

EVALUATION OF VYDATE™ IN COMBINATION WITH SOIL FUMIGATION ON EGGPLANT FOR YIELD INCREASE AND NEMATODE CONTROL

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Introduction

Oxamyl (Vydate, Dupont Chemicals) is an oxime carbamate used to control nematodes, mites and insects. A systemic pesticide, it is suggested for use as a pre-plant, at-plant and post-plant treatment. Oxamyl is used in a variety of formulations and is currently one of the only available post-plant nematicides registered for vegetables in the southeastern US. Although Vydate will not be acceptable to farmers as a stand-alone treatment for nematode control, it may have potential as a post-plant application following pre-plant soil fumigation. Several researchers also reported improved fruit quality of tomato and pepper following Vydate application.

The following test was set up to evaluate the effect of Vydate on nematode damage and fruit yield of eggplant in combination with soil fumigation with methyl bromide and Telone C-35.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area had a history of soybeans, tobacco, and assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a split plot design with fumigants as main treatments and Vydate drip applications as sub-treatments. Plots were arranged in randomized complete blocks consisting of single bed plots replicated five times. Each plot was 30 feet long and 30 in wide

On 28 March, 2003, the soil fumigants methyl bromide and Telone C35 were applied and all test plots were covered with black polyethylene mulch with drip tape in the center of the bed approximately 1 in. deep. Vydate was applied at planting (April 17), and two and four weeks post plant through the drip tape at a rate of 2 qts/A per application (Table1).

Eggplant seedlings, cv. Black Beauty, were produced in nutrient tray system to the 4-leaf stage. A single eggplant was transplanted using a mechanical type transplanter, which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 17 April. Plant spacing was 12 in.

As per the recommendation of the University Of Georgia Extension service, all plots received 700 lbs. of fertilizer (10-10-10) incorporated prior to planting. Additional fertilizer was added in the form of liquid fertilizer (NPK 20-20-20 and 8-0-4 alternated) injected through the irrigation tubing during the growing season. All eggplant plots were sprayed on a 4 to 7 day interval with Manex with Zinc (2.4 qt/A) plus Kocide LF (0.5 gal/A) and Bravo (2 pts/A) for

control of foliar diseases. Except for one insecticide spray (Avaunt) shortly after planting to control armyworm, no insecticides were applied.

Stand counts were made to record live plants and plant vigor ratings were done starting at 14 days after planting. Plant vigor was rated on a 1 to 10 scale, 10 representing live and healthy plants and 1 representing dead plants.

Twelve cores of soil, 2.5-cm-diam × 25-cm-deep, were collected from the center of each plot before fumigation (24 March), at planting (17 April) and at harvest (9 July). Nematodes were extracted from a 150-cm³ soil sub-sample using a centrifugal sugar flotation technique, except at planting when they were extracted in Baermann pans (to capture only active nematodes). On 4 June (at flowering stage) an early root gall evaluation was done on three plants per plot using a 0 to 10 scale, whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 = 75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead. Again following final harvest on 22 July ten plants per plot were evaluated for root galls using that same scale.

Shoot and root weights were recorded at flowering stage of eggplant (4 June) on three plants per plot. All eggplants were hand-harvested from the 15-ft center area of each bed (15 plants per plot). Each harvest was separated into marketable and cull fruits, counted, and weighed. There were a total of four harvests, on 13, 19, and 26 June and 3 July.

All data collected was analyzed with an analysis of variance ($P = 0.05$) and means were separated using Duncan's Multiple range test.

Summary

Plant vigor of eggplant was improved following vydate up to 42 days after planting (DAP) (Table 1). Gall indices at flowering and harvest of eggplant were low for all treatments, including the non-treated control (Table 1). Fumigation reduced nematode galling compared to the control both at flowering and at harvest of eggplant. Vydate reduced gall indices in the control at flowering, but not at harvest. Root-knot nematode soil populations were significantly reduced at plant and at harvest of eggplant following fumigation (Tables 4, 5, 6). Vydate reduced at harvest soil populations of root-knot nematode following C-35 fumigation, but not following methyl bromide. Stubby root nematode soil populations at harvest of eggplant were not affected by fumigation, but were increased following vydate (Table 6).

Greatest total marketable yield was recorded following fumigation with C-35 (Tables 2, 3). Vydate applications did not increase yield following methyl bromide, but increased yield following C-35 with 10% and following control plots with 15% (Table 3).

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Table 1. Effects of soil fumigation with and without oxamyl drip applications on plant vigor, shoot and root weights (at 45 days) and root-gall indices (at 45 days and at harvest) of eggplant cv. Black Beauty, fall 2003, Black Shank Farm Tifton, GA.

