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Maintaining Fescue In Bahia Mixtures

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MAINTAINING FESCUE IN BAHIA MIXTURES

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PENSACOLA BAHIAGRASS *(Paspalum notatum)* is dormant and unproductive in Alabama from late October to April. Kentucky 31 tall fescue *(Festuca arundinacea)* is semidormant in summer. It begins growth in September or October, grows little in mid-winter, and makes most of its production in spring until June or July. The two grasses in association should provide better forage over a longer grazing season than either one alone. Some farmers in central Alabama have successfully maintained the two species together in pastures over a number of years. More commonly, pure stands of tall fescue are eventually dominated by bahiagrass if it is introduced into the sward.

Previous work in the southern Piedmont of Georgia (5) showed that tall fescue persisted and was productive in association with Coastal bermudagrass (*Cynodon dactylon*) for 3 years with high rates of nitrogen (N) fertilization. However, bahiagrass is generally considered to be more aggressive and forms a tighter sod than Coastal bermudagrass. Bahia is tolerant of close cutting or grazing in summer (4), while autumn production of tall fescue is reduced by close summer defoliation in Alabama (2). Tall fescue persistence and productivity is also reduced by nematodes on sandy soils (3). Thus, it is likely that management may be critical for maintenance of tall fescue in association with bahiagrass. This publication summarizes research in Alabama on the influence of rate and time of N application and stubble height on persistence and productivity of a tall fescue-bahiagrass mixture.

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EXPERIMENTAL METHODS

Pensacola bahiagrass seed were broadcast in March 1972 on Kentucky 31 tall fescue established in October 1971. The two experiments were located on Cahaba fine sandy loam (typic hapludult, fine-loamy siliceous) at the Plant Breeding Unit, Tallassee and on Benndale sandy loam (typic hapludult coarse-loamy siliceous) at the Brewton Experiment Field. During the years 1972-73, 1973-74, and 1974-75, nitrogen rates in pounds N per acre of 200 in winter and 200 in summer, 200 in winter and 100 in summer, 200 in winter and 0 in summer, 100 in winter and 100 in summer, 100 in winter and 0 in summer were applied in combination with summer (May-Sept.) stubble heights of 4 and 1½ inches, table 1. In addition, 200 and 100 pounds N per acre were applied in winter to summer rest plots (not cut from May through September). During the remainder of the year (October-April), all treatments were harvested to a stubble height of 1½ inches. At the end of the summer, summer rest plots were cut and the residue, mostly dry tall fescue stems and leaves, was discarded. Winter N was applied in early October, early February, and late March. Summer N was applied in May, early July, and August. The experimental design was a randomized complete block, replicated four times.

The percent tall fescue in forage was determined at each harvest. Percent tall fescue stand was estimated in April of the third year. Soil nematode populations were determined during the third year.

RESULTS

Forage Yields

Winter-spring (October-April) forage yields, mainly tall fescue, were higher at the Plant Breeding Unit than at Brewton Experiment Field, tables 1 and 2. Yields during this season declined sharply over the 3-year period at both locations when plots were cut at the 1½-inch stubble height. Yields also declined at lower rates of N, particularly at Brewton Experiment Field. Summer forage yields were highest when cut at the low stubble height during all 3 years of the tests.

Results for 1975 illustrate effects of the various treatments on forage production, tables 1 and 2. Although summer rest increased winter-spring forage yield over no summer rest

TABLE 1. SEASONAL DRY FORAGE PRODUCTION OF TALL FESCUE-BAHIAGRASS AS AFFECTED BY N FERTILIZATION AND STUBBLE HEIGHT OVER A 3-YEAR PERIOD AT THE PLANT BREEDING UNIT, TALLASSEE

