

EFFECTS OF ROW SPACINGS AND SEEDING RATES OF PEANUT ON NEMATODES AND INCIDENCE OF SOUTHERN STEM ROT¹

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ABSTRACT

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A 2-year study was conducted on two different sites in each of two years to determine the effects of different row spacings and in-row seeding rates on nematode damage, incidence of *Sclerotium rolfsii* Sacc., and peanut yields, and to evaluate the management of nematodes. One site was infested with *Meloidogyne arenaria* (Neal) Chitwood, and the other with *Pratylenchus brachyurus* (Godfrey) Filipjev and Schuurmans Stekhoven and *Criconemella ornata* (Raski) Luc and Raski. 'Florunner' peanut (*Arachis hypogaea* L.) was planted in rows as follows: 1) two single rows spaced 91.4 cm apart on a 147-cm-wide bed seeded at 1.0X rate (seeds spaced approximately 7.6 cm apart in the row); 2) two pairs of twin rows (two rows spaced 20 cm apart) per bed seeded at 0.5X rate (seeds spaced 15.2 cm apart in the row); and 3) two twin rows per bed seeded at 1.0X rate. Nematicide treatments were: 1) no nematicide and 2) phenamiphos (2.8 kg ai/ha) in 1982 or ethylene dibromide (35.8 kg ai/ha) at planting plus aldicarb (2.2 kg ai/ha), applied at early pegging in 1983. Row spacings and in-row seeding rates did not affect *M. arenaria* population levels in the soil near harvest, root-knot indices, and peanut yields. Both nematicides reduced *M. arenaria* damage and increased peanut yields and percent sound mature kernels. In *P. brachyurus* and *C. ornata* infested soil, yields in 1982 were greater from single rows with 1.0X seeding rate than from twin rows with 1.0X seeding rate. Yield differences did not appear to be related to nematode population levels, but to southern stem rot caused by *Sclerotium rolfsii*. In 1983, *P. brachyurus* were more numerous in peanut shells from twin rows with 1.0X seeding rate than in shells from the other two row spacing and seeding rate treatments, but yields among treatments were not different. In 1983, ethylene dibromide plus aldicarb reduced the number of *C. ornata* in the soil and *P. brachyurus* in the peanut shells and pod-lesion index, and increased peanut yield.

Additional key words: *Meloidogyne arenaria*, *Pratylenchus brachyurus*, *Criconemella ornata*, root-knot nematode, lesion nematode, ring nematode, *Arachis hypogaea*, groundnut, phenamiphos, aldicarb, ethylene dibromide, Nemacur[®], Temik[®], Soilbrom 90[®], EDB, *Sclerotium rolfsii*.

RESUMEN

Minton, N. A., y A. S. Csinos. 1986. Efecto de la distancia entre hilera y la densidad de siembra del maní sobre los nematodos y la incidencia de pudrición del tallo. *Nematropica* 16:167-176.

Se llevó a cabo un estudio de dos años de duración en dos localidades diferentes cada año para determinar los efectos de diferentes distancias entre hilera y de diferentes den-

