AMERICAN JOINTVETCH AND PARTRIDGE PEA FOR THE MANAGEMENT OF *MELOIDOGYNE ARENARIA* IN PEANUT

R. Rodríguez-Kábana, D. G. Robertson, P. S. King, and L. Wells

Department of Plant Pathology and Wiregrass Substation, Alabama Agricultural Experiment Station, Auburn University, AL 36849-5409, U.S.A.

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ABSTRACT

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The value of rotations of 'Florunner' peanut (*Arachis hypogaea*) with American jointvetch (*Aeschynomene americana*) and southern blight (*Sclerotium rolfsii*) was studied for 3 years in an experiment in southeastern Alabama. Peanut yields following 1 or 2 years of partridge pea were equal to yields obtained from peanut monoculture with aldicarb application at planting and were higher than yields of peanut monoculture without aldicarb. Peanut yields after 2 years of jointvetch also were higher than those from monocultured peanut without aldicarb. Jointvetch and partridge pea both suppressed development of *M. arenaria* when either was grown for 2 years instead of peanut without aldicarb, but partridge pea was more effective. Suppression of *M. arenaria* populations by growing partridge pea or jointvetch instead of peanut for 2 years was measurable after a subsequent peanut crop was grown. Partridge pea reduced populations more than jointvetch. Partridge pea and jointvetch rotations had no independent effects on southern blight. However, application of aldicarb to peanut following 2 years of partridge pea reduced the incidence of the disease when compared to peanut monoculture with or without aldicarb.

Key words: Aeschynomene americana, aldicarb, American jointvetch, antagonistic plants, *Arachis hypogaea, Cassia fasciculata*, control, cropping systems, management, *Meloidogyne arenaria*, peanut, root-knot nematode, rotations.

RESUMEN

Rodríguez-Kábana, R., D. G. Robertson, P. S. King, y L. Wells. La arvejilla americana y la acacia perdiguera para el manejo de *Meloidogyne arenaria* en el maní. Nematrópica 21:97–103.

Se estudió por 3 años en un experimento de campo en el sureste de Alabama el valor del maní 'Florunner' (*Arachis hypogaea*) en rotaciones con la arvejilla americana (*Aeschynomene americana*) y la acacia perdiguera (*Cassia fasciculata*) para el manejo de *Meloidogyne arenaria* y de la mustia blanca (*Sclerotium rolfsii*). Los rendimientos de maní después de uno o dos años de la acacia fueron iguales a los obtenidos del maní en monocultivo con aldicarb y más altos que los del maní en monocultivo sin aldicarb. El rendimiento de maní seguido a dos años de arvejilla también fue más alto que lo obtenido con monocultivo sin aldicarb. El desarrollo de *M. arenaria* fue inhibido tanto por la arvejilla como por la acacia cuando cualquiera de las dos fue plantada por 2 años en vez de maní sin aldicarb. La acacia fue la más supresora del nematodo. Tanto la arvejilla como la acacia no tuvieron efecto independiente alguno sobre la incidencia de la mustia blanca en el maní. Sin embargo, cuando se trató al maní con aldicarb en parcelas que habían estado con acacia por dos años antes, la incidencia de la enfermedad fue menor que en las parcelas con maní en monocultivo con o sin aldicarb.

Palabras clave: Aeschynomene americana, acacia, arvejilla americana, *Arachis hypogaea,* cambios de cultivos, *Cassia fasciculata,* combate de nematodos, control, manejo de plagas, maní, *Meloidogyne arenaria,* nematodo agallador, rotaciones de cultivos.