Summer stubble height	N applied		Winter-spring yield			Summer yield			Total season yield		
	Winter	Summer	1973	1974	1975	1973	1974	1975	1973	1974	1975
Inches	*Lb/acre*	*Lb/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*
4	200	200	2.40	1.91	2.30	2.01	1.28	0.98	4.46	3.16	3.28
	200	100	2.07	1.73	2.50	2.10	1.59	1.88	3.17	3.32	4.36
	200	0	2.10	1.57	2.20	0.44	1.22	1.75	2.58	2.74	3.87
	100	100	1.87	0.81	1.68	1.12	1.51	1.83	2.99	2.32	3.02
	100	0	1.62	0.61	1.22	0.70	0.98	1.38	2.32	1.60	2.60
1½	200	200	2.46	1.82	1.25	4.41	3.43	4.61	6.87	5.20	5.92
	200	100	2.35	1.40	1.26	3.25	2.92	4.28	5.60	4.33	5.53
	200	0	2.16	1.08	1.34	2.14	1.47	3.12	4.30	2.04	4.41
	100	100	1.93	0.86	0.64	3.41	2.70	3.13	5.34	3.51	3.78
	100	0	1.54	0.59	0.44	2.05	1.36	2.17	3.64	1.95	2.62
Summer rest	200	0	1.85	1.81	2.70	0	0	0	1.34	1.81	2.70
	100	0	1.52	1.05	1.42	0	0	0	1.02	1.05	1.42

TABLE 2. SEASONAL DRY FORAGE PRODUCTION OF TALL FESCUE-BAHIAGRASS AS AFFECTED BY N FERTILIZATION AND STUBBLE HEIGHT OVER A 3-YEAR PERIOD AT BREWTON EXPERIMENT FIELD

Summer stubble height	N applied		Winter-spring yield			Summer yield			Total season production		
	Winter	Summer	1973	1974	1975	1973	1974	1975	1973	1974	1975
Inches	*Lb/acre*	*Lb/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*	*T/acre*
4	200	200	1.53	1.12	0.46	2.88	4.92	5.96	4.40	6.03	6.42
	200	100	1.32	1.00	0.53	2.17	4.16	5.34	3.49	5.16	5.88
	200	0	1.14	0.78	0.60	0.64	2.25	3.57	1.79	3.03	4.18
	100	100	1.15	0.46	0.22	2.04	3.66	4.17	3.20	4.12	4.38
	100	0	0.72	0.23	0.22	0.71	1.64	2.22	1.43	1.88	2.44
1½	200	200	0.82	0.64	0.22	4.40	6.88	6.71	5.22	7.52	6.92
	200	100	0.80	0.63	0.14	3.22	5.27	5.75	4.02	5.90	5.93
	200	0	0.66	0.50	0.27	1.38	3.21	4.28	2.04	3.72	4.55
	100	100	0.55	0.32	0.08	3.17	4.58	4.69	3.72	4.90	4.78
	100	0	0.46	0.16	0.07	1.21	2.09	2.68	1.67	2.25	2.76
Summer rest	200	0	1.43	1.18	0.98	0	0	0	1.43	1.18	0.98
	100	0	1.02	0.34	0.30	0	0	0	1.02	0.34	0.30

($P \leq .01$), it resulted in a large loss in potential summer production at both locations. Winter-spring forage yields were higher from plots cut in summer at a 4-inch as compared to a 1½-inch stubble height. In contrast, bahiagrass production in summer was less when cut at the higher summer stubble height. This is because bahiagrass has such a large amount of forage growth in the 1½-to 4-inch zone.

Total forage yields were highest when bahiagrass dominated the mixture, tables 1, 2, and 3. Highest average yield for the 3 years, 6½ tons per acre, was at Brewton Experiment Field with summer stubble height of 1½ inches and 400 pounds N per acre. Under this management at both locations, tall fescue was virtually eliminated by the second year, leaving nearly a solid stand of bahiagrass.

Although higher winter N rates increased winter-spring production in the third year ($P \leq .01$), summer N had no effect on forage yields during this season, indicating that little N was carried over to the tall fescue in winter from the bahiagrass in summer. Summer-applied N rates resulted in a straight line increase in summer forage production of bahiagrass at both locations ($P \leq .01$). Reduced summer yields at the Plant Breeding Unit from the highest N rate and high stubble was a result of increased crabgrass (*Digitaria sanguinalis*) which was discarded when plots were harvested. This treatment resulted in little or no bahiagrass invasion but did permit crabgrass seedlings to become established in summer.

