A Report for Northwest Potato Research Consortium

Title: Nematicide Efficacy Trial for Nematode Control in Potato

Year Initiated: 2023 **Current Year:** 2025 **Terminating Year** 2025

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Materials and Methods

Following the 2024 trial, the research staff at the Agriculture Development Group, Inc. continued this nematocidal trial in 2025 on a research potato field located at 15 miles north of Pasco, WA to evaluate the efficacy of 38 nematicides/insecticides programs (Table 1), against Columbia rootknot nematode. The 2025 study also included a side trial conducted in a commercial potato field 10 mile west of Moses Lake, WA with 5 programs and focused on stubby-root nematode. The experimental design for the large 38 treatment efficacy trial near Pasco was an RCB with 6 replications and plot sizes of 12 ft (width of 4 rows) x 25ft (length) and 5 replications design with the same plot size for the small Moses Lake trial.

The big efficacy trial involves complicated application schedules (Table 2), with previous year (2024) late fall fumigation applications of Telone treatments on 11/15/2024 by a commercial applicator (Photo 1), and the 2025 pre-planting soil treatment applications were applied on 4/21 by a tractor-mounted chemigator at 0.5-acre inches of water and mechanically incorporated into the soil (Photo 2). In-furrow application at planting were made on 4/28 (B) with a CO2 pressurized sprayer attached on a tractor-mounted planter (Photo 3) and sprays treatment directly onto the seeds during seeding at the spray volume of 30 gallons per acre (GPA). The rest of the applications were made post emergence with the same chemigator at 0.5-acre inches of water on previously irrigated moist soil condition.

The Moses Lake trial was started on May-16 as the in-furrow application A, and followed the application plan listed in Table 2. However, due to this trial was conducted in a commercial field with no pre-setup driveways for tractor mounted chemigator sprayer to mimic the chemigation, we had to manually spray the plots with a CO2 backpack (Photo 4) and then turn on the irrigation right after to push the chemicals into the soil.

Pre-study soil samples from the fumigation plots were taken before the 2024 fall application on 10/1/2024, where the rest plots were sampled before 2025 planting on 4/8/2025 to assess pre-study soil nematode population. All plots were then sampled again right after the 2025 harvest on 9/3 to evaluate the post-study soil nematode population and calculated the actual nematode population changes (per 250cc soil). Columbia root-knot nematode was the dominant nematode species with consistent pressure in this trial area.

The middle two rows of all plots were harvested on 9/3. Tubers were graded by ADG employees for yield and grade data from 9/6 to 9/16 (Photos 5 and 6). The tubers were then stored for 4 weeks and peeled individually (Photo 7 and 8) to evaluate for %nematode incidence of infestation incidence (out of 50 tubers/plot) and # of stings per infected tuber (severity) (Photo 9) from 10/15 to 10/25. A total of 11,400 tubers were peeled and tens of thousands of stings were counted during tuber evaluations.

Table 1. Treatment list and application timings/dates for the Pasco trial.