INTRODUCTION

The root-knot nematode *Meloidogyne arenaria* (Neal) Chitwood is one of the main factors limiting yield in peanut (*Arachis hypogaea*) production in the southeastern United States and in other humid, tropical and subtropical areas of the world (7,10). In Alabama, the nematode is present in 40% of the peanut fields, and in 12–15% of the fields losses are so severe that profitable production of the legume is not feasible without appropriate management of the nematode (4,22). Traditional management strategies for *M. arenaria* in Alabama have been based on the use of nematicides and rotations with crops that are nonhosts or are poorer hosts than peanut. This management approach was based on the lack of peanut cultivars resistant (or tolerant) to the nematode (5). The number of nematicides available for use in peanut is very limited and the cost of nematicide application is too high (U.S. $60–80/ha) for peanut production without governmental subsidies (14). Crop rotation schemes that can be used profitably to manage *M. arenaria* in peanut are also few and limited in scope (12,16). Rotation of peanut with corn (*Zea mays*) can be effective in maintaining fields free of root-knot nematode problems (12). Rotation with corn, however, is ineffective in fields with heavy infestations of *M. arenaria* (> 200 juveniles/100 cm^3 soil at peanut harvest) (19). Bahiagrass (*Paspalum notatum*) is a pasture crop that can be used effectively to suppress root-knot nematode damage in peanut (20) but is cost effective only in situations where peanut production is combined with cattle raising. Cotton (*Gossypium hirsutum*) can be very effective in rotation with peanut for the management of *M. arenaria* (13) but its production requires costly specialized equipment. The diversity of conditions and environments which peanut producers encounter make it necessary to have information on as many options as possible to manage *M. arenaria* and other pathogens. There is, thus, great need to study new crops for their potential use in rotation with peanut in the management of root-knot nematode problems. We have reported on a number of crops uncommon to Alabama that may be useful to develop new crop rotation schemes to suppress *M. arenaria* in peanut (15,17,18). This paper presents additional information on the value of two legumes, American jointvetch (*Aeschynomene americana*) and partridge pea (*Cassia fasciculata*), in rotation with peanut to manage *M. arenaria*.

MATERIALS AND METHODS

The effects of partridge pea and American jointvetch in rotation with 'Florunner' peanut on *M. arenaria* were studied in a 3-year field experiment at the Wiregrass substation, near Headland, Alabama. The field was irrigated, had been in peanut with winter fallow for at least 10 years, and was heavily infested with *M. arenaria* (> 200 juveniles/100 cm^3 soil determined at peanut harvest time). The soil was a sandy loam with pH = 6.2, organic matter content < 1.0% (w/w) and cation exchange capacity < 10 meq/100 g soil. The experiment was started in 1988 and had the following treatments: 1) continuous peanut with no nematicide; 2) continuous peanut with at-plant application of aldicarb each year; 3) partridge pea followed by peanut without aldicarb the second year, and partridge pea the third year; 4) same as treatment 3 but with aldicarb applied to the peanut crop; 5) 2 years of partridge pea followed by untreated peanut; 6) same as treatment 5 but with aldicarb applied to the peanut crop; 7) jointvetch followed by peanut with no aldicarb and jointvetch again on the third year; 8) 2 years of jointvetch followed by peanut without aldicarb. The field was left fallow every winter. Each treatment was represented by eight replications of plots arranged in a randomized complete-block design. Each plot was 7.3 m wide and 10 m long.

Where indicated, aldicarb (Temik 15G) was applied at-plant at 3.5 g a.i./100 m row in a 20-cm-wide band centered on the seed furrow. The row width was 0.91 cm so that this application was equivalent to 15.3 kg a.i./ha on a broadcast basis. Nematicide granules were incorporated 2–3 cm deep into the soil by spring activated tines attached to the planting equipment.

Jointvetch and partridge pea were drill planted each year at 17 and 9 kg seed/ha, respectively; peanut was planted in rows at 112 kg seed/ha. Cultural practices, fertilizer, and pesticides for control of foliar diseases, insects, and weeds in peanut were used according to recommendations for the area (1,3). Jointvetch and partridge pea received the same fertilizer as peanut (2) but no pesticides. Irrigation water was applied as needed.

