HAIRY INDIGO FOR THE MANAGEMENT OF *MELOIDOGYNE ARENARIA* IN PEANUT

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ABSTRACT

Rodríguez-Kábana, R., D. G. Robertson, L. Wells, and R. W. Young. 1988. Hairy indigo for the management of *Meloidogyne arenaria* in peanut. Nematrópica 18: 137–142.

Rotation of hairy indigo (*Indigofera hirsuta*) with 'Florunner' peanut (*Arachis hypogaea*) was evaluated for the management of *Meloidogyne arenaria* in a 2-yr (1986, 1987) field experiment at the Wiregrass Substation near Headland, Alabama. Second-stage juvenile populations in soil, determined 2–4 wk before peanut harvest, were 4–10/100 cm^3 of soil in plots with hairy indigo both years; average juvenile numbers in plots with continuous nontreated peanut were 147 and 239/100 cm^3 of soil in 1986 and 1987, respectively. Juvenile populations in plots with peanut in 1987 and planted with hairy indigo in 1986 were lower than those of plots planted with peanut both years; peanut yields in the hairy indigo-peanut rotation were 15% higher than the yield for plots in peanut monoculture. The hairy indigo-peanut rotation did not result in as high a yield response as the recommended aldicarb treatment (12 kg a.i./ha, applied broadcast). The highest peanut yields in 1987 were from plots treated with aldicarb that were planted with hairy indigo the preceding year.

Key words: Arachis hypogaea, biological control, cultural practices, forages, green manures, hairy indigo, *Indigofera hirsuta,* legumes, *Meloidogyne arenaria,* new crops, organic amendments, peanut, pest management, root-knot nematode, rotations.

RESUMEN

Rodríguez-Kábana, R., D. G. Robertson, L. Wells y R. W. Young. 1988. El índigo hirsuto un cultivo para el manejo de *Meloidogyne arenaria* en maní. Nematrópica 18: 137–142.

Se estudió por dos años (1986, 1987) el valor de una rotación de índigo hirsuto (*Indigofera hirsuta*) con maní (*Arachis hypogaea*) 'Florunner' para el manejo de *Meloidogyne arenaria* en un experimento de campo ubicado en la Subestación Wiregrass cercana a Headland, Alabama. Los niveles de poblaciones de larvas en segundo estadio del nematodo determinados 2–4 semanas antes de la cosecha del maní fueron 4–10/100 cm^3 de suelo en las parcelas con índigo hirsuto en ambos años aun cuando los niveles en aquellas con monocultivo de maní sin tratamiento fueron de 147 y 239 larvas/100 cm^3 de suelo en 1986 y 1987, respectivamente. Los niveles de poblaciones de larvas en las parcelas con maní en 1987 y con índigo hirsuto en el año anterior fueron más bajos que los correspondientes a las parcelas en monocultivo de maní y las parcelas en rotación dieron un 15% más rendimiento de maní que las en monocultivo. La rotación de índigo-maní no resultó en rendimientos de maní tan altos como los obtenidos con el monocultivo con tratamiento de aldicasrb (12 kg i.a./ha, área total). Los rendimientos más altos de maní en

1987 los dieron las parcelas con aldicarb que habían estado con índigo hirsuto el año precedente.

Palabras claves: Arachis hypogaea, combate biológico, forrages, índigo hirsuto, *Indigofera hirsuta*, leguminosas, manejo de plagas, maní, mejoradores orgánicos, *Meloidogyne arenaria*, nematodo agallador, pastos, practicas de cultivo, rotaciones.