Trt#	Treatments	Rates	App Code	App Description
1	Untreated Check			A= in furrow
2	Vydate C-LV	34fl oz/a	ABCDEFG	B=1440 DD, BCDEFG=14D INTERVAL
3	Arino	20fl oz/a	A	
	Vydate C-LV	34fl oz/a	BCDEFG	
4	Salibro	60.4fl oz/a	A	
	Vydate C-LV	34fl oz/a	BCDEFG	
5	Velum Prime	6fl oz/a	A	
	Vydate C-LV	34fl oz/a	BCDEFG	
6	Salibro	15.4fl oz/a	AH	H=hilling/emergence
7	Salibro	30.8fl oz/a	AH	
8	Serifel 10 WP	0.89lb/a	AH	
	Salibro	15.4fl oz/a	AH	
9	Serifel 10 WP	0.89lb/a	AH	
	Salibro	30.8fl oz/a	AH	
10	Votivo 240 FS	10.95fl oz/a	AH	
	Salibro	15.4fl oz/a	AH	
11	Votivo 240 FS	10.95fl oz/a	AH	
	Salibro	30.8fl oz/a	AH	
12	Velum Prime	5.47fl oz/a	AH	
13	Biotan	5.3gal/a	A	
	Biotan	1.77gal/a	HJN	HJN in continuous 3 days in the week of hilling
14	Bioshot	128fl oz/a	AHB	
15	Bioshot	64fl oz/a	AHB	
16	Spectra	22fl oz/a	A	
	Spectra	16fl oz/a	HB	
17	Vigilance	128fl oz/a	A	
	Vigilance	96fl oz/a	HB	
18	Nemaout	64fl oz/a	A	
	Nemaout	32fl oz/a	HB	
19	Product A	lb/a	A	
	Product A	lb/a	I	I=28d after A
20	Product A	lb/a	A	
	Product A	lb/a	I	
21	Product A	lb/a	B	
	Product A	lb/a	D	
22	Product A	lb/a	B	
	Product A	lb/a	D	
23	Agri-Mek	3.5fl oz/a	HB	
24	Impact 6	2pt/a	ABC	
25	Nemasan	32fl oz/a	ABC	
26	Salibro	30.8fl oz/a	ABKE	BKE at 21d interval
27	Warhammer	12fl oz/a	ABCDEF	
	Forge SP	12oz/a	A	
28	Aster	15gal/a	L	
29	Aster	10gal/a	L	
30	Aster	5gal/a	L	
31	LALNIX ACT=Melocon	10.25fl oz/a	LHB	L=7d pre-plant, M=30d af B
	Vydate	34fl oz/a	CDEFG	
32	LALNIX ACT=Melocon	10.25fl oz/a	LHBM	
33	Vigilance	128fl oz/a	A	
	Vydate C-LV	34fl oz/a	BCDEFG	
34	Telone C-35	16.1gal/a	L	L=2024 application for Telone treatments
35	Telone II	15gal/a	L	
36	Telone II	18gal/a	L	
37	Telone II	10.8gal/a	L	
	Exxsol D80	2.2gal/a	L	
38	Telone II	13gal/a	L	
	Exxsol D80	3gal/a	L	

Application Description

	A	B	C	D	E	F	H	I	J
Date	4/28/2025	7/3/2025	7/17/2025	7/31/2025	8/14/2025	8/28/2025	5/28/2025	5/28/2025	5/29/2025

	K	L	M	N
Date	8/6/2025	4/21/2025	8/15/2025	5/30/2025

Table 2. Treatment list and application timings/dates for the Moses Lake trial

Trt#	Treatments	Rates	Application Code
1	Untreated		
2	Vydate C-LV	34fl oz/a	ABCDEF
3	Product A	lb/a	A
	Product A	lb/a	B
4	Agri-Mek	3.5fl oz/a	GIJ
5	Salibro	30.8fl oz/a	ABH

	A	B	C	D	E	F	G	H	I
Date	May-16-2025	Jun-4-2025	Jun-18-2025	Jul-2-2025	Jul-16-2025	Jul-30-2025	Jun-30-2025	Jun-25-2025	Jul-14-2025

	J
Date	Jul-28-2025

Results and Discussion

Pasco 38-Program Efficacy Trial

None of the treatments caused noticeable phytotoxicity on the potato during the study.

Due to the large size of this trial with 38 treatments/programs. The results and discussion will focus on the datasets that showed valuable/significant results.

Tuber infestation - Table 3

The 2025 trial had an extremely high tuber infestation pressure with an 57.5% infestation incidence and 15.8 stings per tuber severity in untreated plots. The standard Vydate program resulted in 44.3% incidence and 10.7 stings per infested tuber severity.

Fumigation Telone treatments resulted in significantly lower than untreated incidence in a range of 27.7 to 41.2%. There appears to be a positive dose effect for both Telone II alone or when mixed with Exxsol D80, where the higher rate of Telone alone at 18 gal/a had 32.2% incidence versus its lower 13 gal/a rate alone at 40.2%, and the high rate Telone at 13 gal/a + Exxsol D80 had the lowest incidence of 27.7% versus the same combination but lower Telone rate of 10.8 gal/a at 29.2%. The higher rate of Telone alone at 18 gal/a had averagely 6 stings per tuber versus 12.3 stings per tuber of its lower 15 gal/a rate, and the high rate Telone at 13 gal/a + Exxsol D80 had 7.2 stings per tuber versus the same combination but lower Telone rate at 9.8 stings per tuber. Interestingly, the Telone C-35 alone at 16.1 gal/a actually resulted in relatively low severity with only 5.2 stings per tuber.

