NITROGEN and MOISTURE REQUIREMENTS of COASTAL BERMUDA and PENSACOLA BAHIA

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Nitrogen and Moisture Requirements of Coastal Bermuda and Pensacola Bahia

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COASTAL BERMUDAGRASS (*Cynodon dactylon* (L.) Pers.) and Pensacola Bahiagrass (*Paspalum notatum* Flugge) are popular forage crops. Wide acceptance of these grasses has come about because of their potential for high production. Present acreage of Coastal Bermuda in Alabama is approximately 150,000 while that of Bahia is more than 300,000. Expansion in Coastal Bermuda acreage has been slowed because the grass must be established by sprigging. Most of the increase of Coastal Bermuda acreage in Alabama has occurred since 1955. The southern part of the State had a considerable acreage of Bahiagrass as early as 1950.

Several workers have shown Coastal Bermuda to be highly responsive to applied nitrogen (*1,2,3,5*). Removal of large tonnages of herbage produced by Coastal should increase the mineral requirements beyond the amounts previously considered adequate for forage crops.

Summarized in this bulletin are results of field tests and grazing trials conducted in Alabama showing the response of Coastal Bermuda and Bahia grasses to nitrogen and irrigation on specific soil types. Also covered are some of the fertility problems associated with high production. Some of the experiments reported were cooperative between Auburn University Agricultural Experiment Station and the Soil and Water Conservation Research Division, USDA Agricultural Research Service.

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RESULTS of EXPERIMENTS

Greenville Fine Sandy Loam, Thorsby

An experiment was begun in 1956 to determine the response of Coastal Bermuda and Pensacola Bahia to fertilizer nitrogen with and without irrigation. The irrigated plots received an average of 12 applications of water totaling 11 inches each year. Water was applied by sprinkler irrigation when 30 per cent of available water in the upper 24 inches of soil was used.

Ammonium nitrate was the source of nitrogen in this experiment as well as in others reported in this publication. One-fifth of the total nitrogen was applied before growth started in the spring; the remainder was applied in four equal applications following the first four harvests.

All plots received fertilizer equivalent to 225 pounds of P_2O_5 and 450 pounds of K_2O per acre annually in 1956 and 1957. In 1958 and 1959, mineral fertilization was increased to 280 pounds of P_2O_5 and 560 pounds of K_2O per acre annually. Phosphate and potash were applied in three equal applications made before growth started in the spring and after the first and third cuttings. All plots received 1 ton of lime per acre in each of the years of 1955, 1957, and 1958.

Yields. The effects of nitrogen fertilization and irrigation on forage yields are shown in Table 1 and Figure 1. Average yields of both species in the 4-year period show a large response to nitrogen with or without irrigation. During the dry summer of 1956, Coastal Bermuda was much more responsive to nitrogen without irrigation than was Bahia.

Average response of both species to irrigation in the 4-year period was relatively small. However, this differed from year to year and within seasons of a given year depending on amount and distribution of rainfall during the growing season. The greatest response to irrigation occurred in 1956, which was the driest of the 4 years. However, there were periods of 2 weeks or more without rainfall during the other years when there was a response to irrigation.

Total rainfall during each of the growing seasons (April-September) was 19.9, 29.7, 31.3, and 25.3 inches for 1956, 1957, 1958, and 1959, respectively. The long-time average for the same period was 28.2 inches of rain. According to a recent study of

TABLE 1. EFFECT OF NITROGEN ON HERBAGE YIELDS OF COASTAL BERMUDA AND BAHIA GRASSES GROWN ON GREENVILLE FINE SANDY LOAM, THORSBY, ALABAMA

