

CHEMICAL MANAGEMENT OF THE ROOT-LESION NEMATODE, *PRATYLENCHUS NEGLECTUS* IN TWO IDAHO POTATO FIELDS

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Summary. Three field trials were conducted in Idaho, USA, to study the efficacy of oxamyl (Vydate C-LV), aldicarb (Temik 15G) and ethoprop (Mocap 6EC) for control of lesion nematode on potato. In the first trial there was an increase in saleable yield and total yield of potato tubers in all treatments with oxamyl and aldicarb compared to the control plots. Saleable yield was significantly increased by oxamyl (Vydate C-LV at 2.2 kg/ha) and aldicarb (Temik 15G at 22 kg/ha) applications compared to the control and Vydate C-LV (1.2 kg/ha). In the second and third trials, although there was no significant difference among treatments in saleable yield, the total yield was significantly increased by all oxamyl and aldicarb treatments compared to the control plots.

Keywords: Chemical management, field trials, *Solanum tuberosum*.

Plant-parasitic nematodes are one of the major limiting factors for potato production in Idaho, USA. More than 68 species belonging to 24 genera are associated with potato fields in different parts of the world (Jensen *et al.*, 1979). Among all nematode pests, the root-lesion nematode *Pratylenchus neglectus* (Rensch) Filipjev *et* Schuurmans Stekhoven is one of the most common and damaging in Idaho potato fields (Hafez *et al.*, 1992, 1999). Chemical and non-chemical treatments are very effective in managing root-lesion nematodes. Soil solarisation is a very effective non-chemical approach for control of *P. thornei* Sher *et* Allen on chickpea (Akem *et al.*, 2000), *Pratylenchus* spp. on banana (Araya, 2000), *P. coffeae* (Zimmermann) Filipjev *et* Schuurmans Stekhoven on yellow yam (Hutton, 1998) and tobacco (Tu *et al.*, 1996), and *P. penetrans* (Cobb) Filipjev *et* Schuurmans Stekhoven on Easter lily (Westerdahl *et al.*, 2003). However, this non-chemical strategy can be adopted successfully only in warm environments. In cool geographical regions this non-chemical approach is less effective and chemical treatments with non-fumigant nematicides provide better results. Earlier studies indicated that chemical treatments with oxamyl (Vydate C-LV) applied in potato fields increased yield and delayed infection by the wilt fungus *Verticillium dahliae* by controlling *P. thornei* (Eissa, 1982; Scholte, 1989). Good results were obtained with this chemical applied as seed treatment to control *Meloidogyne incognita* (Kofoid *et* White) Chitw. and *P. brachyurus* (Godfrey) Filipjev *et* Schuurmans Stekhoven on potato and *P. coffeae* on yam (Rodriguez-Kabana and Ingram, 1977; Oramas-Nival, 2002). However, Westerdahl *et al.* (1992) found that oxamyl did not provide significant control of *M. incognita* on tomato.

The efficacy of oxamyl differs with respect to the maturity date of varieties planted in the soil. Kimpinski *et al.* (2001) found that this compound increased total tuber yield of early-maturing potato cultivars, but poor yield response was observed with late-maturing cultivars.

Also, there were significant inverse relationships between total tuber yields and numbers of *P. penetrans* in soil and in roots. Nematode control could be prolonged by chemigation of this product. Ethoprop (Mocap 6EC) is another non-fumigant product effectively used to control *P. brachyurus* on pineapple (Kehe *et al.*, 1997) and *Pratylenchus* sp. on tobacco (Johnson, 1990). Taking into consideration the good results obtained with these products for nematode management in different geographical areas, a study was conducted to assess the efficacy of oxamyl (Vydate C-LV), aldicarb (Temik 15G) or ethoprop (Mocap 6EC), which are all registered in the USA, for the management of *P. neglectus* on potato in the cool environmental conditions of Idaho.

The first two trials were laid out in a randomized block design with four treatments each with six replicates in a sandy loam soil (sand 50%, silt 25%, clay 25%, pH 7.5) field located at the University of Idaho, Idaho, USA. In the first and second tests granular and liquid formulations of oxamyl (Vydate C-LV) were applied at and after planting at the rates and intervals specified in Tables I and II. Aldicarb (Temik 15G) was applied in a 4-6 inch band at planting in front of the planter shoe at the rate specified in Tables I and II. The initial nematode density in the field was 2,280 *P. neglectus*/500 cm³ of soil. Potato cv. Russet Burbank seed pieces were planted on 20 April, 2005, in rows a meter apart. Plant protection practices, weeding and other standard cultural practices were followed. Five months after planting, the tubers were hand-harvested, on 22 September 2005 from six metres of the middle two rows of each plot and weighed.

A third trial was laid out in a randomized block design with six treatments each with six replicates in a sandy loam field at the same location. Oxamyl, aldicarb and ethoprop (Mocap 6EC) were applied with the modalities, rates and intervals specified in Table III. The initial nematode population density in this field was 3,540 *P. neglectus*/500 cm³ of soil. Potato cv. Russet Bur-

Table I. Effect of granular nematicides on potato tuber yield in a field infested with an initial density of 2,280 *Pratylenchus neglectus*/ 500 cm³ of soil.

