INSECTICIDES AND SURFACTANT-INSECTICIDE COMBINATIONS FOR CONTROL OF THE MITE, *TETRANYCHUS MARIANAE* McG., ON TOMATOES AND EGGPLANT [1]

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The mite, *Tetranychus marinae* McG., has been an important pest of late-spring, summer and early-fall tomatoes and eggplant in the Rio Grande Valley since 1955. Schuster (1959) reported that demeton, ethion, carbophenothion and Kelthane were effective toxicants for mite control. Since mites can develop resistance to acaracides, several alternative effective acaracides should be available. The object of the experiment reported here was to determine the effect of insecticides applied as foliar sprays or as seed, soil, or drench treatments.

METHODS AND MATERIALS

Duplicate tests with phorate, Di-Syston and dimethoate soil treatments on tomatoes (Rutgers) were conducted at Monte Alto and Weslaco on plots two rows wide and 50 ft. long (Tables 1 and 2). The planting at Monte Alto was made on 23 January and at Weslaco on 29 January 1959. Chemical applications in the furrow at planting time and sidedress applications after the plants emerged were made with a Gandy Granular Applicator. Furrow applications of granulated insecticides were placed in a furrow in the soil. Sidedress applications at Monte Alto were made on 23 April, and at Weslaco 22 April. The granulated material and seeds were laid in the same furrow during the planting operation. Sidedress treatments were made by placing the chemical as a 5% granulated formulation in a band on each side of the row after the plants had emerged. The dimethoate granules were impregnated on deactivated charcoal at the Weslaco location. All treatments in all experiments were replicated four times in a randomized complete block design and were artificially infested with *T. marianae* on 1 May 1959 by placing branches of mite-infested white horse nettle, *Solanum elaeagnifolium*, at 20 ft. intervals. The mite infestation did not become severe until late-May. Plant-emergence counts were taken on at Monte Alto on 17 February, and at Weslaco on 23 February 1959 from the center 25 ft. of each row. Except for the test summarized in Table 3, all mites were counted. The mites were machine-brushed from 20 leaflet samples, and trapped in vasoline applied on a glass plate beneath the brushes. Thus, mite counts are presented as mites per tomato leaflet. Tomato fruit yields at Weslaco were recorded 2 and 9 June from the center 25 ft. at each plot.

In the fall of 1962, various systemic insecticides, applied as a soil application, drench, or as foliar sprays were evaluated for *T. marianae* control

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TABLE 1.—PLANT EMERGENCE AND MITE (*Tetranychus marianae*) CONTROL ON TOMATOES OBTAINED WITH SYSTEMIC INSECTICIDES APPLIED AS GRANULES IN FURROW AND SIDEDRESS TREATMENTS. MONTE ALTO, 1959.

Treament	Lbs/acre actual	Type of application	Per cent seedling* reduction	Mites per leaf	
				June 3	June 10
Phorate	3.0	Furrow	84	1.1	8.6
Phorate	1.5	Furrow	84	7.1	37.0
Phorate	2.0	Sidedress	—‡	4.0	35.5
Di Syston	3.0	Furrow	74	0.9	4.0
Di Syston	1.5	Furrow	72	2.8	5.9
Di Syston	2.0	Sidedress	—‡	0.7	3.6
Dimethoate**	3.0	Furrow	28	78.5	——§
Dimethoate**	1.5	Furrow	3	61.1	——§
Dimethoate†	2.0	Sidedress	—‡	7.1	52.1
Dimethoate**	2.0	Sidedress	—‡	4.7	25.2
Check				73.2	159.7

* Based on number plants in check plot.
** Granulated material formulated at TAES laboratory.
† Granulated material formulated by American Cyanamid Co.
‡ No records taken.
§ Plots destroyed.

TABLE 2.—PLANT EMERGENCE, YIELDS, AND THE MITE. (*Tetranychus marianae*) CONTROL ON TOMATOES OBTAINED WITH SYSTEMIC INSECTICIDES APPLIED AS GRANULES IN FURROW AND SIDEDRESS TREATMENTS. WESLACO, 1959.

Treatment	Lbs/acre actual	Applica-tion	Percent* seedling reduction	Mites per leaf		Fruit** yield lbs/50 ft
				June 4	June 11	
Phorate	3.0	Furrow	53	9.6	46.6	14.8
Phorate	1.5	Furrow	47	14.2	107.0	14.9
Phorate	2.0	Sidedress	—†	7.2	75.0	33.0
Di Syston	3.0	Furrow	52	14.3	76.4	20.3
Di Syston	1.5	Furrow	32	17.7	94.8	24.6
Di Syston	2.0	Sidedress	—†	13.1	51.6	35.2
Dimethoate	3.0	Furrow	52	99.8	—‡	25.1
Dimethoate	1.5	Furrow	25	142.6	—‡	31.3
Dimethoate	2.0	Sidedress	—†	16.7	119.2	39.2
Check				141.8	258.6	37.8