Species	Irrigation treatment	Nitrogen applied annually, lb./acre	Dry forage yield per acre					Dry matter produced per pound of N within each increment of N
			1956	1957	1958	1959	Average 1956-59	
			Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Coastal Bermuda	Nonirrigated	0	1,348	3,341	4,190	3,034	2,978	----
		150	4,940	11,169	10,152	8,066	8,582	37
		300	8,473	15,531	15,559	11,922	12,871	33
		600	9,837	19,911	19,234	18,232	16,804	23
Coastal Bermuda	Irrigated	0	1,971	3,117	3,861	4,250	3,300	----
		150	8,350	10,437	9,592	10,649	9,757	43
		300	13,622	16,346	15,959	17,326	15,813	42
		600	17,816	18,811	20,174	21,795	19,649	27
Bahia	Nonirrigated	0	1,263	4,069	3,239	2,386	2,739	----
		150	3,652	10,442	9,268	7,310	7,668	33
		300	3,554	14,620	15,033	12,617	11,456	29
		600	3,746	18,127	19,831	17,503	14,802	20
Bahia	Irrigated	0	2,547	3,845	2,893	3,406	3,173	----
		150	8,364	9,238	8,255	8,491	8,587	36
		300	11,514	15,001	14,001	14,571	13,772	35
		600	15,432	20,756	19,918	20,016	19,030	26

FIG. 1. Coastal Bermudagrass on left did not receive any nitrogen, whereas that on right got 600 pounds of N annually. Neither area was irrigated.

drought occurrences in Alabama (*6*), there is an even chance that optimum crop yields cannot be obtained because of drought.

Water-Use Efficiency. Data on effects of nitrogen and irrigation on water-use efficiency for 1956 and 1957 are given in Table 2. Water-use efficiency is expressed as pounds of dry matter produced per acre inch of water used. There was a marked increase in water-use efficiency with increasing rates of nitrogen, except for unirrigated Bahiagrass in 1956. Irrigation decreased water-use efficiency in 1957. This was probably the result of excessive

TABLE 2. EFFECT OF NITROGEN AND IRRIGATION ON WATER-USE EFFICIENCY OF COASTAL BERMUDA AND BAHIA GRASSES GROWN ON GREENVILLE FINE SANDY LOAM, THORSBY, ALABAMA

Irrigation treatment	Nitrogen applied annually, lb./acre	Dry matter produced per acre inch of water[1]			
		Coastal Bermuda		Bahiagrass	
		1956	1957	1956	1957
		Lb.	*Lb.*	*Lb.*	*Lb.*
Nonirrigated	0	81	196	76	239
	150	297	655	220	612
	600	592	1,168	225	1,063
Irrigated	0	59	114	76	141
	150	249	383	250	339
	600	532	690	461	762

[1] Called water-use efficiency.

water at times, since some irrigations were immediately followed by heavy rains.

Seasonal Distribution of Forage. During the dry season of 1956, irrigation increased yields from nitrogen rates shown, Figure 2, at all harvest dates except the last. The response to irrigation was especially large at the 600-pound rate of nitrogen during the first half of the season. The higher yields from nonirrigated plots for the last harvest may be a result of less removal of nitrogen and other nutrients in previous harvests because of low yields.

Irrigation had little effect on seasonal distribution at either rate of nitrogen during the 1958 season, which had the highest rainfall of any season in the 4-year period, Figure 3. The response to 600 pounds of nitrogen over 150 pounds was much larger for the first half of the season than for the last half. Neither nitrogen nor irrigation kept yields from declining during the latter part of the season. The problem of declining yields after July needs further study.

Nutrient Removal. The production and removal of high yields of forage may create fertility problems much earlier than under less intensive management. Percentage of nitrogen, phosphorus, and potassium in the plant material and total removal of these