sidades de siembra sobre el daño causado por nematodos, la incidencia de *Sclerotium rolfsii* Sacc., el rendimiento del maní y el manejo de nematodos. Una localidad estaba infestada con *Meloidogyne arenaria* (Neal) Chitwood y la otra con *Pratylenchus brachyurus* (Godfrey) Filipjev & Schuurmans Stekhoven y *Criconemella ornata* (Raski) Luc & Raski. Se sembró maní (*Arachis hypogaea* L.) 'Florunner' en hileras como se senala a continuación: 1) dos hileras individuales por camellón de 91.4 cm de ancho sembradas a la densidad de 1.0X (semillas distanciadas aproximadamente 7.6 cm); 2) dos pares de hileras dobles (las dos hileras distanciadas a 20 cm) por camellón sembradas a la densidad de 0.5X (semillas distanciadas a 15.2 cm en la hilera); y 3) un par de hileras dobles por camellón sembradas a la densidad de 1.0X. Los tratamientos fueron: 1) sin nematicida y 2) fenamifos (2.8 Kg ia/ha) en 1982 o dibromuro de etileno (35.8 Kg ia/ha) a la siembra más aldicarb (2.2 Kg ia/ha) aplicado en el estado de formación en 1983. Las diferentes distancias entre hilera y las densidades de siembra no afectaron los niveles poblacionales de *M. arenaria* en el suelo próximo a la cosecha, tampoco el índice de agallas o el rendimiento. Ambos nematicidas redujeron el daño de *M. arenaria* e incrementaron los rendimientos y el porcentaje de maní (frutos) maduros y sanos. En el suelo infestado con *P. brachyurus* y *C. ornata*, los rendimientos del año 1982 fueron superiores en las hileras individuales sembradas a la densidad de 1.0X que aquellos procedentes de las hileras dobles con la misma densidad (1.0X) de siembra. Las diferencias en los rendimientos aparentemente no fueron relacionadas con los niveles de población de los nematodos sino con la pudrición del tallo causada por *Sclerotium rolfsii*. En 1983, un mayor número de *P. brachyurus* fue encontrado en el maní cosechado de las hileras dobles con la densidad de 1.0X que en el maní de las otras distancias y densidades; sin embargo, no se encontraron diferencias en los rendimientos obtenidos de los diferentes tratamientos. En 1983, el tratamiento de dibromuro de etileno más aldicarb redujo el numero de *C. ornata* en el suelo, *P. brachyurus* en las cáscaras y el índice de lesiones de los frutos e incrementó el rendimiento del maní.

Palabras claves adicionales: *Meloidogyne arenaria*, *Pratylenchus brachyurus*, *Criconemella ornata*, *nematodo nodulador*, *nematodo de las lesiones*, *nematodo anillado*, *Arachis hypogaea*, *cacahuete*, *fenamifos*, *aldicarb*, *dibromuro de etileno*, *Nemacur*, *Temik*, *Soilbrom 90*; DBE, *Sclerotium rolfsii*.

INTRODUCTION

Nematodes are a principal soil-borne pathogen of peanuts limiting yield in the southeastern United States. There is no known peanut cultivar resistant to either *Meloidogyne arenaria* (Neal) Chitwood (11), *Pratylenchus brachyurus* (Godfrey) Filipjev and Schuurmans Stekhoven (18), or *Criconemella ornata* (Raski) Luc and Raski (8). Consequently, control of these nematodes is almost exclusively based on the use of crop rotations and nematicides (8,15). Fumigants (16) and nonfumigant (12,17) nematicides applied at planting can be used to effectively manage nematodes of peanuts and increase yields. Additional nematode suppression and yield increase above that conferred by an application at planting have been obtained with an application of nematicides at pegging time to fields heavily infested with *M. arenaria* (4).

Research on nematode management on peanut is usually conducted with single rows spaced 76-96 cm apart. However, various close row spacings and in-row seeding rates are now being used (6). Some advan-

tages of these close row planting are higher yields (2,5), and more efficient management of weeds and diseases with pesticides (5,13), but the effects of close row spacings on nematodes have not been evaluated. The objectives of these studies were to determine the effects of different row spacings and in-row seeding rates on nematode damage, incidence of southern stem rot (*Sclerotium rolfsii* Sacc.), and peanut yields, and to evaluate the management of nematodes with phenamiphos and ethylene dibromide plus aldicarb.

MATERIALS AND METHODS

Two experiments were conducted in 1982 and 1983 on a Tifton loamy sand (fine, loamy, siliceous, thermic Plinthic Paleudults) near Tifton, Georgia. Two sites located about 0.5 km apart were used. The site of experiment 1 was infested with *M. arenaria* and the site for experiment 2 was infested with *P. brachyurus* and *C. ornata*. Both sites were also infested with *S. rolfsii*.

