RESEARCH NOTES

Interaction of Plastic, Hay and Grass Mulches, and Metam-sodium on Control of Pratylenchus penetrans in Tomatoes

PATRICK M. MILLER[1]

Black polyethylene film mulches affect the activity of some nematicides (1, 2, 3, 5, 6, 7, 8, 9). Other mulches also may influence the results of fumigation tests; for example, hay mulches, cause the soil to remain cooler (8). Salt-hay mulches are used by strawberry growers, many of whom fumigate. Mulches of grass clippings, wood chips, or leaf mold are used by homeowners. Clear plastic mulches cause the soil to retain heat, (8) and the activity of soil pesticides in warmer soil under clear plastic could change. Because black plastic mulch suppresses *Pratylenchus penetrans* populations (5), it should be useful to determine whether organic mulches act similarly. Therefore, three types of mulches were tested, on fine sandy loam soil fumigated with metam-sodium (sodium-*N*-methyl-dithiocarbamate), for control of *Pratylenchus penetrans*.

In a field where tomatoes had grown the year before, a pretreatment sample for nematode counts was taken on 20 April and nematodes were extracted by sugar flotation (4). On 21 April, metam-sodium was applied, at the rate of 209 liters (a.i.)/ha, to 20 plots, each of which measured 3.0 x 2.8 m. The soil temperature at a depth of 15 cm was 12 C. A 10-10-10 fertilizer was plowed into the soil at the rate of 500 kg/ha before planting. Four tomato plants, *Lycopersicum esculentum* cv. 'Bonny Best', were planted 0.6 m apart in each plot on 18 May. Each plant received 300 ml of a solution containing 0.5 gm of a 23-10-8 fertilizer/liter. Four fumigated and four nonfumigated plots were mulched with either a 7.5-cm layer of salt hay, a 2.5-cm layer of grass clippings, or a 1.5-mil black polyethylene film. The film contained holes (4 cm diam) 30 cm apart for moisture and air exchange. Eight plots (four fumigated and four nonfumigated) were left unmulched and hoed weekly. Each treatment was replicated 4 times. Pesticides were applied as needed to control diseases and insects. Soil and root samples were collected on 25 June and 27 August. Nematodes were extracted from two, 0.1-gm samples of roots which were ground in 20 ml of water for 30 sec in a blender. The *P. penetrans* in the root blendate were counted at 60 X. Starting 3 August, ripe tomatoes were picked weekly for yields.

During the second growing season, a 10-10-10 mixture of fertilizer was applied at the rate of 500 kg/ha before application of the mulches. Plots were not fumigated but were replanted with Bonny Best tomatoes, and new mulches were applied as in the previous year. Tomatoes were planted through holes in new plastic film. Nonmulched plots hoed during the first season were replanted without spading or plowing so that the soil was left undisturbed. Soil and roots sampled on 10 August and 23 September were assayed as before. Tomato picking began 11 August.

The pretreatment population of *P. penetrans* was 29/100 gm of soil. No other plant-parasitic nematodes were present. Within 2 months after application, metam-sodium reduced the number of *P. penetrans* in all plots (Table 1). Counts of *P. penetrans* were 80% less in roots under a grass clipping mulch than in unmulched soil. By 27 August, they were increasing slightly in roots in fumigated soil under the salt-hay mulch, but the major increases were in root infestation in nonfumigated plots, particularly in nonmulched soil and under salt-hay mulch (Table 1).

During the second season, the number of *P. penetrans* in most plots increased 2- to 13-fold. Populations increased in fumigated "control" and plastic-covered plots, but they were still below those in

Received for publication 13 May 1976.

[1]Department of Plant Pathology and Botany, The Connecticut Agricultural Experiment Station, New Haven, Connecticut 06504.

TABLE 1. Influence of different mulches on repopulation by *Pratylenchus penetrans* on tomatoes after fumigation with metam-sodium.