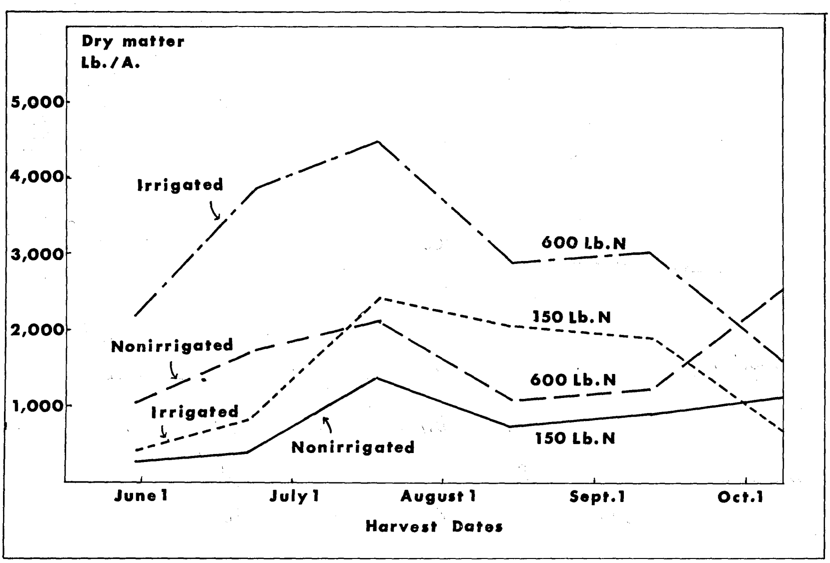

FIG. 2. Seasonal yields of Coastal on Greenville fine sandy loam at Thorsby in 1956, a dry season, show some response to irrigation at two levels of N.

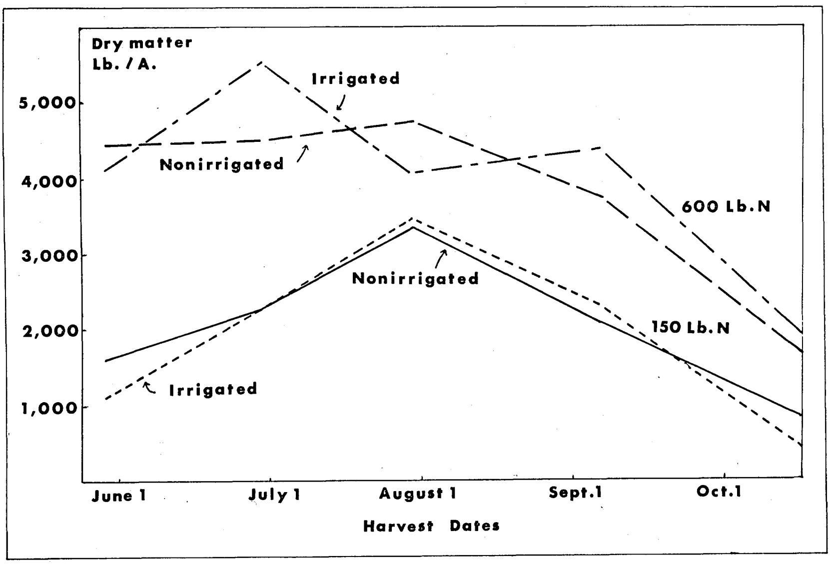

FIG. 3. These seasonal yields of Coastal Bermudagrass on Greenville fine sandy loam at Thorsby show little response to irrigation in 1958, a wet year.

elements are reported in Table 3. Nitrogen content, as well as total uptake of N, increased with increasing nitrogen fertilization. Seventy per cent of the added nitrogen was recovered in the Coastal clippings and 58 per cent in the Bahia where 600 pounds of nitrogen was added. Recovery was about the same at the 150-pound rate of nitrogen. At the 600-pound rate of N, the nitrogen content of Coastal was equivalent to 15 per cent protein and that of Bahia was 12.25 per cent.

TABLE 3. EFFECT OF NITROGEN APPLICATIONS ON PERCENTAGE COMPOSITION AND TOTAL UPTAKE OF NITROGEN, PHOSPHORUS, AND POTASSIUM BY COASTAL BERMUDAGRASS AND BAHIAGRASS, GREENVILLE FINE SANDY LOAM, THORSBY, ALABAMA, 1957

Species	Nitrogen applied annually, lb./acre	N		P_2O_5		K_2O	
		Content	Total uptake	Content	Total uptake	Content	Total uptake
		Pct.	*Lb./a.*	*Pct.*	*Lb./a.*	*Pct.*	*Lb./a.*
Coastal Bermuda	0	1.23	39	0.60	18	1.58	49
	150	1.45	150	0.64	66	2.05	214
	600	2.45	457	0.62	115	1.80	330
Pensacola Bahia	0	1.27	44	0.55	21	1.70	62
	150	1.43	120	0.53	48	2.04	182
	600	1.96	394	0.48	101	2.05	414

Potassium content of herbage increased only with the first increment of nitrogen, whereas potassium uptake increased through all rates of nitrogen. The uptake of potassium at the 600-pound rate of N was equivalent to 414 pounds of K_2O per acre by Bahia and 330 pounds by Coastal Bermuda. Removals of this magnitude would soon deplete the available potassium supply in most Alabama soils unless properly fertilized.