Fumigation ^a	Rate/acre	Oxamyl ^b	Stand count	Plant vigor ^c (1-10)				Shoot weight (lbs)	Root weight (g)	Root gall index ^d (0-10)	
			7 days	14 days	28 days	42 days	45 days	45 days	45 days	Harvest	
Methyl bromide (67-33)	300 lbs	Yes	31	6.4 b	8.8	9	4.7	137	0 b	0.3 b	
Methyl bromide (67-33)	300 lbs	No	29	6.0 b	6.8	7.4	4.1	136	0 b	0.3 b	
Telone C-35	18 gal	Yes	30	6.6 b	7.6	8.6	4.6	150	0 b	0.0 b	
Telone C-35	18 gal	No	30	5.9 b	7.1	8.5	4.2	130	0 b	0.2 b	
Non-Treated	N/A	Yes	30	8.1 a	8.5	9.1	4.8	145	0.3 b	2.5 a	
Non-Treated	N/A	No	30	6.3 b	6.6	7.8	3.9	154	0.9 a	2.6 a	
<i>F</i> probability fumigation effect			NS	0.07	NS	NS	NS	NS	<0.01	<0.01	
<i>F</i> probability oxamyl effect			NS	0.01	0.02	0.03	NS	NS	0.06	NS	

^a Fumigant treatments were applied on March 28; beds were covered with plastic mulch immediately following chisel fumigation;

^b Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (April 17) and 2 and 4 weeks afterwards.

^c Vigor was done a 1-10 scale with 10= live and healthy plants and 1=dead plants; ^d Root gall index 0-10 scale whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 =75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead.

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant (P>0.10).

Table 2. Effects of soil fumigation with and without oxamyl drip applications on yield of eggplant cv. Black Beauty, spring 2003, Black Shank Farm Tifton, GA.

Fumigation ^a	Rate/acre	Oxamyl ^b	Marketable fruits (No)						Cull fruits (No)
			Yield 1	Yield 2	Yield 3	Yield 4	Yield 1-3	Yield 1-4	Total
1. Methyl bromide (67-33)	300 lbs	Yes	15 a	25	20 b	21	60 ab	81 ab	3.0
2. Methyl bromide (67-33)	300 lbs	No	9 b	22	24 ab	26	54 ab	80 ab	1.5
3. Telone C-35	18 gal	Yes	15 a	25	33 a	24	73 a	97 a	1.8
4. Telone C-35	18 gal	No	16 a	27	22 ab	25	65 ab	90 a	1.9
5. Non-Treated	N/A	Yes	12 ab	29	26 ab	19	66 ab	85 ab	1.0
6. Non-Treated	N/A	No	10 ab	18	20 b	21	48 b	69 b	0.4
<i>F</i> probability fumigation effect			0.04	NS	NS	NS	0.05	0.02	NS
<i>F</i> probability oxamyl effect			NS	NS	0.09	NS	0.07	NS	NS
<i>F</i> probability fumigation x oxamyl			NS	NS	0.08	NS	NS	NS	NS

^a Fumigant treatments were applied on March 28; beds were covered with plastic mulch immediately following chisel fumigation;

^b Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (April 17) and 2 and 4 weeks afterwards.

Yields are for 15 plants per plot (15 ft bed length); data are means of five replications. Means in the same column followed by the same letter are not different ($P = 0.05$) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant ($P > 0.10$).

Table 3. Effects of soil fumigation with and without oxamyl drip applications on weight of marketable eggplant cv. Black Beauty, spring 2003, Black Shank Farm Tifton, GA.

Fumigation ^a	Rate/acre	Oxamyl ^b	Marketable fruits (Lbs)						Cull fruits (Lbs)
			Yield 1	Yield 2	Yield 3	Yield 4	Yield 1-3	Yield 1-4	Total
1. Methyl bromide (67-33)	300 lbs	Yes	15.1 ab	20.8	15.7 b	15.3	51.6 ab	66.8 b	2.2
2. Methyl bromide (67-33)	300 lbs	No	10.0 b	19.1	21.8 ab	17.8	50.9 ab	68.6 ab	1.3
3. Telone C-35	18 gal	Yes	16.3 a	22.6	27.9 a	17.3	66.8 a	84.1 a	1.5
4. Telone C-35	18 gal	No	15.8 ab	22.4	19.8 ab	17.3	58.1 ab	75.4 ab	1.8
5. Non-Treated	N/A	Yes	13.7 ab	26.5	19.9 ab	12.8	60.0 ab	72.8 ab	0.8
6. Non-Treated	N/A	No	11.4 ab	16.8	18.2 b	15.2	46.4 b	61.6 b	0.4
<i>F</i> probability fumigation effect			0.07	NS	NS	NS	0.06	0.02	NS
<i>F</i> probability oxamyl effect			NS	NS	NS	NS	0.10	NS	NS
<i>F</i> probability fumigation x oxamyl			NS	NS	0.01	NS	NS	NS	NS

^a Fumigant treatments were applied on March 28; beds were covered with plastic mulch immediately following chisel fumigation;

^b Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (April 17) and 2 and 4 weeks afterwards.

