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Rotations with Coastal Bermudagrass, Cotton, and Bahiagrass for Management of *Meloidogyne arenaria* and Southern Blight in Peanut

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Abstract: The efficacy of coastal bermudagrass (*Cynodon dactylon*) as a rotation crop for control of root-knot nematode (*Meloidogyne arenaria*) in 'Florunner' peanut (*Arachis hypogaea*) was evaluated in a 3-year field trial. Coastal bermudagrass–peanut rotation (CBP) was compared with peanut monoculture without nematicide (P−) and peanut monoculture with aldicarb (P+). The performance of CBP was also compared with 'Pensacola' bahiagrass (*Paspalum notatum*)-peanut (BP), and 'Deltapine 90' cotton (*Gossypium hirsutum*)-peanut (CP) rotations. Each rotation crop was grown for 2 years (1991, 1992) and peanut was planted without nematicide the third year (1993). In contrast with peanut, the alternate crops of bahiagrass, bermudagrass, and cotton did not support *M. arenaria* populations. In 1993, the lowest numbers of *M. arenaria* second-stage juveniles (J2) in soil were in plots with CP and BP; these rotations resulted in the highest peanut yields. CBP failed to increase peanut yield and resulted in the highest population densities of *M. arenaria* J2. In 1993, aldicarb reduced J2 densities in the soil but did not increase peanut yields. Rotations of BP and CP reduced incidence of southern blight (*Sclerotium rolfsii*) in peanut, but neither CBP nor aldicarb affected the disease.

Key words: aldicarb, *Arachis hypogaea*, bahiagrass, bermudagrass, cotton, crop rotation, cultural practice, *Cynodon dactylon*, forage, *Gossypium hirsutum*, grasses, *Meloidogyne arenaria*, nematode, nematode control, *Paspalum notatum*, peanut, *Sclerotium rolfsii*, root-knot, southern blight, sustainable agriculture.

Root-knot caused by *Meloidogyne arenaria* and southern blight (*Sclerotium rolfsii*) are among the principal yield-limiting soilborne diseases of peanut (*Arachis hypogaea*) (8,9,10). Damage from these diseases can be so severe that continuous production of peanut is impossible in fields with high population densities of the pathogens. There are at present no commercially available peanut cultivars resistant to these diseases (8). Traditionally, control of *M. arenaria* and *S. rolfsii* has been based on the use of chemicals; however, the number of nematicides and fungicides available for use by producers is limited and the cost of these pesticides is high (1). Rotations of peanut with bahiagrass (*Paspalum notatum*), cotton (*Gossypium hirsutum*), and several other resistant or nonhost crops are effective in management of these pathogens (5, 11,14,16).

The use of forage crops in rotation with peanut to manage disease problems is attractive to producers with cattle operations. Coastal bermudagrass (*Cynodon dactylon*) has been grown in the southeastern United States for decades as a forage and as a rotation crop for the management of root-knot nematodes in tobacco (*Nicotiana tabacum*), sweet potato (*Ipomea batatas*), and other vegetable crops (3). Information on the relative efficacy of coastal bermudagrass for the management of soilborne fungal pathogens in peanut is limited (6). This study was conducted to compare coastal bermudagrass with two other rotation crops for the management of root-knot and southern blight in peanut.

MATERIALS AND METHODS

The experiment was established in 1991 and located in an irrigated field at the Auburn University Wiregrass substation, in southeastern Alabama. The field had a history of continuous peanut production and winter fallow for 10 years and was heavily

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infested (>100 second-stage juveniles [J2]/100 cm^3 soil, at peanut harvest time) with *M. arenaria*. The soil was a sandy loam, pH = 6.5, organic matter <1.0% (w/w), and cation exchange capacity <10 meq/100 g soil. The field was divided into eight 10 × 58 m blocks each with five 8-row (row width = 0.91 m) plots. Treatments were as follows: i) continuous peanut without nematicide (P−); ii) continuous peanut treated with aldicarb formulation (P+); iii) coastal bermudagrass in 1991 and 1992, followed by peanut in 1993 (CBP); iv) same as treatment 3 but with 'Pensacola' bahiagrass instead of coastal bermudagrass (BP); v) same as treatment 3 but with 'Deltapine 90' cotton replacing coastal bermudagrass (CP). Plots with continuous peanut and cotton were fallowed each winter. Cotton stalks were mowed and the roots were left in the soil. Aldicarb was applied at-plant with ground-driven hopper boxes, in a 20-cm-wide band at 3.0 g a. i./10 m row (3.3 kg a. i./ha) with light (2–4 cm) incorporation into the soil. Treatments were arranged in randomized-complete blocks with eight replications. Cultural practices, fertilization, and control of insects, weeds, and foliar diseases for cotton and peanut were according to recommendations for the area (1,4). Coastal bermudagrass was established from sprigs, and bahiagrass was broadcast at 28 kg seed/ha. The grasses were fertilized according to recommended practices (4).