* Based on number of plants in check plot.
** Average fruit yield per 50 feet of row from each plot harvested on June 2 and 9.
† No records taken.
‡ Plots destroyed.

on eggplant (Table 3). Two applications of the granulated or drench insecticides were made, one prior to seeding and the second 26 days later. When applied prior to seeding, a furrow was cut 5-6 inches deep in the top of a 38-inch bed and the granules were applied by hand to single-row plots 25 ft. in length arranged in a randomized complete block design in four replicates. The furrows were covered and seeded with a Planet, Jr. to a depth of 2 inches or 3-4 inches above the granules, and the plots were immediately furrow irrigated. The second application was a sidedressing when the plants were approximately 5 inches tall. A furrow 2 inches deep and 3-4 inches from the plants was cut and the granules were applied as a sidedress by hand. The plots were furrow irrigated two days later. Both drench applications were made by adding the materials to 2 gallons of water and drenching the 25 ft. plots, or at the rate of 1058 gallons per acre. The spray applications were made with a carbon-dioxide-powered 3 nozzle sprayer at 27 gallons per acre and 40 psi.

Treatments were evaluated by examining 10 plants per plot for the presence of adult mites. If one mite or more was found on one leaf of the plant, it was recorded as infested. The data are presented as percentage infested plants.

Stand counts were made at various intervals after the second application of granule and drench application. The first count was taken on the day of the second application and reflected the effect of the first application made beneath the seed prior to the first thinning. The data were taken by recording the number of plants in each plot, and are presented as the percentage increase or decrease in the number of plants over the untreated check in Table 3. The counts are reduced because of two thinnings and the adjustment of plant spacing of 12-14 inches in the row between plants.

Results

Phorate and Di-Syston, as furrow and sidedress treatments, gave control of the mite on tomatoes in both tests at both locations when the first counts were taken (Tables 1 and 2). Dimethoate in both tests at both locations gave some mite control as a sidedress application. The mite populations increased rapidly in most plots during the 7-day period between the first and second counts. At Monte Alto (Table 1) the phorate and Di-Syston furrow applications at 3 lb/A per acre still provided effective control of the mite on 10 June. The remaining phorate treatments and the two dimethoate sidedress applications reduced mite infestations compared to the check, but were less effective than the previously mentioned treatments. With the exception of the dimethoate furrow applications, all treatments gave some control of *T. marianae* at Weslaco (Table 2) on 11 June. However, the mite populations increased to such an extent in all plots that the treatments were considered ineffective. Under normal cultural practices the tomato crop at Weslaco and Monte Alto would have been harvested prior to the date of the last mite count. Plants in the check were virtually destroyed by the mite at the time the second counts were made.

Fruit yields at Weslaco (Table 2) gave further evidence of the phytotoxicity of the furrow treatments. The sidedress applications did not affect the tomato fruit yield. Phorate caused the greatest reduction in yield, followed by Di-Syston and dimethoate. The effect of mite populations on

TABLE 3.—SYSTEMIC INSECTICIDES FOR CONTROL OF THE MITE, *Tetranychus marianae*, AND THEIR PHYTOTOXICITY ON EMERGING EGGPLANT SEEDLINGS. WESLACO, 1962.

Treatment and method of application	Lbs./acre actual	Increase (+) or decrease (−) in number of plants over untreated check on days after second application		Per cent mite infested plants §			
		0	14	8/11	8/20	8/29	10/16
Granular application *							
Phorate	2.0	+ 64	+ 14	9.81a	0a	0a	35.41a
Phorate	4.0	+146	+ 19	0a	0a	0a	39.47a
Di-Syston	2.0	+ 62	+ 33	9.81a	4.61a	0a	30.65a
Di-Syston	4.0	− 2	− 26	0a	0a	0a	22.50a
AC 18133	2.0	+ 24	+ 42	67.50b	38.14abc	16.45ab	22.50a
AC 18133	4.0	+ 21	+ 13	58.28a	35.94abc	24.16ab	48.76b
Bayer 25141	2.0	+234	+ 38	42.12a	19.55ab	4.61a	36.80b
Bayer 25141	4.0	+ 16	− 11	64.62b	23.09ab	18.70ab	27.48a
AC 43064	2.0	+ 68	+ 34	0a	0a	0a	45.75b
AC 43064	6.0	+ 70	+ 61	32.31a	0a	0a	26.19a
Zectran	4.0	+ 23	− 19	29.14a	26.36ab	22.50ab	53.37b
Zectran	2.0	+ 24	+ 1	32.31a	36.92abc	21.06ab	62.22c
NIA 9205	2.0	+ 37	+ 17	51.64a	0a	16.45ab	67.50c
NIA 9205	4.0	+ 25	+ 10	0a	0a	8.30ab	65.84c
Isolan	2.0	+ 78	+ 38	51.74a	51.64bc	30.87ab	69.89b
Isolan	4.0	+ 78	+190	51.64a	4.61a	6.64a	49.61b
Dimetilan	2.0	+ 24	0	9.81a	9.81ab	14.42ab	48.69b
Dimetilan	4.0	+ 56	+ 6	0a	4.61a	11.25ab	67.50b

