

Evaluation of Vydate[®] for Control of Root-knot Nematode Damage in Potato

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Introduction

Root-knot nematodes (*Meloidogyne chitwoodi*) remain one of the most costly pests for potato production in the Klamath Basin and other areas of the Pacific Northwest. Current control measures, while effective, constitute a significant proportion of production costs. Recent research has developed improved strategies using Vydate[®] C-LV (Oxamyl, E. I. DuPont de Nemours and Co., Inc.) for control of root-knot nematodes in potato. Preliminary findings suggest early applications of Vydate[®] C-LV may be very effective for control of root-knot nematodes in a cool, short-season area like the Klamath Basin. A study was conducted at the Klamath Experiment Station (KES) in 2002 to determine how many applications of Vydate[®] C-LV are necessary to protect tubers from root-knot nematode damage.

Procedures

The Vydate[®] C-LV root-knot nematode trial was conducted on a Poe fine sandy loam soil at KES that was planted to spring grain in 2000 and remained in grain stubble during the irrigation cut-off experienced in 2001. Primary and secondary tillage was performed in late April. The soil has

about 1.5 percent organic matter in the plow layer and a pH of about 6.7 to 7.0. The field was sampled for nematode analysis in October 2001 and March 2002. Root-knot nematodes per 250 g dry soil averaged 891 and 266, respectively. Stubby-root nematodes (*Paratrichodorus allius*) per 250 g dry soil averaged 111 and 11, respectively. This field did not receive any preplant fumigants or nematicides.

The following treatments with Vydate C-LV at 2.1 pints/acre per application were evaluated:

- 1) Untreated control.
- 2) Water-run at 950 DD_{5C} + 14 and 28 days later.
- 3) In-furrow at planting + banded at hilling + water-run at 950 DD_{5C}.
- 4) In-furrow at planting + banded at hilling + water-run at 950 DD_{5C} + 14 days later.
- 5) In-furrow at planting + banded at hilling + water-run at 950 DD_{5C} + 14 and 28 days later.

DD equals heat units measured as soil degree-days, base 5°C (41°F) recorded at 6-8 inches deep within a potato row. Cumulative degree-days are calculated by subtracting the minimum temperature for nematode development (5°C, 41°F) from the daily average temperature and adding these values on a daily basis. Previous work suggests the

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hatch of second generation root-knot nematodes and time of first tuber invasion by juvenile root-knot nematodes occurs near 950 DD_{5C} (1,710 DD_{41F}) so applications are recommended to begin before this event.

All Vydate C-LV applications were made at 2.1 pt/acre (1.0 lb active ingredient [a.i.]/acre). The in-furrow application was sprayed over the seed piece at planting. The application at hilling was sprayed as a band over the hill and immediately incorporated using a rolling cultivator. Water-run applications were injected with 0.5 inches of water during irrigation and were preceded and followed by 0.25 inches of water. Water-run applications were applied on July 24, August 8, and August 23. Plastic tarps were positioned over plots not treated during water-run applications, but were removed during pre- and post-application irrigation.

Russet Norkotah seed was hand-cut to approximately 1.5-2.0 oz/seedpiece on May 14, treated with Tops MZ[®] (thiophanate methyl-mancozeb, Gustafson) at 1.0 lb/cwt, and suberized at approximately 55⁰F and >90 percent relative humidity. Potatoes were planted at 9-inch spacing in four 32-inch row plots with a two-row, assisted-feed planter on May 21. Fertilizer was banded on both sides of rows at planting at 160 lb/acre N, 80 lb/acre P₂O₅, 80 lb/acre K₂O, and 140 lb/acre S at planting. DiSyston[®] (disulfoton, Bayer) was applied in the seed furrow at 3.0 lb a.i./acre at planting. Irrigation was applied with solid-set sprinklers arranged on a 40- by 48-ft spacing. Total crop water, including irrigation and rainfall, was approximately 20 inches.

Weeds were adequately controlled with Dual[®] (metolachlor, Syngenta) and Prowl[®] (pendimethalin,

Cyanamid) applied with a ground sprayer at recommended rates on May 30 and incorporated with a rolling cultivator. Several foliar fungicides and one foliar insecticide applications were made aerially during the growing season. Vines were desiccated with Diquat[®] (diquat dibromide, Syngenta) applied with a ground sprayer at 1.5 pt/acre on August 29 and shredded with a rotobearer 1 day prior to harvest.

