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Coastal Bermudagrass Rotations for Control of Root-knot Nematodes

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The use of 1,2-dibromo-3-chloropropane (DBCP) and ethylene dibromide (EDB) as soil fumigants to control nematodes has been banned. Other nematicides are more expensive and often less effective than DBCP and EDB and may experience a similar fate. A renewed interest in biological control of nematodes will surely follow. Among root-knot nematode-resistant crops that may be used in rotation with susceptible crops are the perennial bermudagrasses (*Cynodon dactylon* L.) 'Coastal' and 'Coastcross-1'.

Coastal bermudagrass sod turned 25–30 cm deep with a moldboard plow recovers slowly enough that many annual crops can be grown with little competition from the grass. When such crops are harvested, Coastal will quickly form a sod without replanting; it can recover fertilizer not used by the annual crops and produce hay for which there is usually a good market. Coastal bermuda will provide excellent erosion control on slopes that should not be cropped with annuals. Herbicides, such as *N*-(phosphonomethyl) glycine (glyphosate), can be used to suppress or destroy Coastal should this be required.

Results of research and experience supporting the use of Coastal bermudagrass as a rotation crop for the control of root-knot nematodes are summarized here.

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On 29 February 1944, 'Kobe' lespedeza (*Lespedeza striata*) was seeded at 40 kg/ha on 147 genotypes of bermudagrass that had been planted in 5 × 21-m plots in triplicate in 1939 (3). Excellent stands developed on all plots in late May, but by mid June stands of lespedeza were thinning noticeably on most plots. By 21 August 1944, lespedeza plants still alive in bermudagrass plots of genotypes 39, 76, and 80 were 96% infected with root-knot nematode *Heterodera marioni* Cornu, whereas only 1% of the lespedeza growing in plots of genotypes 3, 7, 17, 35, and 104 were infected. On 5 September 1944, hay cut from genotypes 39, 76, and 80 contained less than 1% lespedeza, whereas that cut from genotypes 3, 7, 17, 35, and 104 contained 24% lespedeza. 'Kobe' lespedeza was again sown at the same rate over all plots on 9 March 1945. By June 1945, 90% of the lespedeza plants in 39, 76, and 80 plots were infected with root-knot, whereas no root-knot nematodes were found on any lespedeza plants in plots of genotypes 3, 7, 35, and 104. Genotype 17 had 3% infected lespedeza plants. Genotype 35 was released in 1943 as Coastal bermudagrass.

Beginning in 1944, McBeth (6) conducted three host tests with several grasses. Roots of grasses planted in soil infested with *Heterodera marioni* (Cornu) Goodey were stained with lactophenol-acid fuchsin and examined for the presence of egg-producing female nematodes. McBeth concluded, "of the 18 grasses examined, all but 2 were found to be infected. Coastal Bermudagrass and common pearl millet failed to show any signs of infection in their single test (#3), in spite of the heavily infested soil in which they were grown."

Gaines (4) grew flue-cured tobacco on Coastal bermudagrass sod turned with a moldboard plow and reported that Coastal bermudagrass was among the most promising sod rotations for controlling the root-knot nematodes *Meloidogyne incognita acrita* and *M. javanica.* He stated that "good leaf quality followed such resistant crops as rye, oats, and pure stands of Coastal bermuda."

For several years Paul Fulwood II grew vegetable transplants, such as tomato, cabbage, onion, and pepper, on plowed Coastal bermudagrass sod. He turned the sod 25–30 cm deep with a moldboard plow, fertilized heavily, disked thoroughly, and planted vegetable seeds in February or early March. The plants were harvested in May before the Coastal bermudagrass made enough growth to interfere with harvest. As soon as the plants were removed, the Coastal bermudagrass, using the residual fertilizer in the soil, formed a sod and produced hay for the remainder of the season. The following February, Fulwood turned the sod again and grew another crop of transplants. He reported (pers. comm.) that the Coastal bermuda controlled the nematodes and other soil pests, and the transplants were easier to pull and had better root systems than those produced on newly cleared forest land. Using this procedure, he grew certified plants year after year on the same land without treating for nematode control. Nematodes and other pests increased so rapidly on recently cleared forest lands that such land could be used to produce certified plants for only 1–2 years. In 1966 it was estimated that more than 2,000 acres of Coastal bermudagrass sod were used for growing certified plants in Georgia (7).

For 3 years, Ukkelberg and Harmon (7) grew snapbeans, cucumbers, and sweet potatoes on plowed 4-year-old Coastal bermudagrass sod growing on a Fairhope fine sandy loam. They reported "good yields of each crop were obtained indicating that these crops can be successfully grown on such sod. Root-knot nematodes, rots or wilts were not found on any of the vegetables at any time during this experiment. Rapid germination and early growth of the vegetable crop shaded the land and retarded the growth of the bermudagrass."

On 15 April 1949, well-established sods of five bermudagrass hybrids were turned 18 cm deep, fertilized with 67 kg/ha of N plus 560 kg/ha of 4-8-8 (N-P-K), and smoothed with a disk harrow. Dixie 18 hybrid corn planted 25 April in rows 0.9 m apart was cultivated twice, first with disks set to move soil away from the plants and later to move soil back around the plants. An additional 90 kg/ha of N were applied 2 June. Coastal bermudagrass sod, with fewer rhizomes than sod of common types, was easier to turn and the land easier to prepare. Corn on the Coastal plots yielded as well as control plots that were free of bermudagrass (2). Coastal bermuda grew slowly while shaded by the corn but reestablished a good sod by the end of the growing season.

New improved bermudagrasses have been evaluated for resistance to root-knot nematode species. Both Coastal and Coastcross-1 are resistant to *Meloidogyne incognita, M. javanica, M. hapla,* and *M. arenaria* (5). Recently it was reported that Coastal, Coastcross-1, and Tifton 44 were resistant to *M. incognita* and a mixed population of *M. javanica, M. arenaria,* and *M. hapla* (1), but that Tifton 68 and Tifton 79-16 were susceptible to both *M. incognita* and the mixed population of *Meloidogyne* spp. Tifton 78 was resistant to the mixed population of *Meloidogyne* spp. and exhibited some resistance to *M. incognita.* These grasses may be used to develop even more efficient crop production systems and minimize the use of nematicides to manage root-knot nematodes in suitable climates.

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