EVALUATION OF VYDATE™ IN COMBINATION WITH SOIL FUMIGATION ON SQUASH FOLLOWING 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 reports on a second crop of squash that was grown following a first crop of eggplant (see previous report). The effect of Vydate on nematode damage and fruit yield of squash was evaluated in combination with drip fumigation with metam sodium and InLine (emulsified C-35).

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. Beds were installed in spring and a first crop of eggplant was grown from 17 April till 7 July (see previous report). Following eggplant, beds were drip-fumigated with metam sodium (50 gal/A) or InLine (18 gal/A) on 24-25 July (Table 1). Non-treated beds were sprayed with glyphosate to kill eggplant and plastic mulch was painted white. Vydate was applied three days after planting (18 August), and 10 and 20 days afterwards through the drip tape at a rate of 2 qts/A per application (Table1).

Squash seedlings, cv. Croockneck, were produced in nutrient tray system to the 4-leaf stage. A single squash 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 15 August. Plant spacing was 12 in.

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 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, and Ambush (10 oz./A) alternating with Pounce 3.2 (6 oz./A), Asana XL (6 oz./A) and Avaunt (3 oz./A) for insect control.

Stand counts were made to record live plants the first week after planting and plant vigor ratings were done at 14 and 21 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 at planting (15 August) and at final harvest (7 October). Nematodes were extracted from a 150-cm^3 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 12 September (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 7 October ten plants per plot were evaluated for root galls using that same scale.

All squash 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 five harvests, on 19, 22, 26, 30 September and 6 October. 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 squash was improved by fumigation, but not by vydate drip applications (Table 1). Plant vigor was better following metam sodium as compared to InLine. Very high at plant root-knot nematode soil populations, due to the first crop of eggplant (previous report), were noted for the non-treated plots (Table 4). At plant nematode soil populations were significantly reduced by metam sodium and InLine (Table 4). Root-knot nematode pressure was very high and most of the squash plants in the non-treated plots were severely damaged by th nematode. Gall indices at flowering and harvest of squash were significantly reduced both by fumigation and by vydate (Table 1). Root-knot nematode soil populations at harvest of squash were still significantly less in plots that were fumigated, as well as in plots in which vydate was dripped (Table 5). Stubby root nematodes were not affected by fumigation, but were reduced following vydate applications. Ring nematodes were only found in non-treated plots (Table 5). Free-living (non-parasitic) nematodes were not affected by any of the treatments.

Very low yields were recorded in non-treated plots (Tables 2, 3), due to severe nematode infection. Yields in fumigated plots showed small differences between metam sodium and InLine. Vydate increased yields in fumigated plots with 30% following metam sodium and with 35-75 % following InLine (Tables 2, 3).

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Table 1. Effects of soil fumigation with and without oxamyl drip applications on plant vigor and root-gall indices of crookneck squash, fall 2003, Black Shank Farm Tifton, GA.

First crop (eggplant)	Second crop (squash) [a]	Oxamyl [b]	Stand count		Plant vigor [c] (1-10)		Root gall index [d] (0-10)	
			7 days	14 days	14 days	21 days	27 days	52 days
Methyl bromide	InLine	Yes	24	22	5.8 ab	6.5 ab	0.0 c	1.1 d
Methyl bromide	InLine	No	22	19	4.4 bc	5.5 b	1.5 b	4.3 bc
Telone C-35	InLine	Yes	23	22	6.2 ab	7.8 ab	0.3 c	1.7 cd
Telone C-35	InLine	No	23	21	6.5 ab	7.8 ab	0.7 bc	4.3 b
Telone C-35	Metam sodium	Yes	23	21	6.6 ab	8.3 ab	0.1 c	0.9 d
Telone C-35	Metam sodium	No	24	22	7.3 a	8.4 a	1.7 b	4.8 b
Non-Treated	InLine	Yes	25	22	6.4 ab	7.8 ab	0.2 c	2.2 cd
Non-Treated	Non-treated	No	22	18	2.0 c	1.8 c	6.5 a	9.1 a
F probability fumigation effect			NS	NS	<0.01	<0.01	<0.01	<0.01
F probability oxamyl effect			NS	NS	NS	NS	<0.01	<0.01

[a] Fumigant treatments on the 2nd crop were applied on 24-25 July;

[b] Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (August 15) and 10 and 20 days 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 number of marketable crookneck squash fruits, fall 2003, Black Shank Farm Tifton, GA.