Soil samples for nematode assays were collected each year from every plot 2–3 weeks before peanut digging to coincide with the period when *M. arenaria* J2 population densities in soil are highest (17). A soil sample from plots of peanut or cotton consisted of 18–20 2.5-cm-d cores taken with a soil probe from the root zone to a depth of 20–25 cm at approximately 0.5-m intervals along the two center rows of each plot. The cores from each plot were composited and a 100-cm^3 subsample was used for nematode extraction by the 'salad bowl' incubation method (12). Soil cores from plots of bermudagrass or bahiagrass were collected from the center 1.5 m of each plot at 0.5-m intervals and were processed as described for peanut and cotton soil samples.

Incidence of southern blight in peanut was quantified as the number of disease loci or 'hits' in the two center rows of each plot after digging and inversion of the crop. A disease locus was defined as a length of row ≤ 30 cm (1 foot) affected by the disease (10).

Cotton and peanut yields were obtained from the two center rows of each plot at crop maturity. No yield data were collected for coastal bermuda or bahiagrass.

All data were subjected to analysis of variance (7). Fisher's least significant differences were calculated when F values were significant ($P \leq 0.05$).

Results and Discussion

Bahiagrass, bermudagrass, and cotton did not support *M. arenaria* in 1991 and 1992, whereas peanut supported high population densities (Table 1). These results agree with reports on the unsuitability of these crops as hosts for *M. arenaria* (3,5,13–15). Aldicarb did not reduce *M. arenaria* J2 population densities in plots with peanut in 1991 or 1992.

In 1993, plots of peanut following either cotton or bahiagrass contained lower numbers of *M. arenaria* J2 than those of continuous peanut (Table 1); the highest density of *M. arenaria* J2 was in plots of peanut following 2 years of bermudagrass. Aldicarb reduced J2 population densities below those found in continuous peanut without the nematicide; however, populations in aldicarb-treated peanut plots were higher than in untreated peanut plots with the bahiagrass and cotton rotations.

Aldicarb and the bermudagrass rotation had no effect on the incidence of southern blight in peanut (Table 1). Both cotton and bahiagrass rotations resulted in lower incidence of the disease than peanut monoculture without nematicide. These results agree with earlier reports in which cotton and bahiagrass rotations suppressed the incidence of southern blight in peanut (14,16).

TABLE 1. Effect of rotation with peanut, coastal bermudagrass, bahiagrass, and cotton on second-stage juvenile population densities of *Meloidogyne arenaria*, incidence of southern blight, and crop yield in a 3-year field study at the Auburn University Wiregrass Substation.

Crop and year†			*M. arenaria* juveniles/100 cm³ soil‡			Southern blight hits/100 m row§			Yield kg/ha‖		
1991	1992	1993	1991	1992	1993	1991	1992	1993	1991	1992	1993
Peanut(−)	Peanut(−)	Peanut(−)	170	240	611	120	43	63	2,170	3,065	2,631
Peanut(+)	Peanut(+)	Peanut(+)	159	354	401	90	52	68	3,173	3,662	2,848
C. Bermudagrass	C. Bermudagrass	Peanut(−)	21	1	868	–	–	60	–	–	2,929
Bahiagrass	Bahiagrass	Peanut(−)	24	0	193	–	–	43	–	–	3,580
Cotton(−)	Cotton(−)	Peanut(−)	15	0	147	–	–	49	(2,821)	(570)	3,363
		FLSD (P = 0.05):	88	95	166	24	14	13	439	396	496

† (−) = untreated; (+) = treated with aldicarb at 3.0 g a.i./10 m row in a 20-cm-wide band at planting.
‡ Determined 2 weeks before peanut harvest using the "salad bowl" incubation technique.
§ A "hit" is a disease locus ≤30 cm row length.
‖ FLSD values apply only for peanut yields; seed cotton yield in parentheses.

Peanut yields in 1993 were highest in plots with the bahiagrass and cotton rotations (Table 1). Aldicarb application and the bermudagrass rotation did not increase yields over the peanut monoculture without nematicide. Bahiagrass and cotton rotations have repeatedly increased yield of peanut (5,14,16) and other crops in Alabama and other southeastern states (11, 13,15). Cotton yields, although adequate in 1991, were low in 1992 due to late planting.

Rotations with coastal bermudagrass have been beneficial for control of root-knot nematodes in flue-cured tobacco, sweet potato, and other vegetables (3). Rotations with coastal bermudagrass were proposed as a general solution for the problems caused by root-knot nematodes in the southeastern United States (2). Our results do not support this view and indicate clearly that there are differences among graminaceous species in their efficacy as rotation crops for the management of *M. arenaria* and *Sclerotium rolfsii.*

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