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Comparison of Winter and Spring Soil Fumigation with 1,3-D for the Management of *Meloidogyne arenaria* on Peanut[1]

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Abstract: Field experiments were conducted in which the fumigant 1,3-D was applied at broadcast rates of 56 and 112 liters/ha during late winter and spring to two differing soil types in north Florida. No advantage was demonstrated in applying the fumigant at the higher rate for the management of *Meloidogyne arenaria* on peanut, and there was no disadvantage to applying a standard rate of the fumigant during winter as opposed to the standard practice of a 2-week preplant treatment. At one site, where rainfall was less than adequate for normal peanut yields, all treatments with 1,3-D decreased nematode populations and increased yields 2.5-fold over banded applications of aldicarb (broadcast rates of 6.7 kg/ha at planting with 3.4 kg/ha at peg initiation), and 5-fold over the untreated control. At a site where weather conditions were optimal and soil infestation levels of *M. arenaria* juveniles were relatively low at harvest, none of the treatments produced peanut yields different ($P \leq 0.05$) from the untreated control.
Key words: aldicarb, *Arachis hypogaea,* 1,3-dichloropropene, fumigation, peanut, *Meloidogyne arenaria,* nematicide, nematode, root-knot nematode.

Peanut, *Arachis hypogaea* L., is produced in two general soil types in Florida: loamy sands, generally with a compacted clay plow pan, in the western panhandle; and soils with a deep sand profile in the northern peninsula of the state. In both regions, the major nematode pest of the crop is *Meloidogyne arenaria* (Neal) Chitwood race 1 (1). In the past, it was managed with crop rotation (2,4) and/or applications of dibromochloropropane or ethylene dibromide. These nematicides are no longer available. Alternative nematicide programs now include soil fumigation with 1,3-dichloropropene (1,3-D), with or without a nonfumigant applied at peg initiation, or a nonfumigant applied at planting plus an additional application at peg initiation (2). The soil fumigant must be applied at least 7 days preplant. This requires the growers to alter their practice of plowing as close to planting as possible to conserve soil moisture. Consequently, a fall or winter application may be advantageous in avoiding land preparation problems.

Field experiments involving winter and spring applications of 1,3-D, each at two rates, with and without application of the nonfumigant aldicarb at peg initiation, were conducted for the management of *M. arenaria* on two sites of differing soil types in Florida during 1990.

Materials and Methods

Site 1, in Santa Rosa County, was a Troup loamy sand (70% sand, 15% silt, 15% clay; 2% organic matter; pH 6.0) with a hard clay compaction layer at 0.4 m deep. Along with *M. arenaria,* the field was infested with *Helicotylenchus dihystera* Cobb (Sher) and *Criconemella ornata* (Raski) Luc and Raski. This field was fallowed and undisturbed following the previous year's peanut crop. Site 2, in Alachua County, was an Arredondo fine sand (89% sand, 6% silt, 5% clay; 1.1% organic matter; pH 6.2) with a deep sand profile (> 0.45 m). In addition to *M. arenaria, Paratrichodorus minor* (Colbran) Siddiqi, *Pratylenchus brachyurus* (Godfrey) Filipjev & Schuurmans Stekhoven, and *C. ornata* were present. This site had been planted with hairy vetch, *Vicia villosa* Roth., which was plowed under on 4 April 1990.

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Cultural practices and control of weeds, insects, and foliar diseases of peanut were as recommended for the area (5).

Plots at site 1 were 15 m long with 6 rows on 0.90-m centers, with 6-m-wide alleys between blocks. At site 2, plots consisted of six 12-m-long rows spaced 0.76 m apart, with 3-m alleys separating the blocks. Eight treatments were replicated eight times at site 1 and six times at site 2. The fumigant 1,3-D was injected 0.3 m deep via chisels set 0.30 m apart at rates of 170 and 340 ml/100 m 65 days before planting (14 February 1990) at site 1 and 86 days before planting (12 February 1990) at site 2 (winter treatments). Similar treatments (spring treatments) were repeated to designated plots on 3 April (site 1) and 23 April (site 2), 17 and 16 days before planting, respectively. Aldicarb was applied at planting in a 0.30-m band behind the planter opening disk and in front of the planter shoe with a Gandy applicator (Gandy Co., Owatanna, MN) at a rate of 138 g/100 m on 20 April at site 1 and on 9 May at site 2. Peg initiation treatments with aldicarb were applied at rates of 160 and 78 g/100 m in a 0.35-m band over peanuts treated with one series of the 170 ml 1,3-D and over those that had received the at-planting aldicarb treatment, respectively, at both sites. Sweeps set to plow flat and adjusted to sweep under the peanut vines were used to incorporate aldicarb at site 2.