Treatment	Saleable yield (t/ha)	Total yield (t/ha)
Vydate C-LV, 1.1 kg/ha, at planting; Overhead chemigation (2 times)	51.9 bc	70.6 a
Vydate C-LV, 2.2 kg/ha, at planting; Overhead chemigation (2 times)	53.4 b	70.2 a
Aldicarb (Temik 15G) 22 kg/ha, at planting	59.0 a	73.3 a
Untreated check	49.6 c	61.2 b
*FLSD ($P < 0.05$)	2.7	3.3

*Fisher's protected least significant difference test

Table II. Effect of chemical nematicides on the potato tuber yield and percentage reduction of nematode population in a field infested with an initial density of 2,280 *Pratylenchus neglectus*/500 cm³ of soil.

Treatment	Saleable yield (t/ha)	Total Yield (t/ha)	Nematode percentage reduction
Vydate C-LV 2.2 kg/ha, in furrow banded at planting+ Vydate C-LV 1.1 kg/ha before row closure and 14 days after	26.6 b	44.0 a	52.2
Vydate C-LV 2.2 kg/ha, before row closure, 14 days after and 28 days after	33.7 a	45.3 a	63.1
Aldicarb (Temik 15G) 22 kg/ha, at planting	29.5 ab	47.2 a	68.1
Untreated control	32.3 ab	40.2 b	-
*FLSD ($P < 0.05$)	6.4	3.1	

*Fisher's protected least significant difference test

bank seed pieces were planted on 30 April, 2008, in rows one metre apart. Plant protection practices, weeding and other standard cultural practices were followed. Five months after planting, the tubers were hand-harvested, on 17 September 2008, from 20 feet of the middle two rows of each plot and weighed.

Soil samples were taken before and after treatment and the nematodes were extracted using Cobb's decanting and sieving technique followed by a centrifugal flotation method. The percentage reduction of *P. neglectus* from the untreated control for each treatment was calculated.

In the first trial there was an increase in total yield due to nematicide treatments compared to the control plots (Table I). Maximum saleable yield was obtained as a result of application of Temik 15G. Application of the higher rate of oxamyl (Vydate C-LV at 2.2 kg/ha) at planting with overhead chemigation significantly increased the marketable yield compared to the untreated control. Although the lower rate of oxamyl (Vydate C-LV at 1.2 kg/ha) application with overhead chemigation significantly increased the marketable yield compared to the control plots, the percentage increase was less than that provided by the aldicarb (Temik 15G) application.

In the second trial, only the applications of the granular formulation of oxamyl at 2.2 kg/ha at planting and at two 14-day intervals increased significantly the yield of marketable tubers compared to the control. The other treatments, including aldicarb and the control, did not differ for this variable (Table II). However, all the

chemical treatments increased significantly the total tuber yield and suppressed nematode population compared to the control. Maximum suppression was observed with the aldicarb application (68.1%) (Table II).

In the third experiment, a significant increase in total potato tuber yield and the greatest nematode population suppression were observed in the plots treated with aldicarb (Temik 15G) alone or in combination with oxamyl (Table III). There was variability in the results provided by the other chemical treatments, including those with ethoprop and oxamyl, which did not differ from the control. In this trial all chemical treatments failed to increase significantly the yield of marketable tubers compared to the control.

The efficacy of aldicarb in increasing potato tuber quality has been reported by Weingartner *et al.* (1974). However, inconsistent results with this product were observed by Kimpiski (1979; 1986). Applications of high rates of oxamyl were effective in our study in increasing marketable and total tuber yield, but some variability in the results occurred. It is known that potato yield response differs with respect to the application of oxamyl at planting or thereafter. Olthof (1989) observed that either granular or liquid formulations of oxamyl (Vydate C-LV) applied immediately after planting increased only the total yield, while application of this product two weeks after planting failed to control *P. penetrans* or to increase total or marketable yields. The good yield response obtained with aldicarb applications in this study confirms the results of previous studies

Table III. Effect of chemical nematicides on potato tuber yield in a field infested with an initial density of 3,540 *Pratylenchus neglectus*/500 cm³ of soil.

Treatment	Saleable yield (t/ha)	Total yield (t/ha)
Untreated control	31.7	50.2 c
Vydate C-LV 19 l/ha in furrow banded + 9.5 l/ha before row closure + 9.5 l/ha 14 days later	28.9	53.9 ab
Vydate C-LV 9.5 l/ha before row closure + 2 applications of 9.5 l/ha at 14 days intervals	33.3	50.9 bc
Aldicarb (Temik 15G) 22 kg/ha, at planting	33.1	53.9 ab
Aldicarb (Temik 15G) 22 kg/ha in furrow, at planting, + Vydate C-LV 9.5 l/ha prior to row closure + Vydate C-LV 9.5 l/ha 14 days later	31.2	54.9 a
Ethoprop (Mocap 6EC) 19 l/ha pre-planting, broadcast + Vydate C-LV 9.5 l/ha prior to row closure + Vydate C-LV 9.5 l/ha 14 days later	31.1	52.6 abc
*FLSD ($P < 0.05$)	NS	3.5

*Fisher's protected least significant difference test

conducted by Hafez (1983) in managing *P. neglectus* in the cool conditions of Idaho. The current studies indicated that application of aldicarb at planting or multiple applications of oxamyl are the most viable chemical options for the management of lesion nematode on potatoes in Idaho.

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