During the growing season, each plot was soil sampled for nematode analysis on 2-week intervals starting on June 21, the date of the at-hilling Vydate application. Eight cores were collected per plot from one of the two center plot rows with a 1-inch-diameter soil probe. All samples were taken from the top foot of soil.

Potatoes were harvested with a one-row, digger-bagger on September 17. A 25-tuber subsample from the row used for soil samples was picked at random from the harvester and saved for nematode infection analysis after storage. All other tubers from the two center plot rows were graded on September 17. Grades included B size (<4 oz); U.S. No. 1s 4-8 oz, 8-12 oz, and >12 oz; U.S. No 2s, and culls. Fifty tubers were subsampled during the grading process. Twenty-five tubers were immediately analyzed for external and internal nematode blemish analysis. The remaining 25 tubers and subsamples from the harvester were stored (incubated) at ambient temperature and analyzed for external and internal nematode blemish at 850 DD_{5C} post-harvest.

The trial was arranged in a randomized complete block design. Yield data were analyzed using MSTAT (Microcomputer Statistical Program, Michigan State University) software. Least significant differences (LSD) are

based on Student's *t* at the 5 percent probability level. Only a portion of the data collected is reported here.

Results and Discussion

Growing season conditions favored physiological stress and development of stress symptoms in Russet Norkotah. Periods of alternating high and low temperatures were experienced from late June through mid-August. Temperatures of 90⁰F were reached or exceeded on 22 days with a maximum of 101⁰F recorded on July 13. In contrast, frosts were recorded at KES on June 19, August 5, and September 5-10. Heavy smoke from forest fires engulfed the region on several days from late July through late August. Mean total yields were approximately 100 cwt/acre lower than normally observed for Russet Norkotah. Heat stress and disease symptoms associated with early-die complex undoubtedly contributed to poor yield. Average tuber size was much smaller than commonly observed for Russet Norkotah and tuber appearance tended to be fairly rough. Tuber infections from root-knot nematodes were observed in adjacent variety trials treated with Vapam[®] at 38 gal/acre. Observations at harvest would indicate that moderate populations of spring-sampled nematodes were not adequately controlled by Vapam[®].

Vydate C-LV applications did not affect tuber size distribution or yield parameters across all treatments (Table 1). Vydate C-LV significantly reduced internal nematode blemish in all treatments compared to the untreated control (Fig. 1). Approximately 65 percent of tubers from the untreated control contained 6 or more internal nematodes. Vydate applied at 950 DD and 14 and 28 days later significantly

reduced internal nematode blemish compared to the untreated control. However, nematodes were still present in 2.3 percent of the tubers.

As expected, internal symptoms increased during incubation (storage) conditions. Recent data on population dynamics suggest that *M. chitwoodi* begins to hatch at a low rate before 950 DD, so earlier timing of the first water-run application (i.e., 900 DD) may improve performance of this treatment schedule. Treatments 3, 4, and 5 reduced internal nematode blemish to acceptable levels (Fig. 1). Tubers exhibiting any external blemish produced similar trends (Fig. 2). Interestingly, external nematode blemish did not appear to worsen during incubation conditions. In most circumstances, tubers showing more than 10 percent external blemish would not meet fresh market grade standards. Approximately 50 percent of tubers from the untreated control contained more than 10 percent external blemish (Fig. 3). All other treatments reduced nematode blemish to acceptable levels. Preliminary data from this trial suggest Vydate C-LV applications can significantly reduce nematode blemish.

Soil samples for monitoring of nematode population dynamics have not been analyzed at this time. It is expected that results will allow prediction of the timing of generation development. It is not known whether development of new generations closely follows the pattern for heat units observed in the warmer, long-season area in the Columbia Basin.