(Continued)

Table 3. (Continued)

Drench application **							
Dimethoate	3.0	+ 20	+ 4	22.50a	0a	0a	27.11a
Dimethoate	6.0	+ 56	+ 31	0a	0a	0a	49.61b
Demeton	3.0	+ 15	− 13	9.81a	0a	0a	28.63a
Demeton	6.0	+ 62	+ 27	0a	0a	0a	12.92a
Bidrin	2.0	+ 43	+ 35	42.12a	0a	6.64a	55.66b
Bidrin	4.0	+ 7	− 14	0a	6.64a	14.94ab	51.64b
Bidrin + IP-1	2.0+0.60	+ 43	+ 6	22.50a	0a	0a	53.08b
Spray applications ‡							
Sulfur	1.3			67.50b	24.16ab	21.00ab	39.28a
Sulfur	2.6			67.50b	35.48abc	32.09bc	42.75a
CP 40294	0.25			13.28a	0a	0a	31.17a
CP 40294	0.5			6.64a	4.61a	0a	23.09a
CP 40294	1.0			0a	0a	8.30ab	12.92a
Bidrin	0.25			0a	0a	0a	14.42a
Bidrin + NS 139	0.25+1 qt			0a	0a	0a	12.92a
Bidrin + L-775	0.25+1 qt			0a	0a	0a	17.52a
Check	———	123†	99‡	51.64a	62.89bc	41.53b	49.34b

* Applied 6-30 prior to seeding at a 1-2 inch depth beneath the seed and watered and 7-24, 25 as a sidedress application 2-3 inches away from the planted row.

** Applied 6-30 and 7-24, 25 in 8 gallons of water per 100 square feet of linear row.

† Mean stand count per 100 feet row.

‡ Applied 7-3, 7-12, 7-19, 8-3, 8-20, 9-6 and 10-1.

§ a, b, c, d, e -- Any two means with the same postscript are not significantly different from each other according to Duncan's multiple range test at the 5% level.

tomato fruit yields were not clearly defined; however, plants heavily infested with mites would produce russetted fruit.

When applied in granulated form (Table 3) phorate, Di-Syston and AC 43064 were the most effective toxicants in these tests. Infestations occurred naturally and were not introduced as they were in the tomatoes; therefore, data pertaining to the eggplant appear to be more reliable.

Applications at the high rate of the granulated phosphate insecticide AC 43064 did not effect mite populations initially, but effectively reduced infestations 88 days after the second application; it was the most effective granulated systemic, although not significantly better than phorate or Di-Syston. The remaining materials were ineffective for mite control.

Demeton was the most effective toxicant when applied as a drench at high total liquid rates per acre. Dimethoate, applied as a drench, was equal to phorate and Di-Syston. Bidrin, as a foliar spray, was effective for the control of this mite, either alone or in combination with two penetrants, as was the phosphate insecticide, CP 40294. The penetrants did not increase control of the toxicant relative to mite control.

None of the foliar sprays were phytotoxic to either seedlings or mature plants. Bidrin, applied at the high rates, reduced the stand. The 10% Di-Syston granulated formulation at the high rate affected the stand of eggplant both initially and after the first sidedress application. Zectran and Bayer 21541, used at the high rate, reduced the stand.

Chemical Names of Proprietary Compounds

CP 40294 . . . 0-(p-nitrophenyl)0-phenyl methyl phosphorothionate

Bayer 25141 . . . 0,0-diethyl 0-p-(methyl sulfinyl) phenyl phosphorothioate

AC 18133 . . . 0,0-diethyl 0-2-pyrazinyl phosphorothioate

AC 43064 . . . 2-(Diethoxy phosphinothioylimino)-1,3-dithiolane

Zectran . . . 4-Dimethylamino-3,5-xylyl methyl carbamate

NIA 9205 . . . N-methyl-5-(diethoxyphosphinothioylthio)-3-thiapentanamide

Dimetilan . . . 2-dimethyl carbamyl-3-methyl pyrazolyl-(5)-dimethylcarbamate

Di-Syston . . . 0,0-diethyl S-(2-ethylthio)methyl phosphorodithioate)

Literature Cited

Schuster, Michael F. 1959. Chemical control of *Tetranychus marianae* McG. on tomatoes in the Lower Rio Grande Valley. Jour. Econ. Ent. 52(4): 763-764.