INTRODUCTION

Peanut (*Arachis hypogaea* L.) is a good host for a variety of plant-parasitic nematodes (6,9). In Alabama and other states of the southeastern United States, the peanut root-knot nematode *Meloidogyne arenaria* (Neal) Chitwood is one of the main limiting factors in the production of the legume (4,5,9,18). Mnagement of the nematode has been based on the use of nematicides and rotations with corn (*Zea mays* L.) (9,10,12,21). Previous studies have shown that rotation with corn or sorghum (*Sorghum bicolor* Moench) are ineffective in fields heavily infested with *M. arenaria* (19). Rotation with corn is effective only in preventing buildup of *M. arenaria* in fields with low populations of the nematode and then only if corn is planted consecutively for 2 yr prior to peanut (10). However, consistent profitable production of corn in Alabama is feasible only in fields with irrigation which is uncommon in Alabama peanut fields. Other crops such as cotton (*Gossypium hirsutum* L.) and bahiagrass (*Paspalum notatum* Flugge) can be used effectively to manage *M. arenaria* in Alabama (11,15); however, there is need to find additional crops, specifically legumes, that can be used in rotation with peanut to suppress *M. arenaria*.

Previous studies have shown that a number of crops including some legumes which are uncommon to the southeastern United States, may be good choices as rotation crops to manage root-knot and other nematodes in peanut, soybean (*Glycine max* (L.) Merr.) or vegetable crops (13,14). Hairy indigo (*Indigofera hirsuta* L.) is a legume which was introduced from Africa as a forage or green manure crop for use in the southeastern United States (2). Hairy indigo and other tropical legumes were useful in Florida in suppressing development of *Meloidogyne* sp. and *Belonolaimus longicaudatus* Rau (7,8). In previous studies (14) we demonstrated that hairy indigo is not a good host for the soybean cyst nematode (*Heterodera glycines* Ichinohe) and is a poor host for *M. arenaria* and *M. incognita* (Kofoid & White) Chitwood. This paper presents results of a field evaluation of hairy indigo in rotation with peanut for the management of *M. arenaria*.

MATERIALS AND METHODS

A 2-yr (1986, 1987) field study was conducted at the Wiregrass substation near Headland, Alabama, to evaluate hairy indigo as a rotation crop for the management of *M. arenaria* in peanut production. The

experiment was established in a field that had been in continuous peanut production for 10 yr with hairy vetch (*Vicia villosa* Roth) planted as a winter cover crop. The soil was a sandy loam with pH = 6.2, cation exchange capacity <10 meq/100 g of soil, and organic matter content ≦1.0% (w/w). The field was divided into 40 plots each 10-m-long and 8-rows-wide on 91-cm centers. Rotation systems in the experiment were: 1) continuous peanut, 2) continuous peanut with aldicarb, 3) hairy indigo in 1986 followed by peanut in 1987, 4) hairy indigo followed by peanut treated with aldicarb, and 5) continuous hairy indigo. Cultivars chosen for the study were 'Florunner' peanut and 'Florida 101' hairy indigo. The field was left fallow during the winter and each rotation system was represented by eight replications (plots) arranged in a randomized complete block design. The field was equipped with a center pivot irrigation system and water was applied as needed. Cultural practices and control of foliar diseases, insects, and weeds were according to recommendations for the area (1,3). Hairy indigo was planted broadcast at 10 kg seed/ha. Each year peanut and hairy indigo were planted during the first week of May.

The 15G formulation of aldicarb was applied at-plant at the rate of 3.3 kg a.i./ha in a 25-cm-wide band with the seed furrow in the middle of the band. The granules were incorporated lightly (2–3 cm) into the soil with spring activated tines set immediately behind the applicator. The banded rate of aldicarb used was equivalent to a broadcast rate of 12 kg a.i./ha.

Sampling for nematode analysis was performed on 26 August 1986 (2 wk) and on 2 September 1987 (4 wk) before peanuts were dug to coincide with the period of maximal population development of *M. arenaria* in the crop (16). Soil samples consisted of 16–20 cores collected from the two center rows of each plot using a standard 2.5-cm-d cylindrical probe. The cores were collected from the root zone of the plants to a depth of 20–25 cm in order to have a core every 30–40 cm along the length of a plot. Cores from each plot were composited and a 100-cm^3 subsample was then used to determine the number of second-stage juveniles (J2) using the "salad bowl" incubation technique (17). Samples from plots with hairy indigo were obtained by sampling a 1-m-wide band through the center and along the length of the plot.