The experimental design was a split-plot replicated 8 times. Peanuts were planted on beds that measured 183 cm from tractor wheel centers and about 147 cm from shoulder-to-shoulder of the bed. Each subplot consisted of a single bed 7.6 m long. The whole-plot treatments were nematicides and the subplot treatments were row spacing-seeding rates. Nematicide treatments were: 1) no nematicide and 2) phenamiphos (2.8 kg ai/ha) in 1982 or ethylene dibromide (35.8 kg ai/ha) plus aldicarb (2.2 kg ai/ha) at early pegging in 1983. Two row spacings were utilized: two single rows per bed spaced 91 cm apart and two twin rows per bed spaced 20 cm apart between twin rows and 51 cm apart between each pair of twin rows. Row spacing-seeding rate treatments were: 1) two single rows per bed seeded in the row at a 1.0X rate (seeds spaced approximately 7.6 cm apart in the row), 2) two pairs of twin rows per bed seeded at a 0.5X rate (seeds spaced approximately 15.2 cm apart in the row), and 3) two pairs of twin rows per bed seeded at the 1.0X rate.

The seed bed was prepared to a depth of 25 cm with a moldboard plow. Fertilizer and lime were applied as recommended for peanut production in Georgia. The beds were shaped and benefin (1.7 kg ai/ha) was applied broadcast for weed control. Nematicide treatments were applied and seeds were planted on 5-7 May 1982 and 17 May 1983. Phenamiphos was applied in 1982 in a 46-cm wide band and incorporated 5 cm deep. In 1983, ethylene dibromide was injected with two chisels per row spaced 25 cm apart for the single rows, or one chisel per row for the twin rows. The ethylene dibromide-treated plots also received aldicarb (2.2 kg ai/ha) in a 46-cm band on 11 July 1983 (55 days after planting).

The herbicides naptalam (3.4 kg ai/ha) and dinoseb (1.7 kg ai/ha) plus chloramben (2.2 kg ai/ha) were applied after planting on 14 May 1982 and 25 May 1983. Bentazon (1.1 kg ai/ha) was applied on 11 June 1982 and 1 July 1983. Gypsum (calcium sulfate) was applied at 780 kg/ha on 24 June 1982 and 560 kg/ha 27 June 1983. The fungicide, PCNB 10G, (11.2 kg ai/ha) was applied over the row in a 46-cm wide band on 28-29 June 1982 and 11 July 1983. Chlorothalonil and sulfur were used for foliar disease control and methomyl, permethrin, and monocrotophos for control of insects. Rainfall supplied adequate moisture during 1982, but 3.5 cm and 5.0 cm of irrigation were applied on 21-22 July and 22-23 Aug. 1983, respectively.

Stand counts of the number of plants per 0.9 m of plot were made on 24 May 1982 and 16 June 1983. Ten 2.5-cm diam cores of soil for nematode assays were collected from the 0-20-cm depth on 8 Sept. 1982 and 31 Aug. 1983. The soil in each sample was thoroughly mixed, and the nematodes were extracted from a 150-cm³ subsample by the centrifuge-flotation method (7).

The plants were harvested on 20 Sept. 1982 and 12 Oct. 1983. Roots and pods of 10 plants from each plot in experiment 1 were rated for severity of root-knot galling soon after digging. Roots and pods in experiment 2 were examined for nematode injury soon after digging in both years. Lesions caused by *P. brachyurus* occurred on pods in 1983, therefore a lesion index was recorded. Ratings for both root-knot and lesions were based on a scale of 1-5 with 1 = no galls or lesions, 2 = 1-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of roots, pods, and pegs galled or pod surface covered with lesions. Forty pods per plot were selected at random for assaying *P. brachyurus* populations in 1983. A 5-g sample of peanut shells per plot was fragmented in a food blender for one min and incubated on a Baermann funnel in a moist chamber for 48 hr after which nematodes were collected and counted. The number of southern stem rot loci per 15.2 m linear row was recorded soon after digging using the methods of Rodriguez-Kabana *et al.* (14). A southern stem rot locus is defined as one or more infected plants per 30 cm of row.

Data were analyzed using standard procedures for analysis of variance, correlation, and Duncan's multiple range test. Differences referred to in this text were significant to the 5% or lower level of probability.

