

Growth and Survival of Perennial Tropical Grasses in North Georgia

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Highlight: Coastal, midland, and common bermudagrasses and Pensacola and Wilmington bahiagrasses were established and grown in the Limestone Valley and upland province of Georgia at six rates of nitrogen (N) fertilization. Forage and weed yields reflected N fertilization rates. Bermudagrasses out-yielded bahiagrasses at high N levels, and weed production composed a significant part of the total harvested. Common and midland bermudagrass and Wilmington bahiagrass are significantly more winter hardy than are coastal bermuda or Pensacola bahia.

Grasses of tropical and subtropical origin, because of their aggressive growth habits, tolerance to diverse management practices, and production reliability, are becoming more important for grazing in the temperate Southeast. Survival of common, coastal, and midland bermudagrass (*Cynodon dactylon* (L.) Pers.) and Pensacola and Wilmington bahiagrass (*Paspalum notatum* var. *saurae* Perodi.) are limited in the North and East by winter cold and West by dry weather.

The purpose of this investigation was to compare the perennial summer grasses as to forage production, winter survival, and weed production under conditions where stand retention and survival become difficult and to establish the influence of nitrogen (N) on the forage production and survival of these forage grasses.

Literature Review

Certain varieties of bermudagrass and bahiagrass will grow from central Texas to Kentucky. However, no one variety is superior over the entire area. Coastal bermudagrass is considered superior for hay and grazing over much of the Coastal Plain (Burton, 1954), while Pensacola bahiagrass has been found to do well on deep sands and nonfertile soils of the same area. (Tan et al., 1970). The northern limits for these species cannot be well defined, as severity of winter cold varies significantly. Central Georgia to Jackson, Miss., has been considered the northern limit of Pensacola bahiagrass. Coastal bermudagrass survives on well-drained soils as far north as the

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Tennessee line. However, it will winter-kill south of that during excessively cold winters and when grown on shallow and wet soils. Trial plantings of midland bermudagrass and Wilmington bahiagrass by the Soil Conservation Service have survived in Oklahoma, northern Arkansas, and Kentucky; and common bermudagrass will survive in the Great Lakes Region (Burton, Personal Communication). Reported research on stand damage to perennial grasses by cold temperatures in the Southeast has been limited to specific conditions (Adams and Twerski, 1960).

The relationship between forage yield and height of clip has been pointed out by Ethredge and Beaty (1969). In that work, forage yields were reduced by 25% when clipping height of coastal bermudagrass was increased from 0 to 2.8 inches. Up to 2,200 pounds of dry forage was harvested by clipping at 0 inches, while less than 50 pounds would be harvested by clipping at 2.8 inches.

The significance of clipping height is greater with short-growing grasses such as common bermudagrass and bahiagrass than with the taller growing coastal and midland bermudas, (Beaty et al., 1968), since up to 60% of total vegetation may be below 2 inches.

Recently, it has been shown that atmospheric N can be fixed by some bahiagrasses (Kass et al., 1971), while Tan and Beaty (1971) have shown that bahiagrass can concentrate fertilizer elements in the soil surface.

Seasonal forage production patterns of coastal bermuda and Pensacola bahia have been established (Beaty et al., 1960 and 1961) and effects of fertilizer on forage production have also been established, (Beaty et al., 1960; and Adams and Stelly, 1958). Weed control in pastures is frequently discussed in the literature, but weed production and their possible utilization in perennial forage crops has not been researched.

Procedure

The investigation was conducted at Calhoun, Ga., in the Limestone Valley and upland soil province. The Montivallo silt loam soil, a widely occurring entisol, had a shallow A horizon and was poorly drained. The subsoil was composed of incompletely decomposed shale. At the beginning of the investigation, the surface soil had a pH value of 6.1.

On June 10, 1963, whole plots of common, coastal, and midland bermudagrass were sprigged on 1-ft centers, and

Pensacola and Wilmington bahiagrass were seeded at 30 lb/acre. No fertilizer was applied at planting. During the springs of 1964 and 1965, 30 lb/acre N were applied to all plots. During the spring of 1966 and annually during 1967, 1968, and 1969, N treatments of 0, 50, 100, 200, 400, and 600 lb/acre were made on 6-ft by 10-ft split plots. Treatments were replicated four times. Nitrogen treatments were split into four equal applications: 1/4 in late April and 1/4 after the first, second, and third clippings. Applications of P₂O₅ and K₂O were made as indicated by soil tests.