			Marketable fruits (No)					
First crop	Second crop (squash) [a]	Oxamyl [b]	Yield 1	Yield 2	Yield 3	Yield 4	Yield 5	Total
Methyl bromide	InLine	Yes	5.0 ab	6.6 ab	13.2 a	11.6 a	15.0 a	51.4 ab
Methyl bromide	InLine	No	3.0 ab	3.6 bc	6.6 ab	5.0 bc	11.0 a	29.2 b
Telone C-35	InLine	Yes	8.4 a	11.0 a	12.8 a	13.8 a	13.0 a	59.0 a
Telone C-35	InLine	No	9.6 a	5.2 abc	8.8 a	8.2 ab	11.6 a	43.4 ab
Telone C-35	Metam sodium	Yes	8.2 a	11.4 a	14.2 a	14.4 a	14.4 a	62.6 a
Telone C-35	Metam sodium	No	8.4 a	8.0 ab	11.0 a	9.2	11.0 a	47.6 ab
Non-Treated	InLine	Yes	8.6 a	9.0 ab	8.8 a	12.2 a	13.2 a	51.8 ab
Non-Treated	Non-treated	No	0.0 b	0.0 c	0.4 b	0.8 c	2.0 b	3.2 c
F probability fumigation effect			0.01	<0.01	<0.01	<0.01	<0.01	<0.01
F probability oxamyl effect			NS	0.01	0.05	<0.01	NS	0.01

[a] Fumigant treatments on the 2nd crop were applied on 24-25 July;

[b] Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (August 15) and 10 and 20 days afterwards.

Fruits were harvested on September 19, 22, 26, 30 and October 6; 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 crookneck squash fruits, fall 2003, Black Shank Farm Tifton, GA.

			Marketable fruits (Lbs)					
First crop	Second crop (squash) [a]	Oxamyl [b]	Yield 1	Yield 2	Yield 3	Yield 4	Yield 5	Total
Methyl bromide	InLine	Yes	1.8 ab	1.6 ab	3.7 abc	2.5 ab	4.4 a	13.9
Methyl bromide	InLine	No	1.1 ab	0.8 bc	1.9 cd	1.4 bc	3.2 ab	8.4
Telone C-35	InLine	Yes	3.1 a	2.3 ab	4.8 ab	3.8 a	4.7 a	18.5
Telone C-35	InLine	No	3.2 a	1.1 abc	2.8 bc	2.0 b	4.0 a	13.0
Telone C-35	Metam sodium	Yes	3.1 a	2.5 a	5.7 a	4.0 a	5.0 a	20.3
Telone C-35	Metam sodium	No	3.7 a	1.6 ab	3.4 abc	2.3 ab	3.9 a	14.9
Non-Treated	InLine	Yes	3.1 a	1.8 ab	3.1 abc	3.1 ab	4.5 a	15.5
Non-Treated	Non-treated	No	0.0	0.0	0.1 d	0.2 c	0.4 b	0.6 c
F probability fumigation effect			0.01	0.01	<0.01	<0.01	<0.01	<0.01
F probability oxamyl effect			NS	0.02	0.01	<0.01	NS	0.02

[a] Fumigant treatments on the 2nd crop were applied on 24-25 July;

[b] Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (August 15) and 10 and 20 days afterwards.

Fruits were harvested on September 19, 22, 26, 30 and October 6; 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 at plant of squash following a first crop of eggplant and following drip fumigation, fall 2003, Black Shank Farm Tifton.

First crop	Second crop (squash) [a]	Oxamyl	At planting nematode soil populations (per 150 cc soil) RKN	SRN	RN	FLN
Methyl bromide	InLine	Yes	0 b	0	0	994
Methyl bromide	InLine	No	6 b	2	0	144
Telone C-35	InLine	Yes	0 b	2	0	704
Telone C-35	InLine	No	1 b	2	0	692
Telone C-35	Metam sodium	Yes	0 b	2	0	638
Telone C-35	Metam sodium	No	0 b	0	0	650
Non-Treated	InLine	Yes	6 b	2	0	818
Non-Treated	Non-treated	No	1052 a	10	0	382

[a] Fumigant treatments on the 2nd crop were applied on 24-25 July;
Nematode samples were collected on August 15 (before oxamyl application);
RKN = Root-knot nematode (*Meloidogyne* spp.); 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 harvest of squash following a first crop of eggplant and following drip fumigation, fall 2003, Black Shank Farm Tifton.

First crop	Second crop (squash) [a]	Oxamyl [b]	At harvest nematode soil populations (per 150 cc soil) RKN	SRN	RN	FLN
Methyl bromide	InLine	Yes	4 c	6 bc	0	492
Methyl bromide	InLine	No	82 b	32 a	0	422
Telone C-35	InLine	Yes	16 bc	0 c	0	227
Telone C-35	InLine	No	58 bc	14 abc	0	360
Telone C-35	Metam sodium	Yes	6 c	2 bc	0	264
Telone C-35	Metam sodium	No	100 b	21 ab	0	561
Non-Treated	InLine	Yes	78 b	4 bc	0	314
Non-Treated	Non-treated	No	551 a	32 a	92	372
F probability fumigation effect			<0.01	NS	<0.01	NS
F probability oxamyl effect			<0.01	<0.01	-	NS

[a] Fumigant treatments on the 2nd crop were applied on 24-25 July;
[b] Oxamyl was applied at a rate of 2qts/A through the drip tape at planting (August 15) and 10 and 20 days afterwards.
Nematode samples were collected on October 7; 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).