Large tonnages of hay also remove considerable phosphorus. The herbage produced at the 600-pound rate of nitrogen contained phosphorus equivalent to over 100 pounds of P_2O_5.

Soil Analysis. Data showing effects of nitrogen applications and crop removal on acidity and levels of soil phosphorus and potassium are given in Table 4. The effect of nitrogen applications on acidity was pronounced in the upper 3-inch soil layer and was evident in the 3- to 6-inch layer. In the 0- to 3-inch layer, the pH dropped from 6.6 with no nitrogen to 5.4 with 600 pounds of nitrogen, even though 3 tons of lime had been applied during the 4-year period. However, there was no effect below 6 inches as indicated by pH values.

Soil phosphorus and potassium decreased with increasing nitrogen applied. Much of the decrease can be accounted for by greater removal in herbage, which increased as a result of nitrogen fertilization. Most of the change in soil potassium was found in the upper 9 inches of soil, whereas the phosphorus change was limited to the upper 3 inches. Some of the decrease in extracta-

TABLE 4. EFFECT OF AMMONIUM NITRATE APPLICATIONS TO COASTAL BERMUDAGRASS ON CERTAIN CHEMICAL PROPERTIES OF SOIL SAMPLES COLLECTED IN 1958, GREENVILLE FINE SANDY LOAM, THORSBY, ALABAMA

Depth of sample, inches	Acidity and P_2O_5 and K_2O levels, three rates of N[1, 2]								
	No N			300 pounds N			600 pounds N		
	pH	P_2O_5	K_2O	pH	P_2O_5	K_2O	pH	P_2O_5	K_2O
		p.p.m.	*p.p.m.*		*p.p.m.*	*p.p.m.*		*p.p.m.*	*p.p.m.*
0-3	6.6	198	248	6.1	118	135	5.4	126	98
3-6	6.5	22	189	6.3	40	96	6.1	22	73
6-9	6.2	3	114	6.3	6	57	6.2	8	46
9-12	5.9	0	50	6.0	0	32	5.8	0	32
12-15	5.4	0	36	5.7	0	24	5.6	0	25
15-18	5.3	0	33	5.4	0	21	5.4	0	21
18-24	5.2	0	27	5.3	0	19	5.2	0	21

[1] Original soil sample collected in 1955 had a pH of 6.1 and contained 35 p.p.m. P_2O_5 and 76 p.p.m. K_2O.

[2] All plots received 2,250 pounds of 0-10-20 the first 2 years and 2,800 pounds of 0-10-20 the second 2 years. All plots received 1 ton of lime per acre in 1955, 1957, and 1958.

ble phosphorus may be caused by greater chemical fixation of phosphorus resulting from increased acidity.

Sumter Clay, Marion Junction

An experiment was established on Sumter Clay to determine the response of Coastal Bermuda to rates and frequencies of nitrogen applications. Yield data are given in Table 5 for 1957. Caley peas (*Lathyrus hirsutus*) were grown in the Coastal sod the previous winter but were grazed closely in the spring to keep to a minimum the effect of legume nitrogen on the grass. Although there was a response to as much as 600 pounds of nitrogen, it was probably not economical beyond 160 pounds. There was no yield advantage from split applications of nitrogen on this soil.