Plots were clipped when seed heads were observed on the 200 lb/acre N-treated coastal bermudagrass plots. Clipping dates were usually June 5 to 10, July 10 to 20, August 20 to 30, and October 20 to 25. For forage and weed yields, 25 ft² of each plot was clipped and dried at 165°F for dry weight measurements. Plot clipping was completed with a sickle bar mower set to clip to a 2.5 inch stubble height. Weed production was established by clipping on April 18, in 1967, 1968, 1969, and May 5 in 1970; all species except the crop planted were considered weeds.

On February 5, 1970, forage crop survival was established by enclosing 6-inch sod cores in plastic in the greenhouse and counting developed tillers on February 27, 1970. Stand survival in the field was quantified by visual estimates and counting live tillers on May 5 and August 4, 1970.

Results and Discussion

Crop Establishment

All grasses were slow to establish. By late 1964, the bermudagrass plots were well established. However, bahiagrass plots were not completely established by the first clipping in 1966, 3 years after seeding. Soils of the Limestone Valley are heavier than Coastal Plain soils, and the heavier soil combined with cooler temperatures likely influenced establishment of the subtropical grasses. The slow establishment corroborates the findings of Richardson and Diseker (1965).

Forage Yields

Average yields for the different harvested grasses (Fig. 1) indicate that coastal bermudagrass would be most desired as forage grass, with midland and common bermudagrass being second and third. The two bahiagrasses produced 1,500 to 2,000 lb lower yields as compared to coastal bermudagrass.

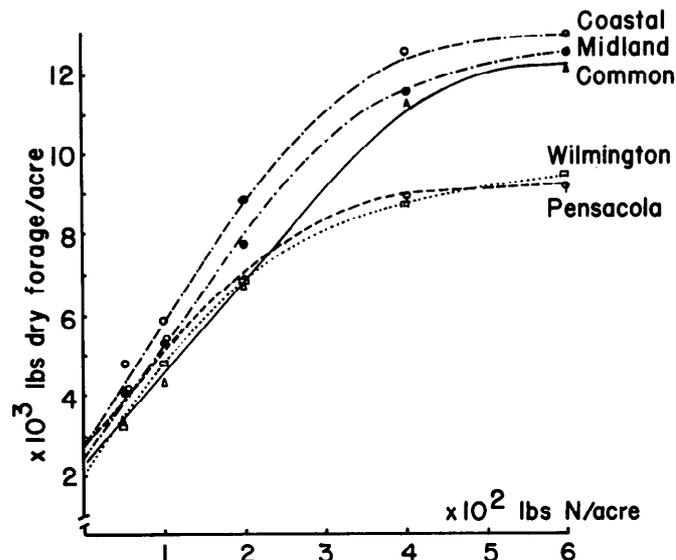


Fig. 1. Yield of three bermudagrasses and two bahiagrasses by N rates at Calhoun, Georgia, 1966-1969.

Coastal bermudagrass, where adapted because of its upright growth habit, would be preferred for hay production. However, the lower-growing common and midland bermudagrass would probably produce as much forage for grazing purposes as coastal bermudagrass. Over most of the Southeast, grazing is the predominate use of bermudagrass.

Approximately 60% of the forage produced by the low-growing bahiagrasses was below the 2.5-inch mowing height used in this investigation (Beaty et al., 1968). When yield data of bahiagrass reported in Figure 1 are evaluated using that evidence, all five grasses would be considered essentially equal in yield for grazing purposes, and coastal and midland bermudagrass would be superior for haying. The N-fixing capacities of bahiagrass have not been delineated, but related research suggest significant quantities may be. Stand maintenance is no problem with bahiagrasses in areas where winter-killing does not occur.

Crop Competition with Weeds

Plants harvested in this study and classed as weeds included Carolina crainsbill (*Geranium carolinianum* L.), common vetch (*Vicia sativa* L.), ryegrass (*Lolium multiflorum* Lam.), little barley (*Hordium pusillum* Nutt), hop clover (*Trifolium procumbens* L.), white clover (*T. repens* L.), wild onion (*Allium vineale* L.), and Kentucky bluegrass (*Poa pratensis* L.). During early spring, before May 1, when the bermudagrasses and bahiagrasses compose only a small fraction of available forage, these species are highly nutritious and are readily grazed by livestock. However, they are not the species seeded and were classed as weeds in this study. During the summer growing season, all five seeded grasses produced weed free stands.

Weed production, as a complement to forage production of bermuda and bahiagrasses, was influenced significantly by both crop and N rate (Table 1). Lowest weed production was on coastal bermudagrass plots; highest weed production was on Pensacola bahiagrass plots. These data indicate that under environmental conditions of the Limestone Valley soil province, coastal bermudagrass competes more vigorously with weeds than other grasses investigated. Coastal would appear to offer greatest competition to interseeded crops.

