz/A					X							
10	Maxim 4FS	0.08 oz/100 lbs seed							84	464	401	6.7	6.9	4.4
10	Quadris in furrow	0.6 fl. oz/1000 ft												
10	Quadris foliar 1st app.	12 fl. oz/A			X									
10	Endura foliar 2nd app.	8 oz/A				X								
10	Tanos foliar 3rd app.	8 oz/A					X							
11	Maxim 4FS	0.08 oz/100 lbs seed							87	459	388	6.5	6.8	5.3
11	Moncut in furrow	1.1 lb/A												
								95% confidence interval	NS	NS	NS	NS	0.3	NS

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 9/27/2013; Graded on 9/28/2013
Soil type: mucky silty clay loam soil with 4.5% organic matter

Table 2. Influence of Biological & FungicideTreatments on Disease Symptoms at IREC in 2013

			Foliar Treatment Application Times						Rhizoctonia coverage over tuber surface	Black dot coverage over tuber surface	Rhizoctonia lesion incidence on belowground stems	Rhizoctonia lesion severity on belowground stems and stolons
			5 WAP	5-15 WAP	6.5 WAP	9 WAP	12 WAP	13 WAP				
Trt #	Product	Product Rate	Early Vegetative Growth	Every Two Weeks	Late Vegetative Growth	Tuber Initiation	Tuber Bulking	Tuber Bulking	%	%	%	1-10 scale (10=high)
1	Untreated Control								2.36	14.92	70.3	4.2
2	Serenade in furrow *(Bacillus subtillis)*	4qt/A							0.90	10.26	69.7	4.4
2	Optiva foliar *(Bacillus subtillis)*	16 oz/A	X			X		X				
3	Compost pre-plant	10 ton/A							1.46	11.96	57.3	4.4
4	Compost tea in furrow	10 gal/A										
4	Compost tea foliar	5 gal/A	X			X		X	3.02	12.96	58.5	3.7
4	Fish emulsion	2.5 gal/A	X			X		X				
5	Compost pre-plant	10 tons/A										
5	Compost tea in furrow	10 gal/A										
5	Compost tea foliar	5 gal/A	X			X		X	2.30	11.14	59.1	3.4
5	Fish emulsion	2.5 gal/A	X			X		X				
6	Nutri-Rich Pelleted Chicken Manure 4-3-3 pre-plant	3 ton/A							0.68	12.14	62.5	4.4
7	Steer Manure pre-plant	10 ton/A							1.16	13.44	67.0	3.8
8	Compost pre-plant	1 ton/A										
8	Nutri-Rich Pelleted Chicken Manure 4-3-3 pre-plant	1 ton/A										
8	Serenade in furrow (Bacillus subtillis)	4 qt/A							1.04	10.76	64.0	3.8
8	Optiva foliar *(Bacillus subtillis)*	16 oz/A	X			X		X				
8	Compost tea foliar	5 gal/A	X			X		X				
8	Fish emulsion	2.5 gal/A	X			X		X				
9	Maxim 4FS	0.08 oz/100 lbs seed										
9	Moncut in furrow	1.1 lb/A										
9	Vertisan	20 fl. oz/A			X				0.76	10.52	33.8	1.7
9	Quadris	12 fl. oz/A				X						
9	Luna Tranquility	11.2 fl oz/A					X					
10	Maxim 4FS	0.08 oz/100 lbs seed										
10	Quadris in furrow	0.6 fl. oz/1000 ft										
10	Quadris foliar 1st app.	12 fl. oz/A			X				0.74	9.16	52.5	2.9
10	Endura foliar 2nd app.	8 oz/A				X						
10	Tanos foliar 3rd app.	8 oz/A					X					
11	Maxim 4FS	0.08 oz/100 lbs seed							0.14	11.04	42.5	2.3
11	Moncut in furrow	1.1 lb/A										
								95% confidence interval	NS	2.47	15.7	1.0

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 9/27/2013; Graded on 9/28/2013

10 plants per plot were pulled and washed on 7/25/2013 to evaluate the incidence and severity of Rhizoctonia lesions on belowground stems and stolons.

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

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

Coverage was the average cover of the tuber blemish over the entire tuber surface area for 10 tubers.

There were no signficant differences between treatments for early-dying rating at three evaluations throughout the season.

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