Seasonal productivity during the third season (1975) with a tall fescue-bahia mixture was best with 200 pounds N per acre in winter and a summer stubble height of 4 inches, figure 1. This management system provided considerable winter and spring forage from tall fescue but resulted in reduced midsummer production. In contrast, cutting to 1½ inches in summer resulted in low winter and spring production of tall fescue but high summer production from bahiagrass.

Botanical Composition of Forage

Tall fescue content of the total forage in each of the 3 years at the Plant Breeding Unit was highest with the 4-inch stubble height and 200 pounds N per acre in winter, table 3. Low stubble height drastically reduced the amount of tall fescue in forage, regardless of the N rate. After the first year at Brewton Experiment Field, tall fescue comprised only a small amount

TABLE 3. PERCENT TALL FESCUE STAND IN 1975 AND PERCENTAGE TALL FESCUE IN TOTAL FORAGE AS AFFECTED BY N FERTILIZATION AND SUMMER STUBBLE HEIGHT OVER A 3-YEAR PERIOD AT PLANT BREEDING UNIT (PBU) AND BREWTON EXPERIMENT FIELD

Summer stubble height	N applied		Tall fescue stand in early April of 3rd year		Tall fescue composition of total forage					
					PBU			Brewton		
	Winter	Summer	PBU	Brewton	1973	1974	1975	1973	1974	1975
Inches	*Lb/acre*	*Lb/acre*	%	%	%	%	%	%	%	%
4	200	200	89	19	44	87	90	35	20	5
	200	100	90	38	51	65	80	35	20	7
	200	0	89	40	69	60	75	62	22	14
	100	100	76	20	56	52	60	34	3	3
	100	0	35	35	60	58	57	47	9	9
1½	200	200	23	0	26	37	35	13	2	0
	200	100	46	4	29	32	24	17	3	0
	200	0	39	14	32	42	31	30	7	3
	100	100	11	5	26	24	32	12	0	0
	100	0	6	6	43	30	16	25	0	0
Summer rest	200	0	100	62	100	92	100	98	88	89
	100	0	58	45	100	61	94	98	56	83

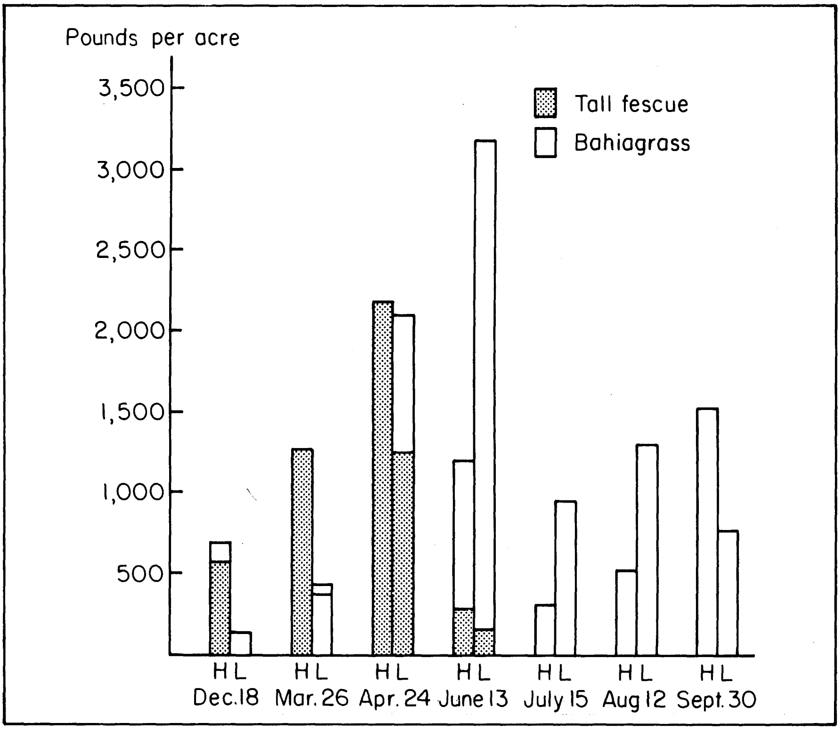

FIG. 1. Seasonal forage distribution of tall fescue-bahia mixtures as affected by summer stubble heights of 4 inches (H) and 1½ inches fertilized with 200 pounds N per acre in winter, and none in summer, third year, Plant Breeding Unit.