It is possible that certain of the weedy species furnish

Table 1. Average annual weed production (lb/acre, dry wt) on five subtropical grasses treated with various rates of nitrogen fertilizer, Calhoun, Georgia 1967-1970.

N rate	Bermudagrass			Bahiagrass	
	Common	Coastal	Midland	Pensacola	Wilmington
0	451 ^{defc}	312 ^{fc}	560 ^{defbc}	323 ^{fc}	388 ^{efc}
50	526 ^{defbc}	496 ^{defbc}	711 ^{defabc}	405 ^{efc}	479 ^{defbc}
100	601 ^{defbc}	419 ^{defc}	636 ^{defbc}	628 ^{defabc}	577 ^{defbc}
200	790 ^{defabc}	628 ^{defbc}	768 ^{defabc}	655 ^{defbc}	739 ^{defabc}
400	914 ^{defabc}	826 ^{defabc}	1014 ^{bdefabc}	1700 ^{abcab}	1138 ^{bcdeabc}
600	920 ^{defabc}	661 ^{defbc}	1200 ^{bcdabc}	1926 ^{aa}	1699 ^{abab}
Avg	700	557	815	940	837

¹ Means within a N rate followed by the same subscript letter, and means within a column followed by the same superscript letter, are not significantly different at the 0.05 level of probability.

Table 2. Survival (%) of five subtropical grasses treated with various rates of nitrogen fertilizer, Calhoun, Georgia, 1970.

N rate	Bermudagrass			Bahigrass	
	Common	Coastal	Midland	Pensacola	Wilmington
0	100 ^a _a	96 ^{ab} _a	92 ^{ab} _a	35 ^e _d	100 ^a _a
50	98 ^{ab} _a	100 ^a _a	100 ^a _a	16 ^{ef} _e	100 ^a _a
100	93 ^{ab} _a	100 ^a _a	98 ^{ab} _a	16 ^{ef} _e	100 ^a _a
200	98 ^{ab} _a	92 ^a _a	100 ^a _a	11 ^f _e	100 ^a _a
400	93 ^{ab} _a	75 ^{bcd} _{bc}	98 ^{ab} _a	3 ^f _e	95 ^{ab} _a
600	94 ^{ab} _a	64 ^{cd} _c	85 ^{ab} _{ab}	6 ^f _e	63 ^{cd} _c
Avg	96	88	96	15	93

¹ Means within a N rate followed by the same subscript letter, and means within a column followed by the same superscript letter, are not significantly different at the 0.05 level of probability.

quality forage during early portions of the grazing season. Growth of grazable weeds in a pasture when the seeded species are not growing would appear to be desirable in a pasture management program where competition with the crop species is not detrimental to forage production.

Winter Survival

During 3 of the 4 experimental years, winter survival of all species was satisfactory. However, during the winter of 1969-1970, mean temperatures were below normal, and cold injury to stands was noted in two species (Table 2). Common bermudagrass used in this test was of a local ecotype, and excellent survival was obtained.

Survival of coastal bermudagrass on plots treated with up to 100 lb/acre N was good. However, stand damage increased as N rates were increased above 100 lb/acre. Stand reductions of 8, 25, and 36% on plots receiving 200, 400, and 600 lb/acre N would indicate Calhoun, Ga., is close to the northern limit of dependability for coastal bermudagrass. By August 4, 1970, coastal plots had reestablished stands, but much of the season had been lost to forage production. Midland bermudagrass survived well at this location, except at the 600 lb/acre N treatments.

Stands of Pensacola bahigrass were damaged at all N levels and had not reestablished by August 4, 1970, indicating Calhoun, Ga., to be north of the area of adaptation of this grass. Stands of Wilmington bahigrass were excellent up to 400 lb/acre N. Only at 600 lb/acre were stands noticeably reduced. Bahigrass is only recommended for grazing, and the N application should not exceed 150 lb/acre (Beaty et al., 1969).

The data obtained in this investigation show that winter stand damage to coastal bermudagrass and Pensacola bahigrass may be severe. During some years, winter damage to stands may cause forage shortages the following year. By selecting midland bermudagrass or Wilmington bahigrass, loss in forage production due to winter injury will be minimal. Common bermudagrass is more disease susceptible than midland and therefore inferior. Survival and forage yields of midland bermudagrass and Wilmington bahigrass appear to make them best suited for forage grasses in this area of Georgia.

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