EVALUATION OF VYDATE™ IN COMBINATION WITH SOIL FUMIGATION FOR YIELD INCREASE AND NEMATODE CONTROL ON A SECOND CROP OF SQUASH AND JALAPENO FOLLOWING A FIRST CROP OF TOMATO

J. A. J. Desaeger, A. S. Csinos
University of Georgia
Dept. of Plant Pathology
P.O. Box 748
Tifton, GA 31793

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. In the subtropical climate of the southeastern US, polyethylene beds are commonly used for two to four vegetable crops before they are destroyed (double- or multiple cropping). Soil pesticides on double-cropped beds can only be applied through the drip system.

The following test reports on a second crop of squash and jalapeno that was grown following a first crop of tomato (see report **'EVALUATION OF VYDATE™ IN COMBINATION WITH SOIL FUMIGATION ON TOMATO FOR YIELD INCREASE AND NEMATODE CONTROL'**). The effect of two application rates of Vydate on nematode damage and fruit yield of these second crops was evaluated in combination with drip fumigation with metam sodium.

Materials and Methods

The study was located at the Blackshank Farm, CPES, Tifton, GA. Beds were installed in spring and a first crop of tomato was grown from 26 March till 23 June (see previous report). Following tomato, beds were drip-fumigated with metam sodium (37.5 gal/A) on 21 July (Table 1). Non-treated beds were sprayed with glyphosate to kill tomato and plastic mulch was painted white. Vydate was applied one day 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. Prelude, and Jalapeno pepper were produced in nutrient tray system to the 4-leaf stage. Beds were split in two and each half was randomly asigned to receive either squash or jalapeno seedlings (15 plants each). A single squash/jalapeno 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 August. Plant spacing was 12 in.

Fertilizer was added in the form of liquid fertilizer (4-0-8) 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. Admire was dripped at plant and at bi-weekly intervals (2 oz./A).

Stand counts were made to record live plants the first week after planting and plant vigor ratings were done at 14 and 28 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 (17 August) and at final harvest (20 October for squash, 5 November for jalapeno). Nematodes were extracted from a 150-cm^3 soil sub-sample using a centrifugal sugar flotation technique. On 16 September (at flowering stage of squash) 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 18 October ten squash plants per plot were evaluated for root galls using that same scale. Jalapeno roots (10 per plot) were evaluated at final harvest on 5 November.

All squash and jalapeno fruits were hand-harvested from the 10-ft center area of each bed (10 plants per plot). Each harvest was separated into marketable and cull fruits, counted, and weighed. There were a total of four squash harvests, on 21, 29 September and 5 and 12 October, and two jalapeno harvests on 18 and 28 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

Low build-up of root-knot nematode on the first crop (see report '**EVALUATION OF VYDATE™ IN COMBINATION WITH SOIL FUMIGATION ON TOMATO FOR YIELD INCREASE AND NEMATODE CONTROL')** limited nematode pressure on the second crops. Gall indices on squash and jalapeno pepper were low for all treatments, including the non-treated control (Tables 1, 2). Plant vigor of both crops was similar for all treatments (Tables 1, 2). At plant soil populations of root-knot, sting, ring and free-living nematodeswere reduced by fumigation at planting of crops (Table 3). Stubby root nematodes were not reduced by fumigation at this stage. By harvest, nematode soil populations in squash and jalapeno pepper were still reduced by fumigation (Tables 4, 5). Oxamyl had a negative effect on stubby root and free-living nematodes with squash only (Table 4).

Total marketable yields of squash and jalapeno pepper showed only minor differences and were generally not significantly affected by fumigation or oxamyl applications or rates (Tables 6, 7 and 8).

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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 2004, Black Shank Farm Tifton, GA.

First crop (tomato)	Second crop (squash) [a]	Oxamyl [b]	Stand count		Plant vigor [c] (1-10)		Root gall index [d] (0-10)	
			7 days	28 days	14 days	21 days	27 days	52 days
Methyl bromide	metam sodium	No	10	9.0	7.0	6.0	0	0.1
Methyl bromide	metam sodium	2 Qts/A	9.8	9.2	7.2	6.2	0.1	0.0
Methyl bromide	metam sodium	4 Qts/A	9.6	8.8	7.4	6.4	0	0.1
Metam + chloropicrin	metam sodium	No	9.8	9.0	5.8	5.1	0	0.1
Metam + chloropicrin	metam sodium	2 Qts/A	10	8.4	6.8	5.6	0	0.1
Metam + chloropicrin	metam sodium	4 Qts/A	10	8.2	7.6	6.9	0.1	0.0
Non-Treated	metam sodium	No	9.8	8.0	6.6	5.9	0.1	1.2
Non-Treated	Non-treated	No	10	8.8	7.0	6.0	0.5	1.7
F probability fumigation effect			NS	NS	NS	NS	0.01	<0.01
F probability oxamyl effect			NS	NS	NS	NS	NS	NS

[a] Meta sodium on the 2nd crop was applied on 24-25 July at 37.5 gal/acre;
[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 plant vigor and root-gall indices of Jalapeno, fall 2004, Black Shank Farm Tifton, GA.

