Comparison of Coastal and Common Bermuda-Grass on a Shallow Droughty Soil[1]

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Common bermudagrass (*Cynodon dactylon* (L.) Pers.) has long been a pest in the dominant row crop economy of Southeastern United States. Decrease of cotton acreage in recent years has made more land available for herbage production. Common bermudagrass readily becomes established when row crops are discontinued. More herbage has led to a rapid increase in beef cattle numbers.

In 1959, the South, excluding Texas and Oklahoma, was reported to have 18 percent of the nations beef cattle, (Hughes, 1959). The "Cattle States" of the west supported 21 percent. From a rate of increase viewpoint, the South's beef cattle numbers here increased at a rate almost twice that of the national average.

Long summer growing seasons with ample possibilities for fall and winter grazing have provided opportunity for animal production based on a grassland agriculture.

Herbage management problems in the South are rather diverse. In some pastures a stocking rate in excess of one animal per acre is followed while in adjoining areas one animal may graze 50 or more acres (Williams et. al. 1955). Management of grasslands changes from season to season as the stocking rate fluctuates.

A satisfactory herbage grass must be one that is persistant, responsive to varying levels of fertilizer applications and is drought resistant. Coastal bermudagrass was developed to fill these and other needs. Coastal bermudagrass has been found to be much higher yielding than common bermudagrass in the Coastal Plain and Piedmont regions of the Southeast (Adams and Stelly, 1958; Beaty, 1954; Burton, 1954). These comparisons have been made on the deep more sandy and better aerated soils which are generally used for row crop production. Since the limited areas of good soils are used for row crops, herbage production is likely to be relegated to the marginal soils. Coastal bermudagrass production data are lacking, yet are badly needed, on these latter soils.

The purpose of this study was to compare common bermudagrass with Coastal bermudagrass when grown on a shallow, eroded, droughty yet poorly drained soil and with varying levels of fertilizer.

Methods and Materials

The experiment was conducted on Montevallo shaley silt loam, a lithosol, which occurs widely in the Georgia portion of the Limestone Valley and Upland soil province. It is generally considered to be a very poor agricultural soil characterized by a shallow and poorly drained topsoil overlying the subsoil, starting at a depth of 6 to 8 inches which is incompletely decomposed shale. The area selected had a 3 to 5 percent slope and severe sheet erosion. When the experiment was initiated, in 1954, the soil reaction was pH 6.0, the soil was low in available phosphorus and medium in available potassium according to soil tests.

The bermudagrass sprigs were planted on two-foot centers with portions of the stems uncovered. Fertility treatments were applied about 45 days after establishment of the grass in 1954 and a uniform application of 600 pounds of 4-12-12 was made in May 1955. Two years (1954 and 1955) were required to obtain a uniform sod area for plot trials.

In March 1956, fertility treatments were applied and herbage data collections initiated. Treatments were replicated four times in a randomized block split-plot design with Coastal bermudagrass and common bermudagrass in the whole-plots and the ten fertility treatments (table 1) as split-plots randomized within each whole-plot. Split-plots were 6 x 20 feet in size and were trimmed to 18 feet in length at time of harvest. A sickle-bar mower 30 inches wide equipped with a pan was used to harvest yield

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Table 1. Yields of coastal and common bermudagrass grown at various fertility levels.

Fertilizer treatments			Oven-dry herbage per acre					
			Common Bermuda			Coastal Bermuda		
			(Pounds)					
N	P_2O_5	K_2O	1956	1957	Average	1956	1957	Average
0	0	0	1200	1775	1488	2466	3359	2913
0	100	100	1558	2537	2048	3321	3664	3493
50	0	0	3185	3996	3591	4636	4767	4702
50	50	50	3220	4064	3642	4617	5264	4941
100	50	50	4452	5250	5101	7144	7965	7555
200	50	50	6893	9482	8188	11,684	12,678	12,181
200	100	100	7337	10,514	8926	11,471	11,725	11,598
400	0	0	9978	11,378	10,678	13,804	12,744	13,274
400	100	100	11,258	13,511	12,385	14,955	16,375	15,655
400	200	200	11,064	13,241	12,153	16,698	17,550	17,124
			1956		1957			
L.S.D.			05	01	05	01		
Varieties			522	958	595	1103		
Fertilizer treatments			1355	1830	638	857		

samples. Herbage clippings were generally taken when seed heads appeared on the 200 pound nitrogen treatments which was approximately every 5 to 6 weeks. Yields were determined on an oven-dry basis.

