

Long Report

SUMMARY RESEARCH PROGRESS REPORT FOR 2000 AND RESEARCH PROPOSAL FOR 2001

Submitted to:
SLV Research Center Committee
Colorado Potato Administrative Committee (Area II)

TITLE: Using Biocontrol Crops to Enhance Potato Production

PROJECT LEADER(S): Merlin A. Dillon, SLV Area Extension Agent, Agronomy and beginning 2002 -Dr. Russ Ingham, Associate Professor and Nematologist, Oregon State University, Corvallis, OR

PROJECT JUSTIFICATION:

Nematodes, verticillium (early dying complex), and powdery scab are becoming increasingly more important pests of SLV potato production. Fumigants and fungicides can be used to control some of these pests; however, these chemicals are also very expensive; maybe not available soon; and can be very destructive to beneficial organisms and soil health. Green manure crops have shown great potential in reducing the impact of some of these pests. The effectiveness of these biocontrol crops is now well established but what crops work best for what pests is unknown. Many other questions still remain as to how these crops grow in our environment. Dedicating one entire crop year to a biocontrol crop is still expensive (no crop income). However, if some biocontrol crop could be grown in the same season as an income crop, this would greatly reduce the expense of growing a biocontrol crop.

Research in the Pacific Northwest and other areas has shown the benefit of sorghum-sudan and rapeseed crops. In our area, Dr. Richard Zink and I conducted 3 years research into crop rotations showing the benefit of green manure corn and sudan in reducing the verticillium propagules per gram of soil (VPPG). Sudan planted in early June and incorporated into the soil in August was highly beneficial. Now, we need to know how much sudan is required to be incorporated, as well as how much benefit would accrue if the sudan was hayed and then turned under. We also want to know the effects on nematodes of cover crops grown after barley harvest.

PROJECT STATUS:

This will be the third year of funding for this project. Results of soil samples are now available for treatments in 2000 and 2001. The Ray Wright and Summit Farm trials represent treatments applied in 2000. The Bob Mattive Farm trial was planted and cover crop was incorporated in 2001.

New field trials will be established in 2002. The cooperator needs to be a commercial potato producer with a significant nematode problem; but a cooperator not using fumigation (or willing to fumigate around our plots). Vydate would be acceptable. We intend to establish cover crop treatments at barley harvest. Nematode samples would be taken at harvest of barley and fall freeze up in 2002 and at potato planting and potato harvest in 2003.

SIGNIFICANT ACCOMPLISHMENTS FOR 2001:

The results from 2000 field trials indicate again that sorghum-sudan crop was effective in reducing verticillium disease inoculum from the soil.

The 2001 field trial shows that oilseed radish, mustard, and rapeseed reduced VPPG to very low levels. The Rabbitears sorghum-sudan also produced low levels of VPPG; however, Grazex, Buffalo Brand and Sordan brands of sorghum-sudan were inconclusive; producing one sample testing high and one sample testing low VPPG.

OBJECTIVES FOR 2002:

- 1) To determine if cover crops planted after barley can reduce nematode levels
- 2) To determine the effect of wheat and barley on nematode levels
- 3) To compare various cover crop management practices and their effects on nematode levels in the following potato crop.

In cooperation with Dr. Russ Ingham, Nematologist at Oregon State University, a field trial will be established to determine the effects of certain management practices on the populations of Columbia Root Knot nematode. Treatments will include enhanced barley volunteer, rapeseed planted relay (planted in growing barley crop), and barley volunteer with rye, rapeseed or oilseed radish interseeded. A spring wheat treatment will be included to compare the effects of growing wheat vs. barley on the nematode populations. A page describing 2002 treatments follows the results tables.

Soil samples will be sent to Dr. Ingham's nematode lab at Oregon State University.

FUNDING REQUEST:

2001 Allocation: \$5,000.00:

Soil analysis	\$3490
Labor	\$ 1431
Supplies	<u>\$ 79</u>
TOTAL	\$5000

2002 Request:

Soil Nematode Analysis	\$5,000.00
Verticillium Analysis	\$1,000.00
Demonstration Seed	\$1,000.00
Labor	\$1,500.00
Mileage	\$ 500.00
Supplies	<u>\$ 500.00</u>
TOTAL	\$9,500.00

The following pages contain results from 2000 and 2001 treatments.

Enhancing Potato Production with Biocontrol Crops

Table 1. Verticillium propagules per gram (VPPG) for three sampling dates as influenced by biocontrol crops. Worley Seed Farm (Bob Mattive) Field at Roads 8N and 4E, Rio Grande County, 2001. By Merlin Dillon, CSU Cooperative Extension, SLV Research Center, Center, CO. Project funded by CPAC Area II / SLV Research Center Committee.

Tmt No.	Crop	VPPG ^{1/}			
		June	August	October	October sub samples ^{2/}
2	Salvo Mustard	10	—	2	2 2
4	Rivona Mustard	11	--	5	4 6
5	Arena Radish	6	--	4	2 6
6	Rimbo Radish	16	5	5	4 6
7	Serval Mustard	7	--	5	4 6
8	Humus W. Rape	2	12	7	6 8
9	Maple Peas	3	--	9	6 12
10	Malt Barley	16	3	14	12 16
11	Sordan SS ^{3/}	6	3	20	10 30
12	Rabbit Ears SS	4	--	5	4 6
14	Buffalo Brand SS	15	--	18	28 8
15	Grazex II SS	6	--	22	12 32

^{1/} VPPG = Verticillium propagules per gram found in the soil sample.