TABLE 5. YIELDS AND NITROGEN CONTENT OF COASTAL BERMUDAGRASS HERBAGE GROWN ON SUMTER CLAY AT VARIOUS RATES AND FREQUENCIES OF NITROGEN APPLICATIONS, BLACK BELT SUBSTATION

Rates and frequencies of nitrogen, pounds per acre[1]				Dry forage yield per acre	Nitrogen content by harvests		
First	Second	Third	Total		First	Second	Third
				Lb.	*Pct.*	*Pct.*	*Pct.*
0	0	0	0	4,878	1.54	1.41	1.55
40	0	0	40	5,505	1.74	1.33	1.66
40	40	0	80	6,492	1.78	1.57	1.70
40	40	40	120	8,440	1.73	1.42	1.74
80	0	0	80	7,171	1.92	1.33	1.60
120	0	0	120	8,444	2.03	1.41	1.74
200	200	200	600	11,632	2.14	2.06	2.14
100	100	0	200	9,394	1.87	1.78	1.71
80	80	0	160	9,878	1.84	1.76	1.71
0	0	0	0	5,106	1.65	1.44	1.68

[1] Nitrogen was applied one-third before growth started in spring and the remainder in split applications after first and second cuttings.

There was a tendency for nitrogen content of herbage to increase with increasing nitrogen rates, Table 5. However, the effect of nitrogen treatment on nitrogen content was not as striking as at other locations.

Cecil Sandy Loam, Auburn

At the Dairy Research Unit near Auburn an experiment was begun in 1955 to determine the effect of nitrogen and irrigation on Coastal Bermuda and Bahia grasses. Both showed a response to 200 pounds of nitrogen, but neither responded to irrigation,

TABLE 6. YIELDS OF COASTAL BERMUDA AND BAHIA GRASSES AT TWO LEVELS OF NITROGEN AND IRRIGATION ON CECIL SANDY LOAM, DAIRY RESEARCH UNIT, AUBURN, ALABAMA, 1956-59 AVERAGES

Nitrogen applied annually, lb./acre	Dry forage yield per acre			
	Coastal Bermuda		Bahia	
	Nonirrigated	Irrigated	Nonirrigated	Irrigated
	Lb.	*Lb.*	*Lb.*	*Lb.*
0	2,265	3,133	3,510	4,744
200	8,438	8,872	8,445	8,675

Table 6. The nitrogen rate may not have been high enough to permit an irrigation response under prevailing natural rainfall.

Dewey Silty Clay Loam, Belle Mina

An experiment was conducted on Dewey silty clay loam from 1956 through 1959 to determine the response of Coastal Bermuda and Bahia grasses to irrigation. Average yield data show that Coastal did not respond to irrigation and that Bahia produced a little over a ton more dry matter when irrigated, Table 7. All plots received 200 pounds of nitrogen per acre.

Humphreys Silt Loam, Belle Mina

A study identical to the one on Dewey silty clay loam was conducted on Humphreys silt loam. Results for the 4-year period show that irrigation increased yields of Bahia by about 3,000 pounds, but the increase was only about 1,000 pounds for Coastal, Table 7.

TABLE 7. EFFECT OF IRRIGATION ON HERBAGE YIELDS OF COASTAL BERMUDA AND BAHIA GRASSES ON TWO SITES, TENNESSEE VALLEY SUBSTATION

Species	Irrigation treatment	Dry forage yield per acre				
		1956	1957	1958	1959	Average 1956-59
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Dewey silty clay loam						
Coastal Bermuda	Nonirrigated	13,212	8,621	7,353	9,188	9,593
	Irrigated	14,070	10,455	8,594	6,411	9,882
Pensacola Bahia	Nonirrigated	8,589	10,606	7,437	11,261	9,473
	Irrigated	13,464	15,351	8,758	9,512	11,771
Humphreys silt loam						
Coastal Bermuda	Nonirrigated	11,982	9,390	6,154	8,863	9,097
	Irrigated	14,448	10,659	7,128	8,237	10,118
Pensacola Bahia	Nonirrigated	7,047	7,477	4,330	13,361	8,054
	Irrigated	11,816	11,425	7,161	14,223	11,156

TABLE 8. YIELDS OF COASTAL BERMUDA AND PENSACOLA BAHIA GRASSES AND STEER GAINS AT VARIOUS RATES OF NITROGEN ON GRAZING PADDOCKS, WIREGRASS SUBSTATION