Peanut yields were determined by harvesting the two center rows at maturity of the crop. Indigo green matter was harvested 1 mo before peanut digging at a time when the legume was at the blooming stage. In 1986 hairy indigo yields were determined for eight plots only. The harvested shoots and leaves were dried (70 C) to a constant moisture content of 12% (w/w).

Population and 1987 yield data were analyzed using the analysis of variance (20), and Fisher's protected LSD was used to determine signif-

icant differences among means. Student's *t*-test was used to analyze peanut yield in 1986. Unless otherwise stated, all differences referred to henceforth in the text were significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Data from the study are presented in Table 1. *Meloidogyne arenaria* J2 populations in both years of the experiment were lowest in plots with hairy indigo; populations in these plots were low (4–10 J2/100 cm^3 soil). The aldicarb treatment increased peanut yields in both years. In 1986 and 1987, aldicarb application reduced populations of *M. arenaria* J2 in plots with continuous peanut. In 1987, the lowest J2 populations in peanut plots were those that were recovered from plots treated with aldicarb and planted with hairy indigo the previous year.

Analysis of the 1987 peanut yields revealed no aldicarb × rotation system interaction. The analysis showed that either aldicarb application or the inclusion of indigo in the peanut production system resulted in increased yields.

Hairy indigo dry matter production was in excess of 5 t/ha both years of the study, indicating that this legume may have potential either as a green manure crop or forage crop. Protein content of hairy indigo hay is equivalent to that of alfalfa and other forage legumes (2). Hairy indigo can be used satisfactorily as forage if cut when tissues are tender and palatable to cattle (2). In this study, hairy indigo was harvested when it was probably too fibrous for cattle feeding. We did not incorporate hairy indigo into the soil as a green manure. It is possible that with

Table 1. Effects of rotations with 'Florunner' peanut (*Arachis hypogaea*) and hairy indigo (*Indigofera hirsuta*) on second-stage (J2) juvenile populations of *Meloidogyne arenaria* in soil and on peanut and hairy indigo yields in a 2-yr field study conducted at the Wiregrass Substation, Headland, Alabama.

Crop		Yield (kg/ha)		J2/100 cm^3 of soil	
1986	1987	1986	1987	1986	1987
Peanut (−)[w]	Peanut (−)	1 709[x]	654	147	239
Peanut (+)[w]	Peanut (+)	3 390	2 468	45	168
Hairy indigo	Peanut (−)	5 317[y]	1 953	8	174
Harry indigo	Peanut (+)	5 317	2 784	1	107
Hairy indigo	Hairy indigo	5 317	796	4	10
FLSD (0.05)		427[z]	52	36	

[w]+ = at-plant application of the 15G formulation of aldicarb at 3.3 kg a.i./ha in a 25-cm-wide band; − = no aldicarb.

[x]Peanut yields differ significantly at $P < 0.05$ according to Student's *t*-test.

[y]Hairy indigo yield determined near time of peanut harvest.

[z]FLSD for the 1987 yield is for peanut only.

proper modification the large amount of leguminous organic matter produced could be used as an organic amendment to reduce nematode populations.

This study showed that there is value in using hairy indigo to increase peanut yield and to suppress *M. arenaria* populations in peanut following hairy indigo. We plan to continue our studies to evaluate rotations based on the use of hairy indigo for longer periods than those of this study. Comparison of these results with those of similar studies (11,15) suggest that hairy indigo is not as good a rotation crop as cotton or bahiagrass for the management of *M. arenaria* in peanut. Rotations in which peanut alternated with a single year of cotton or bahiagrass were very effective in suppressing *M. arenaria* population development in peanut.

Our results are in general agreement with those of Rhoades (7,8). Hairy indigo suppressed development of *M. incogita* and *B. longicaudatus* when used as a summer cover crop in Florida prior to winter vegetables. It is significant that in our case as in Rhoades' study, the highest yields were obtained with rotations that combined hairy indigo with nematicide applications.

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