of the forage, regardless of stubble height or N rate. Summer rest at both locations resulted in mainly tall fescue in the forage over the 3-year period.

Stand Persistence

Tall fescue stands in the central Alabama test remained excellent with high stubble height and high N fertilization, table 3. In contrast, stand and vigor of tall fescue was much less with low stubble height, figure 2. When N was applied at 100 pounds N per acre in winter—100 in summer or 100 in winter—none in summer, tall fescue stands were very poor. Summer rest maintained an excellent stand of tall fescue at the 200 pounds N per acre rate, figure 3, but the stand was much reduced at the 100 pounds N per acre rate. Tall fescue survival was much poorer at Brewton Experiment Field but treatment effects were similar to the other location.

FIG. 2. Cutting to 1½-inch stubble in summer (right) reduced stand and vigor of tall fescue as compared to cutting in summer at a 4-inch stubble (left) when both were grown in association with bahiagrass and fertilized with 200 pounds N per acre in winter. Plant Breeding Unit, March 25, 1975, spring of third season.

Parasitic Nematodes

Total plant parasitic nematode populations in soil were high during the third year of the study, table 4. There was some indication of higher nematode populations in plots containing more tall fescue but results were not consistent. Lance (*Hoplolaimus galeatus*), and to a lesser extent stubby root (*Trichodorus christiei*) nematodes, were the predominant species at the Plant Breeding Unit while at Brewton Experiment Field spiral (*Helicotylenchus dihystera*) and stunt (*Tylenchorhynchus*) nematodes were present in largest numbers.

Nematodes are likely a major factor in the shift from tall fescue to bahia dominance in a mixture over a period of several years. Tall fescue roots may be pruned severely by nematodes, restricting roots to a shallow layer of soil and prevent utilization of water at greater depths (3). Bahiagrass roots appear to be more tolerant of nematodes. Thus, under drought stress on

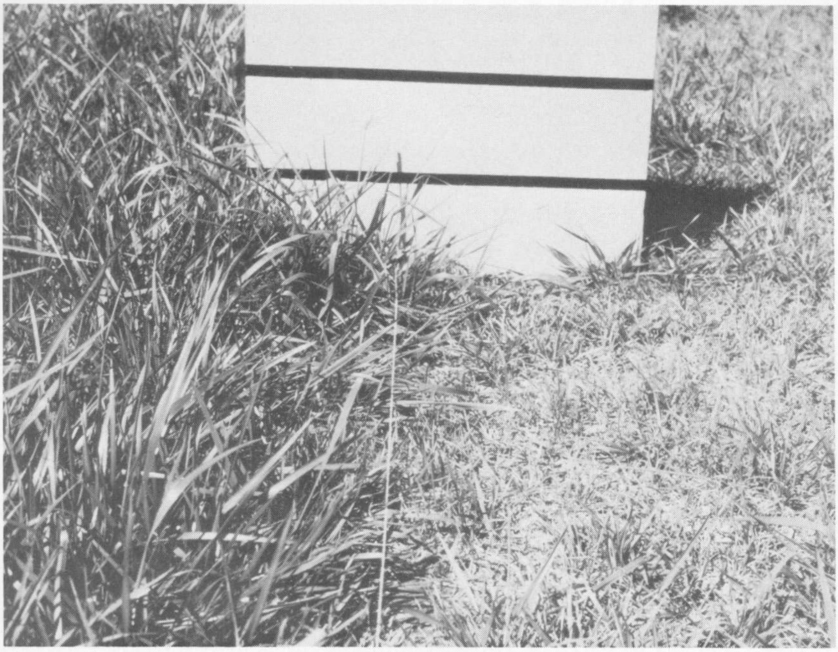

FIG. 3. Summer rest of tall fescue fertilized with 200 pounds N per acre (left) maintained good stand and vigor as compared to cutting in summer to a 1½-inch stubble and fertilized with 100 pounds N per acre (right) when both were grown in association with bahiagrass. Plant Breeding Unit, March 25, 1975, spring of third season.