RESULTS

Peanut plant population levels in most treatments were slightly greater in 1982 than in 1983 (Tables 1-4). This was due, perhaps, to differences in seed viability or soil moisture during the two years. There was no interaction between nematicide treatments and row spacing-

seeding rate treatments for either site. Hence, data presented for nematicide treatments are averages across all row spacing-seeding rate treatments and data presented for row spacing-seeding rate treatments are averages across all nematicide treatments.

Experiment 1, 1982. Phenamiphos reduced root-knot indices and increased yield and percent sound mature kernels, but did not affect the number of *M. arenaria* in the soil on 8 September or the number of southern stem rot loci at harvest (Table 1). Row spacing-seeding rate treatments had no effect on nematode population level, number of southern stem rot loci, yield, or percent sound mature kernels. Yield was negatively correlated ($P = 0.0001$) with root-knot index ($r = -0.84$) and positively correlated with percent sound mature kernels ($r = 0.83$). Percent sound mature kernels was negatively correlated ($P = 0.001$) with root-knot index ($r = -0.78$).

Experiment 1, 1983. The severity of *M. arenaria* was less and the incidence of southern stem rot greater in ethylene dibromide treated plots than in untreated plots (Table 2). Yield and percent sound mature kernels were greater in treated than untreated plots. Row spacing-seeding rate treatments did not affect nematode severity, yield, and percent sound mature kernels, but the number of southern stem rot loci was greater in single rows with the 1.0X seeding rate than in twin rows with

Table 1. Effects of phenamiphos, row spacing, and peanut plant population density on *Meloidogyne arenaria*, southern stem rot, yield, and percent sound mature kernels, 1982.*

Treatments	Plants/ 0.9 m of plot	Root-knot index ^y	<i>M.</i> <i>arenaria</i> juveniles/ 150 cm ³ soil	Southern stem rot loci/15.2 m of row	Yield (kg/ha)	Sound mature kernels (%)
<u>Nematicide and rate (kg ai/ha)</u>						
Control	28.3 a	3.8 a	106 a	10.0 a	3796 b	71.6 b
Phenamiphos (2.8)	27.7 a	2.8 b	1031 a	11.4 a	5013 a	75.4 a
<u>Row spacing and seeding rate^z</u>						
Single 1.0X	21.9 b	3.2 a	1013 a	8.8 a	4598 a	74.4 a
Twin 0.5X	22.6 b	3.4 a	987 a	11.1 a	4407 a	73.4 a
Twin 1.0X	39.5 a	3.3 a	1141 a	12.3 a	4209 a	72.7 a

*Values followed by the same letter within the same column within nematicide and row spacing-seeding rate treatments are not significantly ($P = 0.05$) different according to Duncan's multiple range test. Values are means of 8 replications.

^yRoot-knot index rating based on a scale of 1-5 with 1 = no galling, 2 = 1-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100% of roots and pods galled.

^z1.0X = seeds spaced 7.6 cm apart in the row; 0.5X = seeds spaced 15.2 cm apart in the row.

Table 2. Effects of ethylene dibromide plus aldicarb, row spacing, and peanut plant population density on *Meloidogyne arenaria*, southern stem rot, yield, and percent sound mature kernels, 1983.^x

Treatments	Plants/ 0.9 m of plot	Root-knot index ^y	<i>M.</i> <i>arenaria</i> juveniles/ 150 cm ³ soil	Southern stem rot loci/15.2 m of row	Yield (kg/ha)	Sound mature kernels (%)
<u>Nematicide and rate (kg ai/ha)</u>						
Control	22.6 a	3.1 a	813 a	9.3 b	2582 b	69.6 b
Ethylene dibromide + aldicarb (35.8 + 2.2)	21.0 a	1.9 b	188 b	12.4 a	3845 a	73.0 a
<u>Row spacing and seeding rate^z</u>						
Single 1.0X	17.8 b	2.7 a	331 a	12.8 a	3181 a	71.8 a
Twin 0.5X	19.3 b	3.1 a	564 a	9.1 b	3087 a	70.5 a
Twin 1.0X	28.4 a	2.9 a	606 a	10.8 ab	3372 a	71.6 a

^xValues followed by the same letter within the same column within nematicide and row spacing-seeding rate treatments are not significantly ($P = 0.05$) different according to Duncan's multiple range test. Values are means of 8 replications.

