BIOLOGY AND CONTROL OF THE COLUMBIA ROOT-KNOT NEMATODE ON POTATO, 1984

by
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There are more than 40 described species of root-knot nematodes (Meloidogyne spp.). Of these, two are important on potatoes in the Pacific Northwest. They are the Columbia M. chitwoodi) and the northern (M. hapla) root-knot nematodes. Since its discovery in 1978, M. chitwoodi has been shown to be more important on potatoes than M. hapla. M. chitwoodi causes more severe damage to tubers and is more difficult to control.

Crops commonly grown in rotation with potatoes are alfalfa, wheat and corn. Wheat and corn are good hosts for M. chitwoodi but are not hosts for M. hapla. Alfalfa on the other hand is a good host for M. hapla but a none to a poor host for M. chitwoodi. However, recently a second race of M. chitwoodi has been found that readily attacks alfalfa (Table 1). Thus far, this new race is only known to occur in the Pasco area. Studies are underway to determine its distribution, biology, pathogenicity and control on potatoes.

The most common method used to control root-knot nematodes on potatoes is by soil fumigation with Telone II or the metham sodium products (Metam, Nemasol, Soil Prep or Vapam). Telone II is applied by soil injection with tractor drawn chisels and metham sodium by application through a sprinkler system. However, in fields heavily infested with M. chitwoodi soil fumigation alone may not be adequate. Our nematicide trials show that the nonfumigant nematicides show promise in suppressing M. chitwoodi infection within tubers, especially in combination with the soil fumigants. Over the past several years the best treatment in our plots for control of M. chitwoodi has been the combination of Telone II at 20 gals/A and Mocap 6EC at 6 lbs AI/A applied as a broadcast incorporated spray just prior to planting. Mocap is registered for suppression of M. chitwoodi at 6 lbs AI/A and control of M. hapla at 9 lbs AI/A. The combination of Mocap and Temik 15G at 3 lbs AI/A applied when the plants are 4-6 inches tall is also effective against M. hapla. Temik also provides added benefits of nematode control when combined with a soil fumigant. However, results with Temik have not been as consistent as those obtained with Mocap for control of M. chitwoodi.

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Results of our nematicide trials in 1984 at IAREC, Prosser and K_2H Farms, Burbank are summarized in Tables 2, 3 and 4. Telone II gave excellent control of M. chitwoodi in the Prosser plots but not at K_2H (Tables 2 and 3). This was probably due to the fact that the nematode population at K_2H was higher and occurred deeper than at Prosser. At K_2H the average number of juveniles before treatment was 1,100/250 cm^3 soil (½ pint) compared to the Prosser plots which averaged 180. However, the results with the nonfumigant treatments alone were reversed. The nonfumigants, except for Temik, performed very well at K_2H compared to Telone II but not at Prosser. The reason for the failure of the nonfumigants, especially Mocap, at Prosser is not known. In past years Mocap at 9 lbs AI/A at the same location has given much better results. The results obtained with Disyston at K_2H was encouraging. However, more work must be done to substantiate these results. In the metham sodium plots, all treatments significantly (P=0.05) reduced tuber infection compared to the nontreated plots (Table 4). Total yields and payable yields were greater than the nontreated with all metham sodium treatments, however, not all differences were significant because of the stand variability resulting from phytotoxicity in a number of spring treatments which were planted less than 14 days after fumigation. Based on all criteria, Telone II plus Mocap gave excellent control of M. chitwoodi.

Table 1. Reproduction of Meloidogyne chitwoodi Race 1 and 2 on tomato and alfalfa cultivars after 55 days.

Host	Cultivar	Average number of egg masses/plant* Race 1**	Race 2+
Alfalfa	Ranger	0.2	23.3
	Thor	0	40.4
	Vernal	0	29.3
	Washoe	0	7.6
	Gladiator	0	6.6
	Nevada Syn XX	0	2.2
Tomato	Columbian	200+	200+

* Values are means of 10 replicates.
** Original population isolated from potato tubers from the Quincy area.
\+ Population isolated from potato tubers from the Pasco area.