A soil sample for nematode analysis was collected from each plot every year 1–2 weeks before peanut harvest, to coincide with the period of maximal juvenile population development in soil (21). Each sample consisted of 16–20 2.5-cm-diam soil cores taken to a depth of 20–25 cm at 0.5 m intervals within the central 18 m^2 of a plot. Cores from the plot were composited and nematodes were extracted from a 100-cm^3 subsample by the "salad bowl" incubation technique (9).

The incidence of southern blight caused by *Sclerotium rolfsii* in peanut was assessed by counting the number of disease loci in the two center rows of each plot immediately after digging and inverting the crop. A disease locus was defined as a length of row ≤ 30 cm with one or more plants killed by the fungus (11).

Peanut yields were determined by harvesting the two center rows of each plot. Green matter production of jointvetch was determined 1 month after peanut harvest by cutting, drying (10–12% moisture), and weighing all foliage in a 1 m^2 area in the center of each plot. Partridge pea seed production was determined 1 month after peanut harvest by collecting the seed from the center 18 m^2 area of each plot.

All data were analyzed following standard procedures for analysis of variance (6) and differences between treatment means were compared with Fisher's least significant differences. All differences referred to in the text were significant at $P < 0.05$.

RESULTS AND DISCUSSION

Application of aldicarb reduced numbers of *M. arenaria* juveniles in all 3 years of the study (Table 1). Plots with partridge pea and jointvetch had lower numbers of juveniles than peanut plots without nematicide. In 1990, peanut plots that had partridge pea and jointvetch the previous 2 years had juvenile populations equivalent to those in peanut plots with monoculture plus aldicarb; numbers of juveniles in all of these plots were lower than in plots with continuous peanut without nematicide. In 1989, peanut plots that had either of the two rotation legumes the year before had lower juvenile populations than did peanut nonoculture plots with or without aldicarb.

Table 1. Effective of rotations of 'Florunner' peanut (*Arachis hypogaea*) with partridge pea (*Cassia fasciculata*) or American jointvetch (*Aeschynomene americana*) on juvenile populations of *Meloidogyne arenaria* in a field experiment at the Wiregrass Substation, near Headland, Alabama.

Crop and year			Juveniles/100 cm^3 soil[x]		
1988	1989	1990	1988	1989	1990
Peanut (–)[y]	Peanut (–)	Peanut (–)	590	311	164
Peanut (+)	Peanut (+)	Peanut (+)	197	237	50
Partridge	Peanut (–)	Partridge	9	102	13
Partridge	Peanut (+)	Partridge	9	29	5
Partridge	Partridge	Peanut (–)	9	6	0
Partridge	Partridge	Peanut (+)	0	8	3
Jointvetch	Peanut (–)	Jointvetch	1	111	2
Jointvetch	Jointvetch	Peanut (–)	2	21	82
		LSD (P = 0.05):	97	72	62

[x]Determined 2–3 weeks before peanut harvest with the salad-bowl incubation technique (9).

[y]Nematicide treatment: (–) = none; (+) = aldicarb 15 G at-plant at 30.5 g a.i./100 m row in a 20-cm-wide band.

Aldicarb applications had no measurable effect on the incidence of southern blight in plots with peanut monoculture (Table 2); however, in 1990 the use of the nematicide suppressed the disease in peanut plots that had partridge pea in 1988 and 1989. Rotation with partridge pea or jointvetch had no effect on the incidence of southern blight in peanut plots that did not receive nematicide.

There were no differences in yield in response to aldicarb applications in plots with continuous peanut in any of the 3 years of the study (Table 3). In 1989, peanut yields were highest in plots that had partridge pea in 1988 but were not increased by growing jointvetch in 1988. In 1990, plots with peanut that had either of the two rotation legumes the previous 2 years had higher yields than did plots in peanut monoculture with nematicide, and where partridge pea had been grown for 2 years aldicarb application further increased peanut yields.