Species	Nitrogen applied annually, lb./acre	Dry forage yield per acre						Average steer gain per acre, 1953-57
		1953	1954	1955	1956	1957	Average 1953-57	
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Coastal Bermuda	0	8,989	3,243	4,950	3,216	4,941	5,050	254
	80	10,220	5,757	8,432	7,028	7,836	7,813	337
	160	14,555	9,642	11,028	10,632	11,241	11,303	482
	320	16,107	10,243	13,458	13,602	14,093	13,419	625
Pensacola Bahia	0	4,414	3,071	3,338	2,559	2,734	3,205	221
	80	6,670	4,252	6,260	5,892	4,540	5,482	291
	160	7,802	5,503	7,362	5,108	6,590	6,473	353

TABLE 9. EFFECT OF NITROGEN ON HERBAGE YIELDS OF COASTAL BERMUDA AND BAHIA ON SMALL PLOTS, WIREGRASS SUBSTATION

Species	Nitrogen applied annually, lb./acre	Dry forage yield per acre							
		1953	1954	1955	1956	1957	1958	1959	Average 1953-59
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Coastal Bermuda	0	7,226	2,710	2,846	3,359	1,488	1,698	1,480	2,972
	80	8,920	4,688	5,884	5,769	2,908	3,312	4,418	5,128
	160	11,170	7,321	9,154	9,113	5,037	5,382	6,516	7,670
	320	11,769	9,035	14,214	11,937	9,972	8,473	8,948	10,625
Pensacola Bahia	0	6,822	3,230	2,706	4,120	2,043	1,548	1,570	3,148
	80	7,926	4,929	6,264	6,642	4,263	3,617	3,988	5,376
	160	8,133	5,258	9,108	9,272	8,578	5,401	4,408	7,165
	320	9,476	6,525	12,483	11,276	12,411	9,462	8,653	10,041

Norfolk Sandy Loam, Headland

In 1952 a grazing test was begun at the Wiregrass Substation with Coastal Bermudagrass at four rates of nitrogen and Pensacola Bahiagrass at three rates. The experiment was laid out in a randomized block design with two replications. The paddocks were 1.75 acres in size. Nitrogen was applied in three applications, March 1, May 15, and August 1. Beef gains were determined by grazing yearling steers. Cages were used to measure amounts of forage produced and amounts consumed by steers. Small plots adjacent to the paddocks were clipped to determine the forage yield response of Coastal Bermuda and Bahia to nitrogen.

Results from Grazing Paddocks. Coastal Bermuda produced more forage and beef than Bahia at all nitrogen rates, Table 8. The low yields of Bahia may have resulted in part from a weakening of the stand brought about by disking each fall for establishment of legumes. Also, part of the higher production of Coastal was from a partial stand of crimson clover in the Coastal, as compared with little or no crimson in the Bahia sod.

Clipping Yields from Small Plots. Forage yields were about the same for the two grasses at all rates of nitrogen, Table 9.

TABLE 10. EFFECT OF NITROGEN APPLICATIONS TO COASTAL BERMUDAGRASS GROWN ON NORFOLK SANDY LOAM ON SOIL ACIDITY AND PHOSPHORUS AND POTASSIUM LEVELS, WIREGRASS SUBSTATION

Nitrogen applied annually, lb./acre[1]	Depth of soil sample, inches	pH	P_2O_5	K_2O
			p.p.m.	*p.p.m.*
0	0-6	5.8	229	55
0	6-12	5.5	42	96
0	12-18	5.3	31	62
80	0-6	5.7	147	49
80	6-12	5.6	28	43
80	12-18	5.0	15	36
160	0-6	5.5	181	55
160	6-12	5.3	63	68
160	12-18	4.9	14	31
320	0-6	4.6	88	23
320	6-12	5.1	31	26
320	12-18	4.7	12	20

[1] Area limed in 1952 and again in 1955. All plots received 1,000 pounds 0-14-14 annually. Original surface soil had a pH of 5.0 and contained 53 p.p.m. P_2O_5.

These data are in line with results from other locations showing that Coastal and Bahia will produce about the same amount of herbage when managed alike.