^yRoot-knot index rating based on a scale of 1-5 with 1 = no galling, 2 = 1-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100% of roots and pods galled.

^z1.0X = seeds spaced 7.6 cm apart in the row; 0.5X = seeds spaced 15.2 cm apart in the row.

the 0.5X seeding rate. Yield was negatively correlated ($P = 0.0001$) with root-knot index ($r = -0.69$) and positively correlated with sound mature kernels ($r = 0.82$). Percent sound mature kernels was negatively correlated ($P = 0.0001$) with root-knot index ($r = -0.55$).

Experiment 2, 1982. *P. brachyurus* was present in the soil and peanut shells in very small numbers (data not shown) but relatively large numbers of *C. ornata* were present in the soil (Table 3). The population level of *C. ornata* was less and the number of southern stem rot loci was greater in plots treated with phenamiphos than in untreated plots. However, the nematicide had no effect on yield and percent sound mature kernels. Row spacing-seeding rate treatments had no effect on *C. ornata* population levels. Conversely, numbers of southern stem rot loci were more numerous in twin rows with the 1.0X seeding rate than in twin rows with the 0.5X seeding rate or in single rows with the 1.0X seeding rate. Also, the yield from single rows with the 1.0X seeding rate was greater than yields from twin rows with the 1.0X seeding rate. The percent sound mature kernels was unaffected by row spacing-seeding rate treatments. Yield was negatively correlated ($P = 0.0005$) with num-

Table 3. Effects of phenamiphos, row spacing, and peanut plant population density on *Cricinemella ornata*, southern stem rot, yield, and percent sound mature kernels, 1982.^y

Treatments	Plants/ 0.9 m of plot	<i>C.</i> <i>ornata</i> / 150 cm ³ soil	Southern stem rot loci/15.2 m of row	Yield (kg/ha)	Sound mature kernels (%)
Nematicide and rate (kg ai/ha)					
Control	27.4 a	706 a	7.1 b	6319 a	76.7 a
Phenamiphos (2.8)	28.2 a	206 b	9.3 a	6322 a	76.6 a
Row spacing and seeding rate ^z					
Single 1.0X	22.1 b	412 a	5.1 b	6509 a	76.9 a
Twin 0.5X	21.9 b	378 a	6.9 b	6293 ab	76.8 a
Twin 1.0X	39.5 a	579 a	12.5 a	6158 b	76.3 a

^yValues followed by the same letter within the same column within nematicide and row spacing-seeding rate treatments are not significantly ($P = 0.05$) different according to Duncan's multiple range test. Values are means of 8 replications.

^z1.0X = seeds spaced 7.6 cm apart in the row; 0.5X = seeds spaced 15.2 cm apart in the row.

bers of southern stem rot loci ($r = -0.48$) and numbers of southern stem rot loci were positively correlated ($P = 0.0001$) with stand ($r = 0.61$).

Experiment 2, 1983. *C. ornata* was present in the soil and *P. brachyurus* in peanut shells in relatively high numbers (Table 4). The ethylene dibromide plus aldicarb treatment reduced the number of *C. ornata* in the soil and *P. brachyurus* in shells and the pod-lesion index, but the incidence of southern stem rot was unaffected. The nematicides increased yield but did not affect percent sound mature kernels. Row spacing-seeding rate treatments did not affect the number of *C. ornata* in the soil and the incidence of southern stem rot. *P. brachyurus* was more numerous in shells from twin rows with the 1.0X seeding rate than from twin rows with the 0.5X seeding rate. Pod-lesion indices were greater from twin rows with the 1.0X seeding rate and from single rows with the 1.0X seeding rate than from twin rows with the 0.5X seeding rate. However, yield and percent sound mature kernels were unaffected by row spacing-seeding rate treatments. Yield was negatively correlated ($P = 0.003$) with pod-lesion index ($r = -0.43$), number of *P. brachyurus* in the shell ($P = 0.04$; $r = -0.30$), and incidence of southern stem rot ($P = 0.0005$; $r = -0.49$), but positively correlated ($P = 0.0004$) with percent sound mature kernels ($r = 0.49$).