TABLE 4. PLANT PARASITIC NEMATODES IN 50 CC SOIL FROM TALL FESCUE-BAHIAGRASS AS AFFECTED BY N FERTILIZATION AND SUMMER STUBBLE HEIGHT AT PLANT BREEDING UNIT (PBU) AND BREWTON EXPERIMENT FIELD, 1975

Summer stubble height	N applied		PBU		Brewton
	Winter	Summer	Spring	Autumn	Autumn
Inches	*Lb/acre*	*Lb/acre*	*No.*	*No.*	*No.*
4	200	200	79	67	47
	200	100	47	53	14
	200	0	15	38	22
	100	100	41	65	53
	100	0	24	22	20
1½	200	200	31	111	92
	200	100	12	22	25
	200	0	10	35	19
	100	100	13	52	50
	100	0	12	24	14
Summer rest	200	0	31	63	36
	100	0	44	51	38

sandy soils, bahiagrass will have a competitive advantage and tall fescue will be eliminated. Management that favors bahiagrass, such as cutting or grazing to a low stubble in summer, will add to stress already present from nematode damage to tall fescue root systems. In an environment such as Brewton Experiment Field in southern Alabama with a long warm season combined with drought periods in spring and autumn, nematodes may easily weaken tall fescue plants and allow bahiagrass to dominate the sward.

SUMMARY AND CONCLUSIONS

1. Experiments were conducted at the Plant Breeding Unit in central Alabama and at Brewton Experiment Field in southern Alabama over a 3-year period to determine the effect of N fertilizer rates and summer stubble heights on forage yield and persistence of tall fescue overseeded with bahiagrass.
2. Results of these experiments emphasize the difficulty of maintaining tall fescue stands in association with bahiagrass on sandy loam soils of central Alabama. Under high rates of winter N fertilization and a 4-inch summer stubble height, it was possible to maintain tall fescue with bahiagrass. This mixture provided forage over a longer season of the year than either species alone. Close clipping to a 1½-inch stubble height in summer, together with low N fertilization rates, quickly resulted in complete bahiagrass dominance.
3. In southern Alabama on a sandy soil, tall fescue was replaced by bahiagrass within 2 years except with summer rest (not clipped May through September).
4. The high nematode populations suggest that nematodes may be a major reason for the demise of tall fescue in the mixture when drought stress or close summer defoliation favors bahiagrass.

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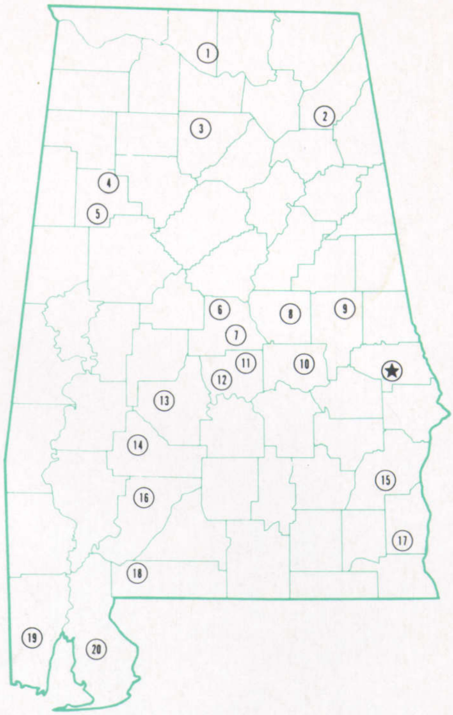

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Ornamental Horticulture Field Station, Spring Hill.
20. Gulf Coast Substation, Fairhope.