Nitrogen was divided into three applications; 37.5 percent of the total amount in March or early April, 37.5 percent after the first harvest, and 25 percent after the second harvest. One-half of the phosphorus and potassium was applied with the first nitrogen application and the remaining one-half at time of the third nitrogen application.

In 1957 composite soil samples of 8 one-inch diameter cores from each plot at the 0 to 2 and 5 to 7 inch depths were taken for chemical study.

Results and Discussion

Herbage Production of the Grasses

During both years, 1956 and 1957, Coastal bermudagrass outyielded common bermudagrass at all fertility levels (table 1). The superiority of Coastal bermudagrass, percentage-wise, was greater at the 0-0-0 fertility level, where in 1956 it outyielded common bermudagrass by 206 percent and in 1957 by 189 percent. At the 400-200-200 fertilizer treatment, Coastal outyielded common by 151 percent in 1956 and 126 percent in 1957. In general, Coastal bermudagrass outyielded common bermudagrass by 50 to 70 percent in 1956 and 30 to 40 percent in 1957. When computed as dry herbage per acre, the greater efficiency of Coastal bermudagrass in converting fertility and moisture into herbage ranged from 1356 pounds at the 0-0-0 fertility level to 5634 pounds at the 400-200-200 level in 1956. Similar data for 1957 are 1584 and 4309 respectively. This superiority of Coastal bermudagrass is in agreement with results reported by other workers (Beaty 1954; Burton 1954) on Coastal Plain and Piedmont soils.

Under the conditions of this experiment, the herbage yields of Coastal and common bermudagrass for any fertility treatment were essentially equal at the first and fourth harvest; however, at the second and third harvest Coastal outyielded common by a wide margin (table 2). At the time of the first and fourth harvests both were growing vegetatively. At the time of the second and third harvests common bermudagrass was producing seed whereas the sterile hybrid, Coastal bermudagrass continued to grow vegetatively. The continued vegetative growth of Coastal is one reason for its superiority. Coastal bermudagrass produced approximately 25 percent of the average annual yield before May 31 and 25 percent was produced after August 10. However, with common bermudagrass, 30 percent was produced before May 31 and 27 percent was produced after August 10. From these data it can be seen that herbage production by Coastal bermudagrass is more evenly distributed throughout the growing season.

Fertilization Effects

During the two years of this experiment, phosphorus and potassium applications increased Coastal bermudagrass herbage production at the 400 pound nitrogen level only. In 1956 the addition of 100 pounds each of P_2O_5 and K_2O increased herbage yield by 1151 pounds over the no phosphorus—no potash treatment. The 200 pound level of P_2O_5 and K_2O outyielded the no phosphorus—no potash treatment by 2894 pounds in 1956. Increases in yields for 1957 were 3631 for 100 pounds of each and 4806 for 200 pounds of each.

Common bermudagrass responded to the application of 100 pounds each of P_2O_5 and K_2O at the 400 pound nitrogen rate where the 400-100-100 treatment outyielded the 400-0-0 treatment by 1280 pounds of herbage in 1956 and 2133 pounds in 1957. No increase in yield above the 400-100-100 treatment was obtained from the 400-200-200 treatment in either year.

Adams and Stelly (1958) working in the Piedmont reported significant increase of Coastal due to P_2O_5 up to 50 pounds per acre and K_2O to 200 pounds per acre. They also reported pH changes from 6.0 to 4.5 over a two year period when 400 pounds of nitrogen were applied.