^{2/} Two sample values that make the October average.

^{3/} SS = Sorghum-sudan hybrid

Field Notes: Two soil samples were GPS located for each plot. Subsequent samples were taken from the same GPS location. June samples were taken right after planting June 1. August samples were taken August 1; just before crops were chopped and turned under by moldboard. October samples were taken after the crop residue had time to decompose and just before the soils got really cold. Analysis by Pest Pros, Plainfield, WI.

The previous crop was potatoes in 2000. The entire center pivot was planted to the four types of sorghum-sudan except for one drill width strips of these biocontrol crops. Seed rate for these crops was 15 lbs/acre; the sorghum-sudan was planted at 20-25 lbs/acre. The Sordan was sampled in 3 places for forage yield; this calculated to 3.0 tons/acre dry matter or 3.3 tons/acre at 10% moisture hay. The yield as harvested was 22.5 ton/acre at 86.5% moisture which is also equivalent to 15.2 ton per acre at 20% dry matter. Seed cost were quoted as Sordan @ 80 cents/lb (80% germ.); Rabbit Ears @ 36 cents/lb (90% germ.); Buffalo Brand @ 37 cents/lb (90% germ.); and Grazex IIW @ 35 cents/lb (80% germ.).

Comments: The oilseed radish, mustard, and rapeseed all produced low levels of VPPG in October. The Rabbitears sorghum sudan also produced low levels of VPPG; Grazex, Buffalo Brand and Sordan produced one sample testing high and one sample testing low.

Enhancing Potatoes with Biocontrol Crops

Table 2. Verticillium propagules per gram as influenced by biocontrol crops. Located at Ray Wright Farm in Rio Grande County, Roads 1S and 4E. By Merlin Dillon, CSU Cooperative Extension, SLV Research Center, Center, CO. Project funded by CPAC / SLV Research Center Committee.

Crop	VPPG ^{1/}	
	April 2001	September 2001
Sorghum-sudan	13	0
Barley Grazed	13	20
Barley Grain	2	23

^{1/}VPPG is verticillium propagules per gram found in the soil sample.

Field Notes:

The April samples were taken prior to the 2001 potato crop; the September samples were taken after the potato crop was grown. Each treatment was sampled in duplicate locations; the locations were GPS located so that the April and September samples were from the same location. Analysis by Pest Pros, Plainfield, WI. The sorghum-sudan was grown in 2000; it was grazed then the remaining crop residue was worked in.

Comments: These results indicate the sorghum-sudan crop was effective in reducing verticillium disease inoculum from the soil.

Table 3. Verticillium propagules per gram as influenced by biocontrol crop. Located at Summit Farms in Saguache County, Roads AA and 55. By Merlin Dillon, CSU Cooperative Extension, SLV Research Center, Center, CO. Project funded by CPAC / SLV Research Center Committee.

Crop	VPPG ^{1/}		
	June 00	Apr 01	September 01
Winter Wheat	6.5	3.6	2.9
Sorghum-sudan	2.8	2.0	2.5
Fallow	---	1.0	1.7

^{1/}VPPG is verticillium propagules per gram found in the soil sample.

Field Notes: The June, 2000, samples were taken prior to planting sorghum-sudan and taken from growing winter wheat. April, 2001, samples were taken prior to planting seed potatoes and September, 2001, samples were taken after the potato crop. Each crop was sampled in 5 locations. The fallow sites were located in the sorghum-sudan field; there were two locations that simply were not planted into sorghum-sudan. Each was GPS located so that all three dates were sampled in the same location. Analysis by Pest Pros, Plainfield, WI.

Comments: The verticillium test levels were fairly low at the beginning of this trial. It is not surprising that biocontrol crops had little effect in lowering verticillium levels, since they were already low.

2002 Biocontrol Treatments

A small plot, replicated trial with 3 sections in separate areas of the same field, areas located as close as practical.

Section 1. Normal Dry Barley

1. Volunteer Barley, normal dry Control
2. Dry Fallow, normal dry, volunteer sprayed w/Roundup

Section 2. Irrigated Section, Stubble Undisturbed

3. Standing Stubble, stubble undisturbed
4. Relay Rapeseed (Seed broadcast July 10; Irrig & Fert; standing stubble)
5. Wheat (small plot planted in April instead of Barley)

Section 3. Irrigated Section (Stubble incorporated)

6. Volunteer Barley (Irrig. & Fert.)
7. Fallow (Volunteer Barley sprayed w/Roundup)(Irrig & Fert)
8. Seeded Rapeseed (Volunteer Barley Irrig & Fert)
9. Seeded Oilseed Radish (Volunteer Barley Irrig & Fert)
10. Seeded Rye (Volunteer Barley Irrig & Fert)

Nematode Sampling Times

1. Barley Harvest (Aug, 2002)
2. Fall Freezeup (Oct, 2002)
3. Potato Planting (May, 2003)
4. Potato Harvest (Sept, 2003)

Plot Size (11.3 x 30 ft)

Budget Request

\$5,000.00 Nematode Analysis: \$25 x 10 treatments x 5 Reps x 4 Sample Times

(5 Reps needed for nematode variability: Dr. Russ Ingham)

\$1,000.00 Verticillium Analysis (\$15 x 5 treatments x 5 reps x 2 sample times)

\$1,500.00 Seed

\$1,500.00 Labor

\$ 500.00 Supplies

\$9,500.00 TOTAL