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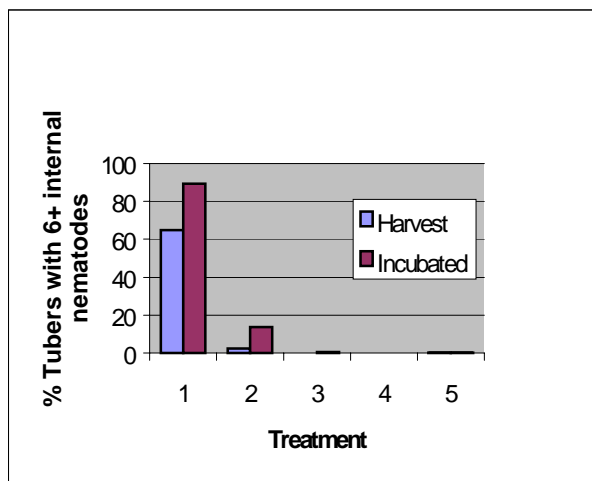


Figure 1. Effect of Vydate[®] on root-knot nematode blemish at Klamath Falls, OR 2002.

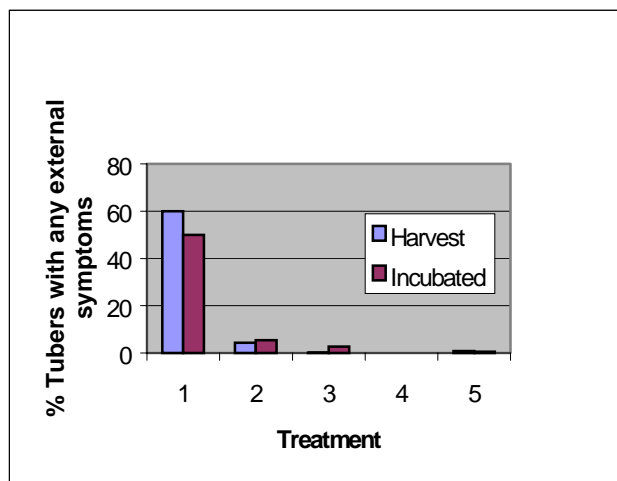


Figure 2. Effect of Vydate[®] on root-knot nematode blemish at Klamath Falls, OR 2002.

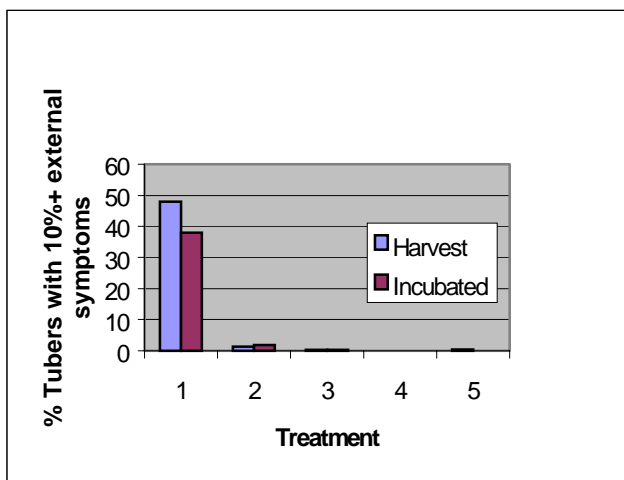


Figure 3. Effect of Vydate[®] on root-knot nematode blemish at Klamath Falls, OR 2002.

- Treatment**
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- 1) Untreated control
 - 2) 950 DD5⁰C + 14 + 28
 - 3) IF¹ + Hilling + 950 DD5⁰C
 - 4) IF¹ + Hilling + 950 DD5⁰C + 14
 - 5) IF¹ + Hilling + 950 DD5⁰C + 14 + 28
- ¹ IF = In-furrow

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Table 1. Effect of Vydate CLV on yield of Russet Norkotah grown at Klamath Falls, OR, 2002.

Treatment ¹	Yield U.S. No. 1s				Yield			
	4-8 oz	8-12 oz	>12 oz	total	<4 oz	No. 2s	culls	total
	cwt/acre							
1	118	132	74	324	44	23	22	413
2	130	117	54	301	51	25	14	392
3	160	107	53	320	49	20	24	413
4	164	138	47	349	65	13	25	452
5	143	121	56	320	57	16	19	412
Mean	143	123	57	323	53	19	21	416
CV (%)	27	27	50	16	26	60	75	11
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

1. ¹Untreated control.
2. Water-run at 950 DD5°C + 14 and 28 days later.
3. In-furrow at planting + banded at hilling + water-run at 950 DD5°C.
4. In-furrow at planting + banded at hilling + water-run at 950 DD5°C + 14 days later.
5. In-furrow at planting + banded at hilling + water-run at 950 DD5°C + 14 and 28 days later.