Type of mulch	Metam-sodium at start of first season	No. *P. penetrans* 0.1 gm of roots				Total yield	
		Year fumigated[w]		Year after fumigation		kg/plant	
		6/26	8/27	7/10	9/23	1st year	2nd year
Control	yes	14 d	7 e[z]	68 d	132 de	12 ab	8 ab
	no	152 a	285 a	303 a	503 c	8 b	5 b
Salt hay	yes	17 d	49 c	113 c	78 e	12 a	10 a
	no	85 b	276 a	254 b	203 d	10 b	7 b
Black plastic	yes	4 d	21 d	135 c	293 d	15 a	8 ab
	no	50 c	152 b	402 a	850 a	11 b	5 b
Grass clippings	yes	14 d	21 b	49 d	25 f	16 a	11 a
	no	30 c	72 c	78 d	92 e	12 b	11 a

[w]Initial population on 21 April was 29 *P. penetrans*/100 gm of soil.
[z]Numbers followed by same letter not significantly different, according to Duncan's New Multiple Range test ($P = 0.05$).

nonfumigated plots. Populations of *P. penetrans* were similar in nonfumigated soil under salt-hay and black plastic mulches on 10 August. In the next 6 weeks, populations in nonfumigated soil under black plastic mulch increased 2.5- to 3-fold. Numbers of *P. penetrans* were lowest in fumigated soil under grass clippings. Salt-hay mulches suppressed *P. penetrans* 50% and 65% in fumigated and nonfumigated soil, respectively.

In this test as in others (1, 2, 3, 5, 6, 7), soil fumigation plus mulching increased yields, but the yield increase depended on the type of mulch. The effects of metam-sodium and the mulches appeared to be additive. However, the fumes of a volatile fumigant penetrate quickly through the organic mulches and they might be less effective than the polyethylene mulch.

Mulches influenced the repopulation of *P. penetrans* after fumigation with metam-sodium only in the second year. Populations increased in fumigated soil in nonmulched plots and under black plastic mulch but not under salt-hay and grass-clipping mulches. *Pratylenchus penetrans* is apparently suppressed by compounds, resulting from decaying hay and grass, leached into the soil. Grass clippings contain ammonia (unpublished, author). Walker et al. (9) found ammonia toxic to *P. penetrans*. The greater increase of *P. penetrans* under black plastic mulch than in bare ground between 10 August and 23 September of the second season is probably the result of enhanced root growth under plastic mulch. The large numbers of *P. penetrans* under the plastic mulch apparently offset the benefits of the mulch, for yields were the same as in the nonmulched control plots.

LITERATURE CITED

1. GERALDSON, C. M., A. J. OVERMAN, and J. P. JONES. 1975. Combinations of high analysis fertilizers, plastic mulch and fumigation for tomato production. Soil and Crop Sci. Soc. Fla. Proc. 25:18-24.
2. JONES, J. P., A. J. OVERMAN, and C. M. GERALDSON. 1966. Effect of fumigants and plastic film on the control of several soil-borne pathogens of tomato. Phytopathology 56:929-932.
3. JONES, J. P., A. J. OVERMAN, and C. M. GERALDSON. 1972. The effect of mulching on the efficacy of DD-MENC for control of Fusarium wilt of tomato. Plant Dis. Rep. 56: 953-956.
4. MILLER, P. M. 1957. A method for the quick separation of nematodes from soil samples. Plant Dis. Rep. 41:194.
5. MILLER, P. M., and P. E. WAGGONER. 1963. Interaction of mulch, pesticides and fungi in the control of soil-borne nematodes. Plant and Soil 18:45-52.
6. MILLER, P. M. 1976. Effect of plastic mulch on soil treatments toxic to Pratylenchus penetrans. J. Nematol. 8:181-183.
7. SUMNER, D. R., A. W. JOHNSON, C. A. JAWARSKI, and R. B. CHALFANT. 1974. Control of soil-borne pathogens in vegetables with fumigation and film mulch. Am. Phytopathol. Soc. Proc. 1:167 (Abstr.).
8. WAGGONER, P. E., P. M. MILLER, and H. C. DE ROO. 1960. Plastic mulching, principles and benefits. Conn. Agric. Exp. Bull. 634.
9. WALKER, J., T. C. H. SPECHT, and S. M. MAVRODINEAU. 1967. Reduction of lesion nematode populations in soybean and oil-amended soils. Plant Dis. Rep. 51:1021-1024.