Nematode abundance was monitored on 13 February, 28 March, 25 June, and 18 September at site 1, and on 16 February, 23 April, 22 June, and 3 October at site 2. Eight soil cores 2.5 cm d and 20 cm deep, taken from along the two center rows of each plot, were bulked, and a subsample was processed by sugar-centrifugal flotation for nematode extraction (3). Weather conditions were extremely dry from pegging until harvest at site 1, where no supplemental irrigation was available. Conditions at site 2 were favorable for peanut production, and supplemental irrigation was not needed. The two center rows of each plot were harvested on 17 September at site 1 and 3 October at site 2.

Results and Discussion

Other than *M. arenaria*, phytoparasitic nematodes at both sites were low in numbers and were not considered to affect peanut yield. The infestation of *M. arenaria* juveniles averaged 690/250 cm^3 soil on 13 February at site 1. There was no significant decline in the soil infestation levels in the untreated control plots throughout the season (Table 1). Similarly, there was no season-long decrease in numbers of juveniles in plots treated with aldicarb only. A decline in juvenile numbers was recorded from plots 42 days after winter fumigation at site 1 and 65 days at site 2 (Table 2). These averaged 33/250 cm^3 soil in fumigated plots as opposed to 445/250 cm^3 soil from all nontreated plots at this time at site 1 and 2/250 cm^3 soil versus 2,199/250 cm^3 soil at site 2. A considerable increase in soil population densities of *M. arenaria* was recovered following the green manuring of hairy vetch in April plots at site 2. By late June all fumigated plots at both sites had lower numbers of juveniles than preseason levels and all were lower ($P \leq 0.05$) than numbers recovered from untreated plots or plots treated with aldicarb alone. The latter comparison still held at the postharvest nematode assay at site 1, but not at site 2. Increased juvenile densities were recovered from the fumigated plots at site 1 at harvest, but at site 2 the population densities remained relatively low.

Favorable weather at site 2 was one factor in the low level of nematode damage. However, at harvest, roots, pods, and pegs of scattered peanut plants within all plots were slightly galled. The decline of the juvenile population density during the summer months at site 2 was surprising and unexplainable except for the observation that numerous juveniles collected from soil later sampled in January 1991 appeared diseased from unknown factors. These diseased juveniles are being investigated.

At site 1, postharvest soil infestation levels from plots receiving 1,3-D with at-pegging aldicarb treatment and from plots receiving the higher dosage of 1,3-D were

TABLE 1. Peanut yield and abundance of *Meloidogyne arenaria* juveniles as affected by nematicide treatments at site 1 in Santa Rosa County, Florida, 1990.

Treatment	Rate (a.i./100 m)	Application date	Yield (kg/ha)	Juveniles/250 cm³ soil			
				13 Feb	28 Mar	25 Jun	18 Sep
1,3-D	170 ml/chisel	14 Feb	1,947 a	525 ab	75 c*	125 c*	225 b
1,3-D + aldicarb	170 ml/chisel	14 Feb	2,142 a	625 ab	25 c*	0 c*	200 b*
	160 g	27 Jun					
1,3-D	340 ml/chisel	14 Feb	2,181 a	750 ab	0 c*	25 c*	125 b*
1,3-D	170 ml/chisel	3 Apr	2,010 a	550 ab	425 abc	100 c*	400 b
1,3-D + aldicarb	170 ml/chisel	3 Apr	1,895 a	350 b	250 abc	25 c*	75 b*
	160 g	27 Jun					
1,3-D	340 ml/chisel	3 Apr	1,973 a	875 ab	600 ab	25 c*	200 b*
Aldicarb + aldicarb	138 g	20 Apr	784 b	800 ab	250 bc*	850 a	1,025 a
	78 g	27 Jun					
Untreated			379 b	1,050 a	700 a	525 b	775 a

Data are means of eight replicates. Means within a column followed by the same letter are not significantly different (Duncan's multiple-range test, $P \leq 0.05$).