The Arino + Vydate and Salibro + Vydate programs had incidences at 30.3% and 34.5%, with around 7.5 stings per tuber, respectively, while the Velum Prime + Vydate program actually resulted in one of the lowest severity with only 5.8 sting per tuber.

Some relatively newer bio-nematicide programs such as Bishot, Spectra, Nemaout, LALNIX ACT (Melocon), and Vigilance alone, Warhammer + Forge, resulted in incidence of around 37.7% to 40.7%, and the LALNIX ACT + Vydate program resulted in similar incidence to Vydate standard of 46.7%. The high rate of Bioshot actually showed numerically one of the lowest incidences of only 37.7%. Spectra, LALNIX ACT and Nemaout alone programs showed lower than Vydate severity of 8.5, 8.7, and 7 stings per infested tuber. The high and medium rates of Aster resulted in slightly lower than Vydate incidence of 39.3% and 40.7%. The higher rate of Aster also had only 7.7 stings per tuber.

Product A at both high and low rates initiated at planting resulted in similar incidence to Vydate at 43.7% and 49.7%, and the hooking initiated program did not have direct control over tuber infestation incidence over untreated. The earlier planting timing application of Product A also resulted in only 8.2 stings per tuber (high rate) and 12.7 stings per tuber (low rate) while the later initiated at-hooking program had 12.7 (high rate) and 17.5 (low rate) stings per tuber.

The other conventional programs had incidences of around 40 to 48% incidence, beside the low rate Salibro alone with a 58.7% incidence. Serifel + Salibro treatments at both rates, as well as Velum Prime and Biotan programs showed advantage over other conventional treatments with only 8.3 (low rate Serifel + Salibro), 6.2 (high rate Serifel + Salibro), 7.8 (Velum Prime), and 10.2 (Biotan) stings per tuber.

It is obvious that we have bio-nematicide options now that will have on-par control efficacy as conventional programs, sometime even better, on suppressing the tuber infestation by Columbia rootknot nematode.

Table 3. Treatment effect on tuber infestation incidence and severity, from the highest incidence to the lowest, top to bottom.

