Influence of Organic Pesticides on Nematode Populations and Seed Production of Centipede Grass[1]

A. W. JOHNSON[2]

Abstract: Applications of ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate, *O,O*-diethyl *O*-((*p*-(methylsulfinyl)phenyl) phosphorothioate, and O,O-diethyl S-[2-(ethylthio)ethyl] phosphorothioate effectively controlled *Trichodorus christiei* on centipede grass. Populations of *Pratylenchus* spp. and *Xiphinema americanum* were significantly reduced with a mixture of methanesulfonic acid, 2,4-dichlorophenyl ester and 1,2-dibromo-3-chloropropane. Ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate and *O,O*-diethyl *O*-((*p*-(methylsulfinyl)phenyl phosphorothioate significantly suppressed populations of *Pratylenchus* spp., and the latter reduced populations of *X. americanum*. Ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate and *O,O*-diethyl *O*-((*p*-methylsulfinyl) phenyl) phosphorothioate significantly reduced populations of *Criconemoides ornatus*. Increased seed production was correlated with nematode control. *Key Words:* Organophosphates, Centipede grass, Nematicides, Turf, Seed production.

Nematodes have been associated with turf decline in most turf producing areas of the United States. Nematode damage has been reported on home and industrial lawns, golf course greens, and turf nurseries. Kelsheimer and Overmann (7) attributed turf decline to parasitic nematodes, and others have reported root injury and quality decline caused by species of *Criconemoides*, *Pratylenchus*, and *Trichodorus* (1, 2, 5, 8, 9). *Xiphinema americanum* Cobb, was found in soil samples from declining turf, but was not implicated as a serious parasite of turf. In a nematode survey of turf nurseries in Georgia, Good, Steele and Ratcliffe (3) found that 17, 48, 58, and 53% of samples from centipede grass, *Eremochloa ophiuroides* (Munro) Hack., contained species of *Criconemoides*, *Pratylenchus*, *Trichodorus*, and *Xiphinema*, respectively.

Centipede grass is maintained in nurseries primarily for asexual propagation, although some nurserymen harvest seed from nursery stock. Seed production may be reduced where nematode infestations occur. This study investigated the nematicidal effectiveness of selected pesticides as related to seed production by centipede grass.

Materials and Methods

On 27 March 1968 pesticides were applied to an area of centipede grass which had been in sod 3 years, and was infested predominantly with *Criconemoides ornatus* Raski, *X. americanum*, and *Trichodorus christiei* Allen. Less abundant species were *Pratylenchus brachyurus* (Godfrey), Filipjev. & Schuurmans-Stekhoven and *P. zeae* Graham. The area was divided into 3.0 × 1.5-m plots which served as experimental units.

Ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate (Bay 68138 E.C., 1.36 kg active ingredient per 3.785 liters and 10% granules); *O,O*-diethyl *O*((*p*-(methylsulfinyl) phenyl) phosphorothioate (Dasanit ®E.C., 2.72 kg active ingredient per 3.785 liters and 10% granules); 4.54 kg active ingredient of methanesulfonic acid, 2,4-dichlorophenyl ester (SD 7727) and 9.46 liters of 1,2-dibromo-3-chloropropane (DBCP) per 18.92 liters of mixture (SD 1897); O,O-diethyl

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[2] Nematologist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Coastal Plain Experiment Station, Tifton, Georgia 31794.

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TABLE 1. Effect of chemical drenches on centipede grass seed production and reduction in nematode populations.[a]

Chemical[b]	Rate kg/ha	Yield (g)/plot[c]	Months after application							
			2	5	2	5	2	5	2	5
			Criconemoides ornatus		*Pratylenchus* spp.		*Trichodorus christiei*		*Xiphinema americanum*	
Bay 68138 E.C.	11.35	81 b[d]	3+[e]	22	31	100*[f]	50	93*	86*	4
Bay 68138 E.C.	22.70	82 b	0	53*	54	100*	30	100*	65	15
Bay 68138 G.	22.70	84 bc	13	81*	69	100*	55	100*	47	42
Dasanit E.C.	11.35	83 b	18	31	15	94*	45	93*	33	77
Dasanit E.C.	22.70	91 c	4	66*	8+	88*	70	100*	73*	69
Dasanit G.	22.70	88 bc	9+	53*	31	100*	60	100*	76*	81
SD 1897	94.62[g]	87 bc	1+	35	8	88*	25	21	62	100
Di-Syston	6.80	83 b	27	18	100+	63	70	43	58	23+
Zinophos	4.52	72 a	35	34	23+	50	5	43	52	127+
Control	—	69 a	493[h]	1044	13	16	20	28	99	52