Results of the study showed clearly that American jointvetch and partridge pea can be used as rotation crops to suppress *M. arenaria* in peanut. Jointvetch can be used as a cover crop for production of greenmanure. It has been used in Florida as a summer cover crop to suppress *Meloidogyne* spp. in fields dedicated to winter vegetable production (8). There is also the possibility of utilizing jointvetch for forage production if harvested when tissues are tender. We harvested jointvetch at the late flowering-fruiting stage, too late for use as forage. However, results on dry matter production (> 5 t/ha) indicate the high potential this legume has as a greenmanure cover crop to improve soil fertility.

Table 2. Effect of rotations of 'Florunner' peanut (*Arachis hypogaea*) with partridge pea (*Cassia fasciculata*) or American jointvetch (*Aeschynomene americana*) on the incidence of southern blight (*Sclerotium rolfsii*) disease loci in peanut in a field infested with *Meloidogyne arenaria* at the Wiregrass Substation, near Headland, Alabama.

Crop and year			Loci/100 m row[x]		
1988	1989	1990	1988	1989	1990
Peanut (–)[y]	Peanut (–)	Peanut (–)	23	59	58
Peanut (+)	Peanut (+)	Peanut (+)	20	44	55
Partridge	Peanut (–)	Partridge	–	45	–
Partridge	Peanut (+)	Partridge	–	51	–
Partridge	Partridge	Peanut (–)	–	–	51
Partridge	Partridge	Peanut (+)	–	–	39
Jointvetch	Peanut (–)	Jointvetch	–	47	–
Jointvetch	Jointvetch	Peanut (–)	–	–	48
		LSD (P = 0.05):	NS	NS	14

[x]A disease locus is a row length ≤ 30 cm with one or more dead plants.
[y]Nematicide treatment: (–) = none; (+) = aldicarb 15 G at-plant at 30.5 g a.i./100 m row in a 20-cm-wide band.

Table 3. Effect of rotations of 'Florunner' peanut (*Arachis hypogaea*) with partridge pea (*Cassia fasciculata*) or American jointvetch (*Aeschynomene americana*) on peanut yield in a 3-year study in a field infested with *Meloidogyne arenaria* at the Wiregrass Substation, near Headland, Alabama.

Crop and year			Peanut yield (kg/ha)[x]		
1988	1989	1990	1988	1989	1990
Peanut (–)[y]	Peanut (–)	Peanut (–)	1 953	1 844	1 736
Peanut (+)	Peanut (+)	Peanut (+)	2 018	2 311	2 143
Partridge	Peanut (–)	Partridge	–	2 585	(235)
Partridge	Peanut (+)	Partridge	–	2 666	(235)
Partridge	Partridge	Peanut (–)	–	(380)	2 210
Partridge	Partridge	Peanut (+)	–	(380)	2 794
Jointvetch	Peanut (–)	Jointvetch	(5 786)	2 295	–
Jointvetch	Jointvetch	Peanut (–)	(5 786)	(5 987)	2 251
		LSD (P = 0.05):[z]	344	659	488

[x]Jointvetch yields represent dry matter production; figures for peanut and partridge pea are seed yields.

[y]Nematicide treatment: (–) = none; (+) = aldicarb 15 G at-plant at 30.5 g a.i./100 m row in a 20-cm-wide band.

[z]LSD values are for peanut yields only; yields for the other 2 crops are in parentheses.

Partridge pea seed is highly priced and is used in wildlife management. This legume may be used as a cover crop to improve soil fertility. Good establishment of partridge pea in Alabama requires that it must be planted early (late March–April) in relatively cool soil (15–20 C) to get acceptable germination. In 1988 we planted in late May and got a poor stand and sparse ground coverage. In subsequent years we advanced the planting of partridge pea to mid-April and got good stands and complete ground cover. Partridge pea and jointvetch are good competitors and we had no weed problems in plots with these legumes.

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