Table 2. Control of Meloidogyne chitwoodi, IAREC, Prosser, 1984. [1]

Treatment (rate AI/A)[2]	% culls[3]	Infection index[4]
Nontreated	96 a	5.4 a
Telone II 20 gal (S)	0 c	0.01 d
Telone II 20 (S) + Mocap 6EC 6 lb (BP)	0 c	0 d
Telone II 20 (S) + Temik 15G 3 lb (PP)	0 c	0 d
Telone II 20 (S) + Furadan 15G 3 lb (AP)	0 c	0 d
Mocap 6EC 9 lb (BP)	91 ab	3.9 bc
Temik 15G 3 lb (PP)	93 ab	5.3 ab
Furadan 15G 3 lb (AP)	80 ab	4.0 bc
Mocap 6EC 6 lb (BP) + Temik 15 G 3 lb (PP)	100 ab	5.7 a
Mocap 6EC 6 lb (BP) + Furadan 15G 3 lb (AP)	92 ab	5.6 a
Mocap 6EC 6 lb (BP) + Disyston 15G 3 lb (PP) + 3 lb (PP)[5]	75 b	3.7 c

1 Values are means of five replicates. Values in each column not followed by the same letter differ significantly at P=0.05 (DMRT).

2 S = Spring application; BP = Before planting; AP = At planting; PP = Post-plant.

3 Tubers with 6 or more infection sites/tuber were graded as culls.

4 Infection index: 0 = no nematodes; 1 = 1-3; 2 = 4-5; 3 = 6-9; 4 = 10+; 5 = 50+; and 6 = 100+ infection sites/tuber.

5 Treatment was made July 5. All other PP treatments were made June 14.

Table 3. Control of Meloidogyne chitwoodi, K_2H Farms, Burbank, 1984 [1].

Treatment (rate AI/A)[2]	% culls[3]	% infection[4]	Infection index[5]	Payable Yield (T/A)[6]	Return ($)[7]
Nontreated	100 a	41.0 a	6.0 a	8.1 c	528
Telone II 20 gal (S)	84 a	18.0 bc	4.2 b	16.3 a	1058
Telone II 20 (S) + Mocap 6EC 6 lb (BP)	3 c	1.3 c	0.1 d	19.8 a	1284
Telone II 20 (S) + Temik 15G 3 lb (PP)	37 b	6.2 c	1.6 c	17.9 a	1163
Mocap 6EC 9 lb (BP)	28 b	9.0 c	1.4 c	16.0 a	1042
Temik 15G 3 lb (PP)	92 a	35.0 ab	5.1 ab	11.4 bc	742
Mocap 6EC 6 lb (BP) + Temik 15G 3 lb (PP)	19 bc	6.2 c	1.0 cd	17.3 a	1124
Disyston 15G 3 lb (PP) + 3 lb (PP)[8]	23 bc	10.0 c	1.2 cd	15.6 ab	1016

1 Values are means of five replicates. Values in each column not followed by the same letter differ significantly at P=0.05 (DMRT).
2 S = Spring application; BP = Before planting; PP = Post-plant.
3 Tubers with 6 or more infection sites were graded as culls.
4 Percent infection rated by Chef Reddy, Othello, Wa. was based on payable tubers. Tubers with greater than 20% of peeled surface showing nematode signs were rejected and contributed to % infection.
5 Infection index: 0 = no nematodes; 1 = 1-3; 2 = 4-5; 3 = 6-9; 4 = 10+; 5 = 50+; and 6 = 100+ infection sites/tuber.
6 Payable yield = tubers greater than 4 oz or 2 inches diameter minus nematode and other culls.
7 Estimated gross return = (Payable yield) x ($65/ton).
8 Treatment was made July 30. All other PP treatments were made June 13.

Table 4. Control of *Meloidogyne chitwoodi* with metham sodium applied through a center pivot, K_2H Farms, Burbank, 1984.[1]

Treatment (rate AI/A)	% culls[3]	% infection[4]	Infection index[5]	Payable Yield (T/A)[6]	Return ($)[7]
Nontreated	100 a	53.0 a	5.6 a	7.2 c	467
Nemasol 50 Fall	19 b	8.4 b	1.2 b	12.4 bc	809
Soil Prep 50 Fall	22 b	0.5 b	0.7 b	16.5 ab	1074
Soil Prep 60 Fall	10 b	1.1 b	1.3 b	18.9 a	1230
Nemasol 50 Spr	15 b	5.3 b	0.7 b	14.0 ab	910
Soil Prep 50 Spr	15 b	3.4 b	0.9 b	16.9 ab	1101
Soil Prep 60 Spr	18 b	3.4 b	0.9 b	16.4 ab	1067

See reference in Table 3.