Trt No.	Treatment Name		Rate of Application		Time of Applic	Incidence % Infested		Severity Sting/tuber	
6	Salibro	fluazaindolizine	15.4	fl oz/a	AH	58.7	a	15.0	a
1	Untreated Check					57.5	a	15.8	a
21	Product A			lb/a	B	55.3	a	12.7	a
21	Product A			lb/a	D				
22	Product A			lb/a	B	54.0	a	17.5	a
22	Product A			lb/a	D				
23	Agri-Mek	Abamectin	3.5	fl oz/a	HB	50.7	a	15.3	a
26	Salibro	fluazaindolizine	30.8	fl oz/a	ABKE	50.5	a	9.3	a
20	Product A			lb/a	A	49.7	a	12.7	a
20	Product A			lb/a	I				
33	Vigilance	Gerinol	128	fl oz/a	A	49.0	a	7.2	a
33	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
30	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	5	gal/a	L	48.7	a	17.8	a
11	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	47.7	a	15.7	a
11	Salibro	fluazaindolizine	30.8	fl oz/a	AH				
5	Velum Prime	Fluopyram	6	fl oz/a	A	47.2	a	5.8	a
5	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
31	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHB	46.7	a	11.8	a
8	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	46.5	a	8.3	a
8	Salibro	fluazaindolizine	15.4	fl oz/a	AH				
10	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	45.0	a	12.3	a
10	Salibro	fluazaindolizine	15.4	fl oz/a	AH				
13	Biotan	Extract of Caesalpinia spinosa	5.3	gal/a	A	44.3	a	10.2	a
13	Biotan	Extract of Caesalpinia spinosa	1.77	gal/a	HJN				
2	Vydate C-LV	Oxamyl	34	fl oz/a	ABCDEFG	44.3	a	10.7	a
19	Product A			lb/a	A	43.7	a	8.2	a
19	Product A			lb/a	I				
7	Salibro	fluazaindolizine	30.8	fl oz/a	AH	43.2	a	13.8	a
25	Nemasan	Quillaja Extract + Chitosan	32	fl oz/a	ABC	41.8	a	14.3	a
12	Velum Prime	Fluopyram	5.47	fl oz/a	AH	41.7	a	7.8	a
34	Telone C-35	1, 3 Dichloropropene	16.1	gal/a		41.2	a	5.2	a
17	Vigilance	Gerinol	128	fl oz/a	A	40.7	a	17.7	a
17	Vigilance	Gerinol	96	fl oz/a	HB				
29	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	10	gal/a	L	40.7	a	13.8	a
16	Spectra	Chitosan	22	fl oz/a	A	40.3	a	8.5	a
16	Spectra	Chitosan	16	fl oz/a	HB				
35	Telone II	1, 3 Dichloropropene	15	gal/a		40.2	a	12.3	a
9	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	40.0	a	6.2	a
9	Salibro	fluazaindolizine	30.8	fl oz/a	AH				
28	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	15	gal/a	L	39.3	a	7.7	a
15	Bioshot	Garlic, cinnamon, clove, thyme	64	fl oz/a	AHB	39.0	a	13.8	a
32	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHBM	38.7	a	8.7	a
32	Vydate	Oxamyl	34	fl oz/a	CDEFG				
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	64	fl oz/a	A	38.5	a	7.0	a
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	32	fl oz/a	HB				
27	Warhammer	Chitosan	12	fl oz/a	ABCDEF	38.0	a	19.8	a
27	Forge SP	Streptomycin nigrescent strain MR541	12	oz/a	A				
14	Bioshot	Garlic, Cinnamon, Clove, and Thyme Oil	128	fl oz/a	AHB	37.7	a	12.3	a
4	Salibro	fluazaindolizine	60.4	fl oz/a	A	34.5	a	7.8	a
4	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
36	Telone II	1, 3 Dichloropropene	18	gal/a		32.2	a	6.0	a
3	Arino	Burkholderia rinojensis strain A396	20	fl oz/a	A	30.3	a	7.5	a
3	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
37	Telone II	1, 3 Dichloropropene	10.8	gal/a		29.2	a	9.8	a
37	Exxsol D80	Hydrotreated light Distillate	2.2	gal/a					
24	Impact 6	Chitosan	2	pt/a	ABC	28.0	a	14.2	a
38	Telone II	1, 3 Dichloropropene	13	gal/a		27.7	a	7.2	a
38	Exxsol D80	Hydrotreated light Distillate	3	gal/a					
LSD P=.10						18.79		8.71	

Nematode Cull Ratio and Actual Marketable Yield - Table 4

We classified tubers with more than 5 stings as the nematode infestation caused cull tuber. With the untreated check's 27.3% nematode cull ratio, standard Vydate had 18% nematode cull ratio. Fumigation Telone programs resulted in the lowest nematode cull tuber ratio. Telone alone resulted in 16.7% (low rate) and 15.5% (high rate) nematode cull tuber ratio, where the C-35 Telone formulation alone at 16.1 gal/a and Telone + Exxsol D80 programs had even better nematode cull control with 10.7%, 11% (low rate Telone + D80) and 10.5% (high rate Telone + D80)) cull ratio, rspectively.

While the Velum Prime + Vydate program and LALNIX ACT alone program had 12.8% and 12.2% cull ratio, Arino and Salibro + Vydate programs resulted in 11.3 and 6% nematode cull ratio, followed by Bioshot high rate, Spectra, and Nemaout alone programs at 16.7%, 14.3%, and 13%, respectively. Aster programs showed an obvious dose effect where the high rate had 15.7% cull ratio, followed by 22.8% of its medium rate and 23.7% of its low rate. High rate Product A initiated at planting resulted in 19.3% (high rate) and 20% (low rate) cull ratio but the later Product A programs with at hooking application did not have direct control over the infestation severity with 28% (high rate) and 29.7% (low rate) nematode cull tuber ratio.

High rate Salibro alone, both rates of Serifel + Salibro, and Velum Prime alone resulted in around 16 to 19% cull ratio, which is on par with the Vydate program's 18%, followed by Votivo both rates + Salibro programs and the Biotan program at around 20 to 22%.