First crop (tomato)	Second crop (squash) [a]	Oxamyl [b]	Plant stand	Plant vigor [c] (1-10)		Root gall index [d] (0-10)
			harvest	14 days	21 days	52 days
Methyl bromide	metam sodium	No	13.4	4.1	6.4	0
Methyl bromide	metam sodium	2 Qts/A	10.6	4.4	5.9	0
Methyl bromide	metam sodium	4 Qts/A	13.8	4.4	6.1	0
Metam + chloropicrin	metam sodium	No	13.8	4.4	6.2	0.2
Metam + chloropicrin	metam sodium	2 Qts/A	13.2	4.1	5.8	0
Metam + chloropicrin	metam sodium	4 Qts/A	12.8	3.2	5.0	0
Non-Treated	metam sodium	No	12.0	4.3	6.0	0.7
Non-Treated	Non-treated	No	14.2	4.2	6.1	1.4
F probability fumigation effect			0.08	NS	NS	<0.01
F probability oxamyl effect			NS	NS	NS	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.

[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 3. Populations of plant-parasitic and free-living nematodes at plant of squash and jalapeno 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	SN	TPAR	MON	FLN
Methyl bromide	metam sodium	No	0	5	0	0	5	27	353
Methyl bromide	metam sodium	2 Qts/A	0	16	0	0	17	34	467
Methyl bromide	metam sodium	4 Qts/A	0	3	0	0	3	49	448
Metam + chloropicrin	metam sodium	No	0	10	0	0	10	31	563
Metam + chloropicrin	metam sodium	2 Qts/A	0	16	0	0	16	39	406
Metam + chloropicrin	metam sodium	4 Qts/A	0	9	0	0	10	39	432
Non-Treated	metam sodium	No	7	21	5	1	37	37	447
Non-Treated	Non-treated	No	8	15	19	8	50	69	708
F probability fumigation effect 1st crop			0.05	NS	NS	NS	NS	NS	NS
F probability fumigation effect 2nd crop			0.02	NS	0.02	0.02	0.03	0.10	<0.01

[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.); SN = Spiral nematodes (*Helicotylenchus* spp.); MON = Mononchid nematodes; 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 4. 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	SN	FLN
Methyl bromide	metam sodium	No	0	9	0	436
Methyl bromide	metam sodium	2 Qts/A	0	0	0	369
Methyl bromide	metam sodium	4 Qts/A	0	0	0	285
Metam + chloropicrin	metam sodium	No	4	2	0	543
Metam + chloropicrin	metam sodium	2 Qts/A	0	0	1	360
Metam + chloropicrin	metam sodium	4 Qts/A	0	0	0	266
Non-Treated	metam sodium	No	10	10	10	392
Non-Treated	Non-treated	No	22	15	40	510
F probability fumigation effect 1st crop			NS	0.03	NS	NS
F probability fumigation effect 2nd crop			<0.01	<0.01	0.02	0.06
F probability oxamyl effect			NS	0.11	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.Nematode samples were collected on October 7; RKN = Root-knot nematode (*Meloidogyne* spp.); SRN = Stubby root nematode (Trichodoridae); SN = Spiral nematodes (*Helicotylenchus* 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 jalapeno 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	SN	FLN
Methyl bromide	metam sodium	No	0	2	0	294
Methyl bromide	metam sodium	2 Qts/A	0	2	0	209
Methyl bromide	metam sodium	4 Qts/A	0	2	0	210
Metam + chloropicrin	metam sodium	No	0	3	0	253
Metam + chloropicrin	metam sodium	2 Qts/A	4	0	0	225
Metam + chloropicrin	metam sodium	4 Qts/A	0	2	0	279
Non-Treated	metam sodium	No	18	7	4	226
Non-Treated	Non-treated	No	142	10	0	1043
F probability fumigation effect 1st crop			NS	NS	<0.01	NS
F probability fumigation effect 2nd crop			<0.01	0.01	NS	0.01
F probability oxamyl effect			NS	NS	NS	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.); SRN = Stubby root nematode (Trichodoridae); SN = Spiral nematodes (*Helicotylenchus* 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. Effects of soil fumigation with and without oxamyl drip applications on number of marketable crookneck squash fruits, fall 2004, Black Shank Farm Tifton, GA.