Yields are for 15 plants per plot (15 ft bed length); data are means of five replications. Means in the same column followed by the same letter are not different ($P = 0.05$) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant ($P > 0.10$).

Table 4. Populations of plant-parasitic and free-living nematodes before fumigation of eggplant cv. Black Beauty, spring 2003, Black Shank Farm Tifton.

Fumigation	Rate/acre	Oxamyl	Pre-fumigation nematode soil populations (per 150 cc soil)				
			RKN	SN	SRN	RN	FLN
1. Methyl bromide (67-33)	300 lbs	Yes	26 b	11	17	2	183 b
2. Methyl bromide (67-33)	300 lbs	No	84 ab	15	38	0	276 ab
3. Telone C-35	18 gal	Yes	198 a	9	23	3	394 a
4. Telone C-35	18 gal	No	55 ab	15	24	1	342 ab
5. Non-Treated	N/A	Yes	95 ab	6	18	2	225 ab
6. Non-Treated	N/A	No	56 ab	16	20	3	288 ab

Nematode samples were collected on March 24 (before fumigation); RKN = Root-knot nematode (*Meloidogyne* spp.); SN = Sting nematode (*Belonolaimus longicaudatus*); SRN = Stubby root nematode (Trichodoridae); RN = Ring nematodes (*Criconemoides* spp.); FLN = Free-living nematodes (bacterial-feeding, fungal-feeding and predatory nematodes).

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant (P>0.10).

Table 5. Populations of plant-parasitic and free-living nematodes at planting of eggplant cv. Black Beauty, spring 2003, Black Shank Farm Tifton.

Fumigation ^a	Rate/acre	Oxamyl	At planting nematode soil populations (per 150 cc soil)				
			RKN	SN	SRN	RN	FLN
1. Methyl bromide (67-33)	300 lbs	Yes	2 b	0 b	0 c	0	75 bc
2. Methyl bromide (67-33)	300 lbs	No	0 b	0 b	0 c	0	30 c
3. Telone C-35	18 gal	Yes	3 b	0 b	0 c	0	126 b
4. Telone C-35	18 gal	No	0 b	0 b	0 c	0	61 bc
5. Non-Treated	N/A	Yes	66 a	4 a	9 b	0	607 a
6. Non-Treated	N/A	No	42 a	12 a	18 a	4	450 a
<i>F</i> probability fumigation effect			<0.01	<0.01	0.04	NS	<0.01

^a Fumigant treatments were applied on March 28; beds were covered with plastic mulch immediately following chisel fumigation; Nematode samples were collected on April 17 (before oxamyl application); RKN = Root-knot nematode (*Meloidogyne* spp.); SN = Sting nematode (*Belonolaimus longicaudatus*); SRN = Stubby root nematode (Trichodoridae); RN = Ring nematodes (*Criconemoides* spp.); FLN = Free-living nematodes (bacterial-feeding, fungal-feeding and predatory nematodes).

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant (P>0.10).

Table 6. Populations of plant-parasitic and free-living nematodes at harvest of eggplant cv. Black Beauty, spring 2003, Black Shank Farm Tifton.

Fumigation ^a	Rate/acre	Oxamyl ^b	At harvest nematode soil populations (per 150 cc soil)				
			RKN	SN	SRN	RN	FLN
1. Methyl bromide (67-33)	300 lbs	Yes	108 b	0 b	62 ab	4	480 abc
2. Methyl bromide (67-33)	300 lbs	No	52 b	0 b	54 b	0	566 ab
3. Telone C-35	18 gal	Yes	13 b	1 b	117 a	3	793 a
4. Telone C-35	18 gal	No	108 a	0 b	46 b	14	623 ab
5. Non-Treated	N/A	Yes	3118 a	8 a	46 b	8	386 bc
6. Non-Treated	N/A	No	2876 a	2 b	20 b	12	326 c
<i>F</i> probability fumigation			<0.01	0.09	NS	NS	0.01
<i>F</i> probability oxamyl			NS	NS	0.02	NS	NS

^a Fumigant treatments were applied on March 28; beds were covered with plastic mulch immediately following chisel fumigation;

^b Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (April 17) and 2 and 4 weeks afterwards.

Nematode samples were collected on July 9; RKN = Root-knot nematode (*Meloidogyne* spp.); SN = Sting nematode (*Belonolaimus longicaudatus*); SRN = Stubby root nematode (Trichodoridae); RN = Ring nematodes (*Criconemoides* spp.); FLN = Free-living nematodes (bacterial-feeding, fungal-feeding and predatory nematodes).

Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Duncan's multiple range test; no letters indicate non-significant difference; NS = not significant (P>0.10).