To better assess the nematode infestation impact on the yield, we calculated the actual marketable yield with no nematode cull tuber (>5 stings) yield by the following equation: actual marketable yield = normal marketable yield x (100% - nematode cull ratio%). Due to poor total yield and high nematode infestation, untreated plots had only 16,415 lbs/a of actual marketable yield. While the standard Vydate program had a 25,459 lbs/a actual marketable yield, the Telone + Exxsol D80 combination with low Telone rate had similar actual marketable yield as the Vydate at 27,939 lbs/a. Telone C-35 alone or Telone alone resulted in 37,980 lbs/a (C-35), 34,833 lbs/a (Telone low rate), and 37,721 (Telone high rate) actual marketable yield. The Telone + Exxsol D80 at high rate (13 gal/a) had the highest actual marketable yield at 38,553 lbs/a.

Aster programs showed certain level of negative impact on the yield when applied at the high-rate, with only 17,533 lbs/a actual marketable yield. However, the medium rate of Aster resulted in much better actual marketable yield of 30,857 lbs/a, an 88% increase compared to untreated. The low-rate Aster also maintained same level of yield protection as Vydate with 24,296 lbs/a actual marketable yield.

Product A applied later at hooking stage led to good actual marketable yield of 26,511 lbs/a (high rate) and 26,118 lbs/a (low rate), all obviously higher than the untreated check with a 60% advantage. Although the at planting-initiated programs of Product A had lower nematode cull ratio, their relatively lower total yield led to relatively lower actual marketable yields of 22,865 lbs/a (high rate) and 21,165 lbs/a (low rate), which are still >30% higher than untreated check's 16,415 lbs/a.

Arino, Salibro, and Velum Prime + Vydate programs also had higher than untreated check's actual marketable yield at 29,851 lbs/a, 34,264 lbs/a, and 26,853 lbs/a, respectively. Bioshot high rate, Spectra, and Nemaout had similar to Vydate program actual marketable yields of 26,253 lbs/a, 28,675 lbs/a, and 24,889 lbs/a, respectively. The low rate Bioshot, Vigilance, Warhammer + Forge program, and both LALNIX ACT programs had respectively 22,659 lbs/a, 20,230 lbs/a, 22,682 lbs/a, and 23,500 lbs/a actual marketable yield, still 23% to 41% higher than untreated.

Other conventional treatments such as Salibro alone at both rates had around 21,500 lbs/a, the high rate Serifel + Salibro program had 23,164 lbs/a, the high rate Votivo + Salibro program had 27,400 lbs/a, and the Velum Prime alone program had 23,134 lbs/a, all obviously higher than the untreated check with a 28% to 67% advantage.

Table 4. Treatment effect on potato yield and grade, arranged from the lowest marketable yield to the highest from top to bottom.

