Effects of Plastic Mulch on Soil Treatments Toxic to *Pratylenchus penetrans*

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Mulches apparently increase plant growth by conserving water and nutrients. Soil fungicides or nematicides increase plant growth by controlling injurious soil microorganisms. A combination of mulch and soil pesticide may increase growth more than each component alone if the moisture supply is limited or if there are injurious soil microorganisms present which can be controlled by soil treatment. Miller and Waggoner (4) found the growth of newly planted apple trees was increased by soil treatments with the nematicide, 1,2-dibromo-3-chloropropane (DBCP), and the fungicide pentachloronitrobenzene (PCNB). Growth of the apple trees increased when a sheet of black polyethylene plastic was placed on the soil around the tree as a mulch after planting. The best growth was obtained if both mulch and soil treatment were used.

A further experiment was conducted to determine if this mulch influenced populations of *Pratylenchus penetrans* (Cobb) Filip. & Schuurm.-Stekh. around tomato roots in soil treated with soil pesticides other than DBCP and PCNB. The long-term effects of these treatments were evaluated.

The test was set up in a nematode-infested (*P. penetrans*) field in which strawberries and tomatoes had grown. Four replicated plots 3 x 6 m were treated with either nabam (8 kg a.i./ha) or PCNB (9 kg a.i./ha), sodium *N*-methyldithiocarbamate (SMDC) (209 liters/ha), or DBCP (16.7 liters/ha). Four plots were not treated. On April 15, chemicals were applied with 22 liters of water/plot on the soil surface and rototilled to a depth of 15 cm 4 h later. On May 5, half of each plot was covered with a black polyethylene mulch. The edges of the plastic were buried in the soil, and 2.5-cm slits were cut every 50 cm to allow water to enter the soil. On May 22, four (*Lycopersicon esculentum*) 'Bonny Best' tomato plants were planted in each plot. At the end of the season the mulch was left undisturbed, and in the second season, Bonny Best tomatoes were planted in the same holes in the plastic.

To study control of *P. penetrans*, 3 g of fresh tomato roots were taken from each plot on August 10, washed free of soil, and soaked in 200 ml of water for 48 h to allow emergence of *P. penetrans* from the roots. For the second season, effects on nematode densities in soil were studied by taking 100 g of soil from each plot on May 18 and September 15. *Pratylenchus penetrans* were removed from the soil by the sugar flotation method (2) and counted.

Compared to nontreated plots, populations were decreased by SMDC in the first season over 95% (Table 1). Compared to populations in nontreated, nonmulched soil, *P. penetrans* populations were reduced 60-70% by PCNB and DBCP. Nabam reduced *P. penetrans* populations in mulched and nonmulched plots 65% below those in nontreated plots.

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TABLE 1. Effects of black polyethylene mulch and soil pesticides on populations of *Pratylenchus penetrans*.

Soil treatment (rate and active ingredient/ha)[a]	With (+) or without (—) mulch	Mean number of nematodes		
		Tomato roots (g) (1st season)	Soil (100 g) (2nd season)	
		8/10	5/18	9/15
Nontreated	—	182	4	8
	+	142	8	3
Nabam—8 kg	—	60	26	5
	+	52	11	4
PCNB—9 kg	—	87	19	20
	+	166	19	6
SMDC—209 liters	—	13	4	20
	+	6	12	2
DBCP—16.7 liters	—	41	16	16
	+	114	22	4
LSD ($P = 0.05$)		26	5	5

[a]Nabam (disodium ethylene bisdithiocarbamate), DBCP (1,2-dibromo-3-chloropropane), PCNB (pentachloronitrobenzene), SMDC (soduim N-methyldithiocarbamate). Each treatment was replicated four times.

In the spring of the second season, *P. penetrans* populations were very low in all plots. Population densities of this nematode were slightly higher in nonmulched nabam plots, in nonmulched and mulched PCNB plots, and in nonmulched and mulched DBCP plots than in other plots.

At the end of the second season, *P. penetrans* densities were higher in nonmulched plots than in mulched plots treated with PCNB, SMDC, and DBCP, but there was little build-up in any treatment. Population densities were low in plots treated with nabam or nontreated plots—approximately 1/4 to 1/2 those in nonmulched DBCP, PCNB, and SMDC plots, and approximately equal to those in mulched DBCP, PCNB, and SMDC plots and nontreated plots. *Pratylenchus penetrans* populations were lowest under mulches and were not influenced by treatment in the first season. Counts varied in nonmulched soil; higher populations occurred where soil was treated with PCNB, DBCP, and SMDC the first season.

Nabam has been shown to stimulate egg hatching of *Heterodera tabacum* and *Meloidogyne hapla* (3). It has been suggested (1, 5) that degradation of nabam and SMDC gives isothiocyanates which are very effective nematicides. It was expected that nabam might reduce the number of *P. penetrans* but not as much as SMDC.

Mulching reduced control of *P. penetrans* by PCNB and DBCP. This difference may have been due to the higher moisture under the polyethylene film which may have retained the toxicants and slowed their dispersion through the soil.

Miller and Waggoner (4) found that black plastic mulches decreased *P. penetrans* infestations around apple trees. Similar results have been obtained in this test with tomatoes in the first season, but mulching did not influence population in nontreated soil in the second season. The reason for this suppression is not known, but use of the black plastic mulch may favor increased activity of soil microflora antagonistic to *P. penetrans*.

Mulching influenced population some at the beginning, but not at the end, of the second season. Populations increased in nonmulched SMDC plots but remained low in mulched SMDC plots. At the end of the second season, populations in all mulched plots were low—indicating no influence of mulch on soil treatments—but nonmulched plots treated with DBCP, PCNB and SMDC did have slightly higher *P. penetrans* populations. Thus, soil treatment can influence *P. penetrans* populations longer in nonmulched soil than in mulched soil.

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