DISCUSSION

The results of these experiments did not show a consistent advantage of any row spacing-seeding rate treatment over any other in managing

Table 4. Effects of ethylene dibromide plus aldicarb, row spacing, and peanut plant population density of *Criconebella ornata*, *Pratylenchus brachyurus*, southern stem rot, yield, and percent sound mature kernels, 1983.^x

Treatment	Plants/ 0.9 m of plot	<i>C.</i> <i>ornata</i> / 150 cm ³ soil	<i>P.</i> <i>brachy</i> <i>urus</i> / 5g of shell	Pod lesion index ^y	Southern stem rot loci/15.2 m of row	Yield (kg/ha)	Sound mature kernels (%)
<u>Nematicide and rate (kg ai/ha)</u>							
Control	26.1 a	784 a	1375 a	2.5 a	6.3 a	4667 b	74.8 a
Ethylene dibromide + aldicarb (35.8 + 2.2)	23.7 b	184 b	13 b	1.0 b	5.9 a	5119 a	74.8 a
<u>Row spacing and seeding rate^z</u>							
Single 1.0X	19.2 b	496 a	585 ab	1.8 a	6.1 a	4744 a	74.5 a
Twin 0.5X	21.8 b	446 a	445 b	1.6 b	5.9 a	4917 a	74.4 a
Twin 1.0X	33.8 a	511 a	1053 a	1.9 a	6.2 a	5019 a	75.5 a

^xValues followed by the same letter within the same column within nematicide and row spacing-seeding rate treatments are not significantly ($P = 0.05$) different according to Duncan's multiple range test. Values are means of 8 replications.

^yPod lesion index rating based on a scale of 1-5 with 1 = no lesions, 2 = 1-25%, 3 = 26-50%, 4 = 51-75% and 5 = 76-100% of pod surface covered with lesions.

^z1.0X = seeds spaced 7.6 cm apart in the row; 0.5X = seeds spaced 15.2 cm apart in the row.

densities of soil-borne pests in soil infested by *M. arenaria* plus *S. rolfssii* or *C. ornata* plus *P. brachyurus* and *S. rolfssii*. However, they did show that nematodes can be effectively managed in peanuts planted in close rows with phenamiphos and ethylene dibromide plus aldicarb.

Yields were unaffected by row spacing-seeding rate treatments in both experiments, except in experiment 2 in 1982 in which the single rows with the 1.0X seeding rate yielded more than the twin rows with the 1.0X seeding rate. A greater incidence of southern stem rot in the latter treatment may account for this difference. Southern stem rot occurred at a relatively high level in these plots even though the fungicide, PCNB, was applied at the recommended rate. Previous research (3,10) has shown that PCNB does not completely control heavy infestations of *S. rolfssii*. Nematode population levels did not differ among row spacing-seeding rate treatments, except in experiment 2 in 1983 where more *P. brachyurus* were present in peanut shells from twin rows with the 1.0X seeding rate than in shells from either of the other two row spacing-seeding rate treatments. It is not known why this occurred. Perhaps a greater plant population density in the plots with twin rows with the

1.0X seeding rate provided more opportunity for nematode reproduction in the early stages of plant development, hence more nematodes would be present in the soil during pod development.

The significant increase of percent sound mature kernels due to nematicides in the *M. arenaria* infested soil and not in the *C. ornata* and *P. brachyurus* infested soil was not surprising. *M. arenaria* caused more severe pod damage than did *C. ornata* and *P. brachyurus*.

The lack of peanut yield increase in response to the reduction of *C. ornata* by phenamiphos in 1982 suggested that the population level of this nematode was too low to cause measurable damage. In microplot experiments (1,9) where yield reductions due to *C. ornata* were reported, population densities were much greater than in this experiment.