Trt No.	Treatment Name		Rate of Application		Time of Applic	Marketable yield (lbs)		Cull ratio%	
8	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	16,277	i	17.3	a
8	Salibro	fluazaindolizine	15.4	fl oz/a	AH				
1	Untreated Check					16,415	i	27.3	a
10	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	17,220	hi	22	a
10	Salibro	fluazaindolizine	15.4	fl oz/a	AH				
28	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	15	gal/a	L	17,533	ghi	15.7	a
13	Biotan	Extract of Caesalpinia spinosa	5.3	gal/a	A	19,730	f-i	20	a
13	Biotan	Extract of Caesalpinia spinosa	1.77	gal/a	HJN				
17	Vigilance	Gerinol	128	fl oz/a	A	20,230	e-i	23.7	a
17	Vigilance	Gerinol	96	fl oz/a	HB				
7	Salibro	fluazaindolizine	30.8	fl oz/a	AH	21,026	e-i	16.8	a
20	Product A			lb/a	A	21,165	d-i	20	a
20	Product A			lb/a	I				
6	Salibro	fluazaindolizine	15.4	fl oz/a	AH	21,957	d-i	27.7	a
15	Bioshot	Garlic, cinnamon, clove, thyme	64	fl oz/a	AHB	22,659	c-i	23	a
27	Warhammer	Chitosan	12	fl oz/a	ABCDEF	22,682	c-i	26.7	a
27	Forge SP	Streptomycin nigrescent strain MR541	12	oz/a	A				
19	Product A			lb/a	A	22,865	c-i	19.3	a
19	Product A			lb/a	I				
12	Velum Prime	Fluopyram	5.47	fl oz/a	AH	23,134	c-i	19	a
9	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	23,164	c-i	15.7	a
9	Salibro	fluazaindolizine	30.8	fl oz/a	AH				
25	Nemasan	Quillaja Extract + Chitosan	32	fl oz/a	ABC	23,175	c-i	26	a
32	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHBM	23,551	c-i	12.2	a
32	Vydate	Oxamyl	34	fl oz/a	CDEFG				
23	Agri-Mek	Abamectin	3.5	fl oz/a	HB	23,657	c-i	28	a
31	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHB	23,920	c-i	21.3	a
33	Vigilance	Gerinol	128	fl oz/a	A	23,939	c-i	16.2	a
33	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
30	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	5	gal/a	L	24,296	c-i	23.7	a
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	64	fl oz/a	A	24,889	c-i	13	a
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	32	fl oz/a	HB				
26	Salibro	fluazaindolizine	30.8	fl oz/a	ABKE	24,931	c-i	15.2	a
2	Vydate C-LV	Oxamyl	34	fl oz/a	ABCDEFG	25,459	c-h	18	a
22	Product A			lb/a	B	26,118	b-g	29.7	a
22	Product A			lb/a	D				
14	Bioshot	Garilic, Cinnamon, Clove, and Thyme Oil	128	fl oz/a	AHB	26,253	b-g	16.7	a
21	Product A			lb/a	B	26,511	b-f	28	a
21	Product A			lb/a	D				
5	Velum Prime	Fluopyram	6	fl oz/a	A	26,853	b-f	12.8	a
5	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
11	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	27,400	b-f	21.3	a
11	Salibro	fluazaindolizine	30.8	fl oz/a	AH				
37	Telone II	1, 3 Dichloropropene	10.8	gal/a		27,939	b-f	11	a
37	Exxsol D80	Hydrotreated light Distillate	2.2	gal/a					
24	Impact 6	Chitosan	2	pt/a	ABC	28,580	b-e	12.2	a
16	Spectra	Chitosan	22	fl oz/a	A	28,675	b-e	14.3	a
16	Spectra	Chitosan	16	fl oz/a	HB				
3	Arino	Burkholderia rinojensis strain A396	20	fl oz/a	A	29,851	a-d	11.3	a
3	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
29	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	10	gal/a	L	30,857	abc	22.8	a
4	Salibro	fluazaindolizine	60.4	fl oz/a	A	34,264	ab	6	a
4	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG				
35	Telone II	1, 3 Dichloropropene	15	gal/a		34,833	ab	16.7	a
36	Telone II	1, 3 Dichloropropene	18	gal/a		37,721	a	15.5	a
34	Telone C-35	1, 3 Dichloropropene	16.1	gal/a		37,980	a	10.7	a
38	Telone II	1, 3 Dichloropropene	13	gal/a		38,553	a	10.5	a
38	Exxsol D80	Hydrotreated light Distillate	3	gal/a					
LSD P=.10						8724.1		15.31	

Soil Nematode Population-Table 5

The post-study versus before study soil nematode population change (per 250 cc soil) showed very interesting yet different pattern from the yield or tuber infestation datasets. While untreated plots had the worst 113.3 after study soil nematode population increase (per 250 cc soil), Vydate had -91.7 post-study nematode population reduction. All Telone treatments also had negative change numbers in a range of -10 to -150, and showed significantly decreased soil nematode population by high rate (18 gal/a) Telone II alone at -40, low rate Telone II (10.8 gal/a) + Exxsol D80 at -60, and high rate Telone II (13 gal/a) + Exxsol D80 at -150. C-35 alone at 16.1 gal/a and Telone II alone at 15 gal/a also had -10 reduction but not as significant as the other Telone programs.

The Salibro or Velum Prime + Vydate programs had -90 and -76.7 decrease. Interestingly, although with much lower incidence and severity as well as significantly better actual marketable yield than untreated check, the Arino + Vydate program resulted in the similar to untreated check's post-study soil nematode increase of 210 counts per 250 cc soil, indicating in-direct suppression of the soil nematode infestation activities.