Soil Analysis. Nitrogen applications to the small plots affected some chemical properties of a Norfolk sandy loam, Table 10. Although the plots were limed according to soil test recommendations at the beginning of the test and again at the end of the 1955 season, plots receiving the highest rate of nitrogen (320 pounds N annually from ammonium nitrate) had become highly acid by 1960. There was a tendency for soil phosphorus and potassium to decrease with increasing nitrogen applications.

DISCUSSION

Both Coastal Bermuda and Bahia grasses have a high yield potential when given adequate nitrogen and water. Either grass can produce 10 tons or more of dry forage per acre annually. With a yield potential of this magnitude, production of feed can be increased without increasing acreage. How much can profitably be spent for fertilizer and water will not only depend on the cost of these production practices, but also on the quality of forage produced and how it is utilized.

Irrigation

The average response of either grass to irrigation was not large at any of the locations. However, average response of Bahia to irrigation was greater than that of Coastal at three of the four locations where irrigation was a variable. Bahia gave a much greater response to irrigation than Coastal Bermuda at Thorsby during the 1956 season, which was unusually dry. If both grasses are grown and there is a choice of land, Coastal should be established on the drier areas and Bahia on the wetter ones.

The economics of irrigating grasses is complex. A few inches of water during extended dry periods may be profitable. Because rainfall is unpredictable, moisture applications are often ineffective. Rain following irrigation destroys the value of irrigating. Results of these experiments indicate that irrigation is usually not an economically sound practice in the production of forage from Coastal Bermuda and Bahia grasses.

Nitrogen

Results show that both grasses are responsive to nitrogen applications. The amount of nitrogen that can be used to advantage will vary from farm to farm. Workers in Georgia (5) found that Coastal Bermuda showed a yield response to as much as 900 pounds of nitrogen during a favorable season. However, they concluded there was not enough response above the 600-pound rate to pay for the additional nitrogen.

Protein content of grasses can be increased by nitrogen fertilization, but it is difficult to determine the value of the additional protein. Until more is known about the value of higher protein contents, nitrogen fertilization should be based mainly on yield response.

Assuming a gross return of $2 should be realized for each $1 spent for nitrogen, each additional pound of nitrogen should produce at least 22 pounds of dry matter (based on dry herbage valued at $20 per ton and N at 11 cents per pound). At two locations with four or more rates of nitrogen, the response of Coastal Bermuda decreased to 22 pounds or less at nitrogen rates of about 200 and 300 pounds per acre on Norfolk and Greenville soils, Figure 4. These figures are based on results from unirrigated plots. The average response curve for the two soils is also shown in Figure 4. This curve shows that a gross return of $3 can be obtained for each $1 spent for nitrogen up to 200 pounds per acre. The next 100 pounds returned only $2 for each $1 spent for nitrogen. Additional N will increase the lime, phosphorus, and potassium requirements, which will narrow the margin of profit from nitrogen.

Effect of Nitrogen on Soil Acidity, Phosphorus, and Potassium

Ammonium nitrate was the source of nitrogen at all localities. The acid-forming nature of ammonium nitrate and certain other nitrogen fertilizers has been recognized for many years (*4*). Acidity developed by 300 or more pounds of nitrogen annually will rapidly lower the pH of sandy soils to the point that grass yields may be lowered. The lime necessary to counteract this acidity must be figured in the cost of producing grass.

Use of high rates of nitrogen and the subsequent removal of large amounts of herbage will create the need for higher rates of phosphorus and potassium. The data show that 10 tons of hay