Available soil phosphorus and potassium levels by treatments

Table 2. Coastal bermudagrass as percent of common bermudagrass by clippings.

Bermudagrass	Year	Clipping 1st	2nd	3rd	4th	Average
Coastal	1956	122.88	206.87	204.96	123.40	150.96
	1957	102.08	136.65	173.61	120.06	125.27
	Average	112.48	171.76	189.29	121.73	138.12

at the end of the experiment are shown in table 3. The P_2O_5 and K_2O levels appear to be adequate except where 400 pounds of nitrogen had been applied.

Work reported here showed no increase due to phosphorus or potassium unless 400 pounds of nitrogen were applied and only a slight decline in soil pH at any nitrogen application (table 4).

Table 3. Soil phosphate and potash levels in 1957 as influenced by fertilizer applied on bermudagrasses.

Applied fertilizer N- P_2O_5 K_2O lbs./A./yr.	Coastal P_2O_5	Coastal K_2O	Common P_2O_5	Common K_2O
	(Pounds per acre)			
0-0-0	26	112	41	91
50-50-50	44	126	66	142
100-50-50	47	126	56	108
200-50-50	50	63	48	101
400-0-0	18	31	30	37

In 1954 P_2O_5 was 33 lbs./A. and K_2O was 240 lbs./A.

Residual Fertility Influence and Frost Injury

In 1958 no fertilizer was applied and clipping was continued. The first harvest was made on July 7, 38 days later than normal, and at that clipping common outyielded Coastal by 11.8 percent. By the second harvest recovery of both grasses was complete and Coastal outyielded common by 36.8 percent when the total yields for the year are considered. There was no significant difference between grasses and no significance attributable to previous treatment. This lack of difference in yield between the two grasses was probably due to lack of carry over of applied fertilizers and to more severe frost injury to the Coastal bermudagrass during the winter (1957-58) as well as the cold spring of 1958.

Table 4. Effect of nitrogen applied to bermudagrass on soil pH values.

Nitrogen applied lbs./A	pH 1954 Surface	1957 Surface	1957 Subsoil
0	6.0*	5.94	5.49
50	6.0	5.94	5.51
100	6.0	5.88	5.40
200	6.0	5.84	5.49
400	6.0	5.73	5.46

*Single composite sample

Summary

Results from a 2-year comparison of Coastal and common bermudagrasses grown at 10 fertility levels on a shallow, eroded and droughty soil in the Limestone Valley and Upland soil province permitted the following conclusions.

Coastal bermudagrass outyielded common bermudagrass by 206 percent at a low fertility level and 150 percent at a high fertility level. A major portion of the increased production was obtained during the mid-summer months when grass is usually in short supply.

Coastal bermudagrass maintains its high productivity on this extreme soil type.

Since there was little or no carry over of nitrogen, each year's production apparently must be fertilized independently of the previous years' fertilizer applications.

Fertilizer response of Coastal bermudagrass and soil reaction in the Limestone Valley was different than that reported from the Piedmont.

LITERATURE CITED

ADAMS, W. E., AND MATTHIAS STELLY. 1958. A comparison of Coastal and common bermudagrass in the Piedmont region. Agron. Jour. 50:457-459.

BEATY, E. R. 1954. Coastal bermuda outyields common bermuda in fertility test. Miss. Farm Research 17:12, pp. 1-7.

BURTON, GLENN W. 1954. Coastal bermudagrass. Ga. Ag. Exp. Sta. Bull. N.S. 2. 31 pp.

HUGHES, C. E. 1959. Dixie Beef. Armour's analysis. 7:1-8.

WILLIAMS, R. E., CASSADY, J. T., HALLS, L. K. AND WOOLFOLK, E. J. 1955. Range Resources of the South. Ga. Ag. Exp. Sta. Bull. N.S. 9. 31 pp.

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