LITERATURE CITED

1. BARKER, K. R., D. P. SCHMITT, and V. P. CAMPOS. 1982. Response of peanut, corn, tobacco, and soybean to *Criconebella ornata*. J. Nematol. 14:576-581.
2. COX, F. R., and R. H. REID. 1965. Interaction of plant population factors and level of production on the yield and grade of peanuts. Agron. J. 57:455-457.
3. CSINOS, A. S., D. K. BELL, N. A. MINTON, and H. D. WELLS. 1963. Evaluation of *Trichoderma* spp., fungicides, and chemical combinations for control of southern stem rot on peanut. Peanut Sci. 10:75-79.
4. DICKSON, D. W., and R. E. WAITES. 1978. Efficacy of at-plant and additional at-pegging applications of nematicides for control of *Meloidogyne arenaria* on peanut. Am. Peanut Res. Educ. Assn. Proc. 10:51. (abstr.).
5. HAUSER, E., and G. A. BUCHANAN. 1982. Production of peanuts as affected by weed competition and row spacing. Alabama Agric. Exp. Stn. Bull. 538. 35 pp.
6. HENNING, R. J., J. F. MCGILL, L. E. SAMPLES, C. SWANN, S. S. THOMPSON, and H. WOMACK. 1979. Growing peanuts in Georgia, a package approach. Coop. Ext. Serv., Univ. Georgia Bull. 640. 46 pp.
7. JENKINS, W. R. 1964. A rapid centrifugal-flotation technique for separating nematodes from soil. Plant Dis. Repr. 48:692.
8. MINTON, N. A. 1984. Nematode parasites of peanuts. Pp. 373-394 in W. R. Nickle (ed.), Plant and insect nematodes. Marcel Dekker, Inc., New York and Basel.
9. MINTON, N. A., and D. K. BELL. 1969. *Criconeboides ornatus* parasitic on peanuts. J. Nematol. 1:349-351.

10. MINTON, N. A., A. S. CSINOS, and D. K. BELL. 1984. Effects of six nematicides and two fungicides, applied in various combinations, on peanuts. U. S. Dept. Agric., Agric. Res. Serv. ARS-3. 14 pp.
11. MINTON, N. A., and R. O. HAMMONS. 1975. Evaluation of peanut for resistance to the peanut root-knot nematode, *Meloidogyne arenaria*. Plant Dis. Repr. 59:944-945.
12. MINTON, N. A., and L. W. MORGAN. 1974. Evaluation of systemic and nonsystemic pesticides for insect and nematode control in peanuts. Peanut Sci. 1:91-98.
13. MIXON, A. C. 1969. Effects of row and drill spacing on yield and market grade of peanuts. Alabama Agr. Exp. Sta. Cir. 166. 11 pp.
14. RODRIGUEZ-KABANA, R., P. A. BACKMAN, and J. C. WILLIAMS. 1975. Determination of yield losses to *Sclerotium rolfsii* in peanut fields. Plant Dis. Repr. 59:855-858.
15. RODRIGUEZ-KABANA, R., T. E. BOSWELL, and N. A. MINTON. 1984. Ring nematodes. Pp. 43-44 in D. M. Porter, D. H. Smith, and R. Rodriguez-Kabana (ed.), Compendium of peanut diseases. The American Phytopathological Society, St. Paul.
16. RODRIGUEZ-KABANA, R., and P. S. KING, W. H. PENICK, and H. IVEY. 1979. Control of root-knot nematodes on peanuts with planting time and post-emergence applications of ethylene dibromide and ethylene-dibromide-chloropicrin mixture. Nematropica 9:54-61.
17. RODRIGUEZ-KABANA, R., P. S. KING, and M. H. POPE. 1981. Comparison of in-furrow applications and banded treatments for control of *Meloidogyne arenaria* in peanuts and soybeans. Nematropica 11:53-67.
18. STARR, J. L. 1984. Expression of resistance in peanuts to *Pratylenchus brachyurus*: Impact on screening for resistance. J. Nematol. 16:404-406.

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