Juvenile mean data followed by * are significantly different ($P \leq 0.05$) from preseason assay on 13 February. Rates were based on a 0.90-m row spacing. 1,3-D was applied broadcast 0.30 m deep via chisels set 0.30 m apart. Aldicarb was applied in a 0.30-m band at planting (20 April) and in a 0.35-m band at pegging (27 June).

still lower ($P \leq 0.05$) than preseason levels. No significant differences were found in numbers of juveniles among the 1,3-D treated plots at any time during the peanut season. This is reflected in the yield data that show that neither the time of fumigation, the dosage, nor the addition of an at-pegging application of aldicarb had an influence on yields of peanuts treated with 1,3-D. Yields averaged 2,025 kg/ha, or 2.5 and 5 times the yields from the aldicarb-treated and untreated peanuts, respectively. Although yields from site 1 were relatively low, the yields of the 1,3-D-treated peanuts compared favorably with the local county average of 2,828 kg/ha (pers. comm.—USDA Agricultural Stabilization and Conservation Service, Milton, Florida). Thus the use of both late winter or springtime preplant applications of this nematicide of 170 ml/chisel/100 m (equivalent to 56 liters/ha broadcast) was justified where soil infestation levels of *M. arenaria* were high. The lack of rainfall at site 1 may have had a bearing on the efficacy of the at-pegging treatment with al-

TABLE 2. Peanut yield and abundance of *Meloidogyne arenaria* juveniles as affected by nematicide treatments at site 2 in Alachua County, Florida, 1990.

Treatment	Rate (a.i./100 m)	Application date	Yield (kg/ha)	Juveniles/250 cm³ soil			
				16 Feb	23 Apr	22 Jun	3 Oct
1,3-D	170 ml/chisel	12 Feb	4,586 a	14 a	2 b	6 b	14 a
1,3-D + aldicarb	170 ml/chisel	12 Feb	4,288 a	10 a	1 b	1 b	12 a
	160 g	27 Jun					
1,3-D	340 ml/chisel	12 Feb	4,179 a	16 a	3 b	1 b	19 a
1,3-D	170 ml/chisel	23 Apr	4,032 a	6 a	2,653 a	26 ab	61 a
1,3-D + aldicarb	170 ml/chisel	23 Apr	3,945 a	6 a	1,690 a	3 b	19 a
	160 g	27 Jun					
1,3-D	340 ml/chisel	23 Apr	4,220 a	8 a	2,357 a	1 b	23 a
Aldicarb + aldicarb	138 g	9 May	4,115 a	27 a	1,609 a	98 a	60 a
	78 g	27 Jun					
Untreated			4,166 a	11 a	2,685 a	81 a	36 a

Data are means of six replicates. Means within a column followed by the same letter are not significantly different (Duncan's multiple-range test, $P \leq 0.05$).

Rates are based on a 0.90-m row spacing. 1,3-D was applied broadcast 0.30 m deep with chisels set 0.30 m apart. Aldicarb was applied in a 0.30-m band at planting (9 May) and in a 0.35-m band at pegging (27 June).

dicarb; hence no conclusive judgement can be made on this management practice. However, data from this experiment does not support the need for fumigation by 1,3-D at rates as high as 340 ml/chisel/100 m (112 liters/ha) as either a winter or spring application.

Literature Cited

1. Dickson, D. W. 1985. Nematode diseases of peanut. Nematology Circular No. 121, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville.

2. Dunn, R. A. 1988. Peanut nematode management. Nematology Plant Protection Pointer 11, Institute of Food and Agricultural Sciences, University of Florida, Gainesville.

3. Jenkins, W. R. 1964. A rapid centrifugal-flotation technique for separating nematodes from soil. Plant Disease Reporter 48:692.

4. Rodríguez-Kábana, R., and H. Ivey. 1986. Crop rotation systems for the management of *Meloidogyne arenaria* on peanut. Nematrópica 16:53–63.

5. Whitty, E. B., W. L. Curry, T. C. Skinner, D. S. Harrison, R. P. Cromwell, F. A. Johnson, T. A. Kucharek, and R. A. Dunn. 1975. Peanut production guide. Circular 145F. Institute of Food and Agricultural Sciences, University of Florida, Gainesville.