First crop	Second crop (squash) [a]	Oxamyl [b]	Marketable fruits (No)					
			Yield 1	Yield 2	Yield 3	Yield 4	Total	Culls
Methyl bromide	metam sodium	No	6.6	10.2	4.6	9.4	30.8	5.8
Methyl bromide	metam sodium	2 Qts/A	4.8	10.2	4.2	11.4	30.6	7.8
Methyl bromide	metam sodium	4 Qts/A	6.2	9.8	4.4	10.2	30.6	7.6
Metam + chloropicrin	metam sodium	No	4.2	6.8	6.0	8.8	25.8	10.0
Metam + chloropicrin	metam sodium	2 Qts/A	5.6	10.4	2.6	9.4	28.0	8.4
Metam + chloropicrin	metam sodium	4 Qts/A	6.2	11.4	3.4	8.0	29.0	8.2
Non-Treated	metam sodium	No	5.4	8.6	4.6	7.0	25.6	8.4
Non-Treated	Non-treated	No	5.2	8.4	4.0	10.0	27.6	5.4
F probability fumigation effect			NS	NS	NS	NS	NS	NS
F probability oxamyl effect			NS	NS	NS	NS	NS	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.

Fruits were harvested on September 21 and 29, and October 5 and 12; yields are for 10 plants per plot (10 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 7. Effects of soil fumigation with and without oxamyl drip applications on weight of marketable crookneck squash fruits, fall 2003, Black Shank Farm Tifton, GA.

First crop	Second crop (squash) [a]	Oxamyl [b]	Marketable fruits (Lbs)					Culls
			Yield 1	Yield 2	Yield 3	Yield 4	Total	Total
Methyl bromide	metam sodium	No	2.74	4.1	2.44	3.7	13.2	1.0
Methyl bromide	metam sodium	2 Qts/A	2.26	4.66	1.96	3.9	13.0	1.0
Methyl bromide	metam sodium	4 Qts/A	1.94	3.92	1.44	3.6	10.8	1.4
Metam + chloropicrin	metam sodium	No	2.02	2.62	2.50	3.1	10.2	2.8
Metam + chloropicrin	metam sodium	2 Qts/A	1.84	4.4	1.26	4.4	12.0	1.4
Metam + chloropicrin	metam sodium	4 Qts/A	2.78	4.92	1.56	2.3	11.6	1.6
Non-Treated	metam sodium	No	1.9	3.02	2.14	2.5	9.6	2.6
Non-Treated	Non-treated	No	1.88	3.76	1.94	3.5	11.0	1.6
F probability fumigation effect 1st crop			NS	NS	NS	NS	0.05	NS
F probability fumigation effect 2nd crop			NS	NS	NS	NS	NS	NS
F probability oxamyl effect			NS	0.10	0.10	NS	NS	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.

Fruits were harvested on September 21 and 29, and October 5 and 12; yields are for 10 plants per plot (10 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 8. Effects of soil fumigation with and without oxamyl drip applications on number and weight of marketable Jalapeno fruits, fall 2004, Black Shank Farm Tifton, GA.

First crop	Second crop [a]	Oxamyl [b]	Marketable fruit number			Marketable fruit weight		
			Yield 1	Yield 2	Total	Yield 1	Yield 2	Total
Methyl bromide	metam sodium	No	23	98	121	438	1456	1894
Methyl bromide	metam sodium	2 Qts/A	17	76	93	322	1081	1403
Methyl bromide	metam sodium	4 Qts/A	28	67	95	537	981	1518
Metam + chloropicrin	metam sodium	No	19	69	88	286	919	1205
Metam + chloropicrin	metam sodium	2 Qts/A	26	67	93	408	809	1217
Metam + chloropicrin	metam sodium	4 Qts/A	12	65	77	197	918	1115
Non-Treated	metam sodium	No	31	51	82	465	712	1177
Non-Treated	Non-treated	No	37	75	111	586	1040	1626
F probability fumigation effect			0.04	NS	NS	0.08	NS	NS
F probability oxamyl effect			NS	NS	NS	NS	NS	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.

Fruits were harvested on October 18 and 28; yields are for 10 plants per plot (10 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).