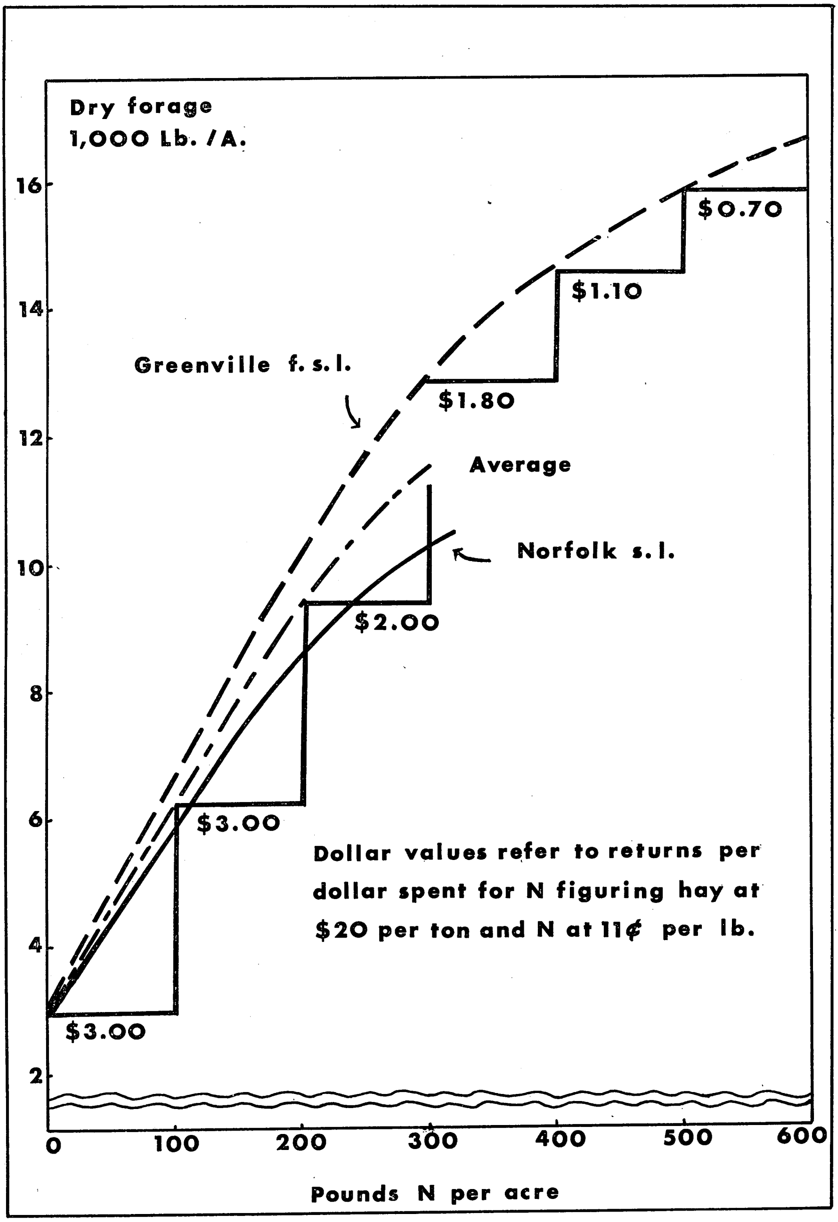

FIG. 4. Response of Coastal Bermudagrass to nitrogen and returns per dollar spent for nitrogen are shown above for two soil types. Return for each dollar spent for nitrogen is shown for each 100-pound increment of N.

will remove phosphorus and potassium equivalent to about 120 pounds of P_2O_5 and 400 pounds of K_2O. Increased acidity from certain nitrogen sources may increase the loss of potassium by leaching and decrease the availability of soil phosphorus. The soil analysis data show that soil phosphorus and potassium decreased appreciably with increasing rates of nitrogen applied. This emphasizes the need for periodic soil tests as a guide to proper fertilization.

SUMMARY

Field tests have been conducted the past 8 years to determine (1) the fertility and moisture requirements of Coastal Bermuda and Pensacola Bahia grasses, and (2) the effect of nitrogen fertilization on certain chemical properties of soils. The results are summarized as follows:

1. Both grasses are responsive to nitrogen fertilization and have a yield potential of 10 tons or more of hay per acre.

2. The average response to irrigation was not large for either grass at any location. It ranged from almost no increase to as much as 2 tons per acre.

3. Soil acidity increased with increasing rates of nitrogen applied. Rates of nitrogen in excess of 300 pounds per acre rapidly increased acidity of sandy soils to a level considered unfavorable for forage crops.

4. The use of high rates of nitrogen and the removal of large tonnages of herbage will result in rapid depletion of soil potassium and phosphorus unless adequate amounts are supplied as fertilizers.

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