Individual bio-nemaoticide programs such as Bioshot, Spectra, and Nemaout had -106.7 to -173 decreases. The earlier at-plating initiated Product A program resulted in -76.7 (high rate) and -153.3 (low rate) decrease, and the later at-hooking program of Product A at high rate also resulted in -270 decrease.

LALNIX ACT alone or + Vydate showed strong direct nematode soil population control with -1,128 to -740 soil population reduction. Aster 3 different rates programs and Warhammer + Forge program had -91.7 to -730 nematode soil population decrease per 250cc soil.

Conventional programs such as Salibro alone at the 2 rates had 36.7 and 46.7 increase, the high rate Serifel + Salibro program had 13.3 increase, the high rate Votivo + Salibro program had -96.7 decrease, and the Velum Prime alone program had an interesting -123.3 decrease.

Overall, many of these bio-nematicides performed equivalent control efficacy against the soil nematode population when compared to conventional treatments.

Table 5. Treatment effect on soil nematode population, ranked from the highest post-study population change to the lowest from top to bottom.

Trt No.	Treatment Name		Rate of Application		Time of Applic	Nematode count per 250 cc Preplant		At Harvest		Net change	
13	Biotan	Extract of Caesalpinia spinosa	5.3	gal/a	A	161.7	a	513.3	a	352	a
13	Biotan	Extract of Caesalpinia spinosa	1.77	gal/a	HJN						
8	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	120	a	330	a	210	a
8	Salibro	fluazaindolizine	15.4	fl oz/a	AH						
3	Arino	Burkholderia rinojensis strain A396	20	fl oz/a	A	103.3	a	313.3	a	210	a
3	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG						
1	Untreated Check					96.7	a	210	a	113	a
34	Telone C-35	1, 3 Dichloropropene	16.1	gal/a		3.3	a	110	a	107	a
10	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	116.7	a	210	a	93	a
10	Salibro	fluazaindolizine	15.4	fl oz/a	AH						
22	Product A			lb/a	B	250	a	323.3	a	73	a
22	Product A			lb/a	D						
7	Salibro	fluazaindolizine	30.8	fl oz/a	AH	113.3	a	160	a	47	a
23	Agri-Mek	Abamectin	3.5	fl oz/a	HB	360	a	400	a	40	a
6	Salibro	fluazaindolizine	15.4	fl oz/a	AH	113.3	a	150	a	37	a
9	Serifel 10 WP	Bacillus amyloliquefaciens strain MBI 600	0.89	lb/a	AH	113.3	a	126.7	a	13	a
9	Salibro	fluazaindolizine	30.8	fl oz/a	AH						
17	Vigilance	Gerinol	128	fl oz/a	A	186.7	a	183.3	a	-3	a
17	Vigilance	Gerinol	96	fl oz/a	HB						
36	Telone II	1, 3 Dichloropropene	18	gal/a		23.3	a	13.3	a	-10	a
35	Telone II	1, 3 Dichloropropene	15	gal/a		50	a	36.7	a	-13	a
38	Telone II	1, 3 Dichloropropene	13	gal/a		20	a	6.7	a	-13	a
38	Exxsol D80	Hydrotreated light Distillate	3	gal/a							
37	Telone II	1, 3 Dichloropropene	10.8	gal/a		30	a	0	a	-30	a
37	Exxsol D80	Hydrotreated light Distillate	2.2	gal/a							
19	Product A			lb/a	A	210	a	133.3	a	-77	a
19	Product A			lb/a	I						
5	Velum Prime	Fluopyram	6	fl oz/a	A	106.7	a	30	a	-77	a
5	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG						
4	Salibro	fluazaindolizine	60.4	fl oz/a	A	103.3	a	13.3	a	-90	a
4	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG						
2	Vydate C-LV	Oxamyl	34	fl oz/a	ABCDEF(	101.7	a	10	a	-92	a
11	Votivo 240 FS	Bacillus firmus I-1582	10.95	fl oz/a	AH	126.7	a	30	a	-97	a
11	Salibro	fluazaindolizine	30.8	fl oz/a	AH						
16	Spectra	Chitosan	22	fl oz/a	A	186.7	a	80	a	-107	a
16	Spectra	Chitosan	16	fl oz/a	HB						
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	64	fl oz/a	A	210	a	96.7	a	-113	a
18	Nemaout	Cinnamon, Clove, and Cottonseed Oil	32	fl oz/a	HB						
14	Bioshot	Garilic, Cinnamon, Clove, and Thyme Oil	128	fl oz/a	AHB	196.7	a	83.3	a	-113	a
12	Velum Prime	Fluopyram	5.47	fl oz/a	AH	146.7	a	23.3	a	-123	a
28	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	15	gal/a	L	850	a	710	a	-140	a
20	Product A			lb/a	A	220	a	66.7	a	-153	a
20	Product A			lb/a	I						
15	Bioshot	Garlic, cinnamon, clove, thyme	64	fl oz/a	AHB	196.7	a	23.3	a	-173	a
21	Product A			lb/a	B	310	a	40	a	-270	a
21	Product A			lb/a	D						
25	Nemasan	Quillaja Extract + Chitosan	32	fl oz/a	ABC	530	a	160	a	-370	a
26	Salibro	fluazaindolizine	30.8	fl oz/a	ABKE	750	a	306.7	a	-443	a
24	Impact 6	Chitosan	2	pt/a	ABC	520	a	73.3	a	-447	a
30	Aster	Thyme, Clove, Garlic, and Cinnamon Oils	5	gal/a	L	1091.7	a	603.3	a	-488	a
27	Warhammer	Chitosan	12	fl oz/a	ABCDEF	846.7	a	146.7	a	-700	a
27	Forge SP	Streptomycin nigrescent strain MR541	12	oz/a	A						
32	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHBM	1450	a	710	a	-740	a
32	Vydate	Oxamyl	34	fl oz/a	CDEFG						
31	Melocon	Purpureocillium lilacinum strain 251	10.25	fl oz/a	LHB	1311.7	a	183.3	a	-1128	a
33	Vigilance	Gerinol	128	fl oz/a	A	1813.3	a	50	a	-1763	a
33	Vydate C-LV	Oxamyl	34	fl oz/a	BCDEFG						
LSD P=.10						1029.67		397.28		1022.07	