[a] Percent reduction or increase in nematode populations based on non-treated controls.
[b] Experimental materials supplied by the following companies: Bay 68138, Dasanit, and Di-Syston (Chemagro Corp.); SD 1897 (Shell Dev.); and Zinophos (American Cyanamid Co.).
[c] Mean of five replications.
[d] Means followed by the same letter do not differ at the 5% level of significance according to Duncan's Multiple Range Test.
[e] + = Percent increase over controls.
[f] * = Significant reduction at 5% level.
[g] SD 1897 applied 94.62 liters of formulation/ha.
[h] Number of nematodes from 150-cc soil sample for controls.

S-[2-(ethylthio) ethyl]phosphorothioate (Di-Syston ®E.C., 2.72 kg active ingredient per 3.785 liters); and O,O-diethyl O-2 pyrazinal phosphorothioate (Zinophos ®E.C., 1.81 kg active ingredient per 3.785 liters) were used as drenches on plots.

Treatments were as follows: (i) control; (ii) Bay 68138 E.C. at 11.35 kg active per ha; (iii) Bay 68138 E.C. at 22.70 kg active per ha; (iv) Bay 68138 10% granules at 22.70 kg active per ha; (v) Dasanit E.C. at 11.35 kg active per ha; (vi) Dasanit E.C. at 22.70 kg active per ha; (vii) Dasanit 10% granules at 22.70 kg active per ha; (viii) SD 1897 at 94.62 liters of formulation per ha; (ix) Di-Syston at 6.80 kg active per ha; and (x) Zinophos at 4.52 kg active per ha. Each treatment was replicated five times. The desired amount of emulsifiable materials was mixed in 7.57 liters of water and applied with a sprinkling can. Granular materials were applied to the turf surface. Immediately after chemicals were applied, an additional 7.57 liters of water were added to each plot, followed by approximately 3.81 cm of water to each by sprinkler-irrigation.

Soil samples (2.54 × 15–20 cm) were taken from each plot 1, 2, 3, 5, and 7 months after chemicals were applied. Each sample (150 cc) was processed by the centrifugal-flotation method (4).

Clipping weights were recorded twice during the experiment. At maturity, seed heads were harvested, bagged, dried, chopped and screened through a 3-cm screen. The straw-seed mixture was passed through a seed cleaner to separate seed from chaff.

RESULTS AND DISCUSSION

One month after chemical application, *C. ornatus* was reduced 47% in plots treated with Bay 68138 granules. *C. ornatus* increased rapidly in most plots during the last 4 months of the experiment; however, both formulations of Bay 68138 showed significant reduction at the final sampling (Table 1).

Five months after chemical applications, *Pratylenchus* spp. were reduced 88–100% in plots receiving Bay 63138 and Dasanit, and remained at low levels during the latter months of the experiment. After 3 months, all other treatments reduced *Pratylenchus* (Table 1).

All chemicals were not equally effective in suppressing *T. christiei.* The most significant reduction occurred 3 months after application of high rates of Bay 68138 and Dasanit which effectively controlled *T. christiei* for 7 months (Table 1).

Two months after chemical application, *X. americanum* was suppressed by Bay 68138 (low rate) and Dasanit (high rate) (Table 1).

Average clipping weights of turf in treated plots, recorded 4 and 5 months after chemical applications, were not significantly different from non-treated plots. No apparent symptoms of phytotoxicity were observed. Results of clipping weights agreed with those of Johnson and Powell (6) who reported an indirect relationship between *C. lobatum* Raski, and clipping weights of centipede grass; however, differences were not statistically significant. Similar results with *T. christiei* on St. Augustine grass were reported by Rhoades (10).

All chemical treatments, except Zinophos, significantly increased seed production when compared with non-treated plots (Table 2). Increase in yield ranged from 3.4 to 31.7%. Highest yields were obtained from plots treated with SD 1897, Bay 68138 granules, and high rates of Dasanit.

C. ornatus, Pratylenchus spp., *T. christiei,* and *X. americanum* are found in many turf nurseries. Damage caused by these pests results in poor root systems. My observations indicate that the reduced root system caused by feeding of nematodes does not allow sufficient uptake of water and nutrients from soil by grass and thereby adversely affects seed production. Nematode control enables grass to develop and maintain more vigorous root systems; thus increases seed production.

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