Moses Lake 5 Program Stubby-Root Trial

We observed no treatments caused phytotoxicity for this trial.

Although the soil nematode population data did not reflect direct treatment effect, Salibro achieved the highest marketable yield at 32,085 lbs/a and total yield at 34,363 lbs/a, which is 1.17 times of untreated check's 27,398 lbs/a, while the other treatments resulted in similar yields as untreated check.

Data suggest good tuber production protection/enhancement from Salibro program.

Table 6. Impact of 5 nematode programs on yield and stubby root nematode population.

Treatment Appl. Interval					152 DA-A			152 DA-A		-43 DA-A		124 DA-A		124 DA-A	
					marketable y		change in	total yield		before study ne>		after study nem>		change in SRN	
Trt #	Treatments	Rates		Appl Code	lbs/acre		yield	lbs/acre		SRN/250 cc		SRN/250 cc		250 cc	
1	Untreated				27,398	a	1	29,568	a	43	a	4	a	-39	a
2	Vydate C-LV	34	fl oz/a	ABCDEF	26,598	a	0.97	28,568	a	39.2	a	7.8	a	-31.4	a
3	NemaClean	2	lb/a	A	27,059	a	0.99	28,753	a	0	a	4	a	4	a
3	NemaClean	1	lb/a	B											
4	Agri-Mek	3.5	fl oz/a	GIJ	26,660	a	0.97	29,060	a	31.2	a	4	a	-27.2	a
5	Salibro	30.8	fl oz/a	ABH	32,085	a	1.17	34,363	a	50.8	a	0	a	-50.8	a
LSD P=.10					6549.04			6593.74		78.32		12.42		82.14	

Photo 1. Fumigation application made by a commercial applicator.

Photo 2. Chemigator used for the chemigation application.

Photo 3. In furrow application made by a CO_2 pressurized sprayer attached to the planter which applies the treatments at the meantime of seeding.

Photo 4. Backpack application made in the Moses Lake trial.

Photo 5 and 6. ADG employee conducting yield and grading ratings.


Photo 7 and 8. Potato peeling for tuber ratings.


Photo 9. Nematode stings on potato tubers, bottom=healthy tuber, top=heavily infested tuber with nematode (root-knot) stings.