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BERMUDAGRASS FOR FORAGE in Alabama

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BERMUDAGRASS for Forage in Alabama

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THE ORIGIN of Bermudagrass (*Cynodon dactylon*) is obscure, but it probably is a native of Africa. It was introduced into the United States prior to the middle 1700's. Over the years it earned a reputation as a serious pest in cultivated crops.

With increasing emphasis on livestock production in Alabama and introduction of improved varieties, Bermudagrass has assumed a new importance. Because of its vigor and productivity, Bermuda is now considered a valuable plant for forage production.

Bermudagrass is a rapidly spreading perennial, having both underground and aboveground creeping stems. It is a hot weather plant, making little growth when night temperatures drop below 50°F. Temperatures of 26 to 28°F. usually kill the herbage back to the ground. Drought tolerance of Bermudagrass is much better than that of Bahia, carpet, or Dallis.

Bermudagrass is best adapted to moderately well-drained soils with medium to high fertility. It will tolerate considerable flooding, but makes little growth under these conditions. When adequate nutrients are available, it grows well at soil reactions ranging from pH 5.0 to 8.0.

COMMON BERMUDA

Common Bermuda is widespread over Alabama. However, Bermudagrass is a variable species and plants that have developed in different areas of the State over a long period vary considerably in vigor, growth habit, and forage yield. Plants exhibiting such

TABLE 1. DRY FORAGE YIELDS OF COMMON BERMUDA ECOTYPES COLLECTED FROM VARIOUS LOCATIONS IN ALABAMA AND GROWN AT AUBURN, 1957-59

Source of plant material	Dry forage yield per acre			
	1957	1958	1959	Average
	Lb.	*Lb.*	*Lb.*	*Lb.*
Opp	8,146	10,548	7,800	8,831
Prattville	8,365	10,376	7,669	8,803
Headland	7,559	8,939	6,942	7,813
Leighton	5,268	9,124	8,789	7,727
Camp Hill	6,672	8,386	7,866	7,641
Crossville	4,755	8,958	7,834	7,182
Tuskegee	5,188	8,200	7,089	6,826
Aliceville	3,760	9,610	6,160	6,510
Marion Junction	3,948	6,960	7,534	6,147
Camden	5,692	7,295	5,332	6,106
Auburn	4,420	6,095	3,230	4,582

differences because of local adaptation are known as ecotypes. Data illustrating this variability are given in Table 1.

Bermudagrass ecotypes were collected from 11 locations in Alabama and grown under uniform fertility and moisture conditions at Auburn. Forage yield differences between the ecotypes were striking, Table 1. Several of the highest yielding common Bermudas averaged over 1 ton more of dry forage per acre than did the least productive ecotype. The highest yielding Bermudas generally came from well-drained soils. These soils generally warm up earlier in spring, thus favoring ecotypes that could begin growth early. Natural selection under particular drainage conditions over a long period is probably responsible for occurrence of plants with high yielding ability and early spring growth.

The ecotypes differed widely in forage production early in the season. The best Bermudas produced more than twice as much forage by June 5 as did several of the least productive ecotypes. Several of the best common Bermudas made more early season forage than did Coastal. These results suggest that there may be many adapted types of common Bermuda that are highly productive. None, however, equal Coastal in total production.

COASTAL BERMUDA

Origin

Coastal Bermudagrass, named for the Georgia Coastal Plain Experiment Station where it was developed by G. W. Burton has generally proved to be superior to common Bermuda throughout Alabama. It is a hybrid between Tift Bermuda (found by J

L. Stephens in an old cotton field near Tifton, Georgia, in 1929) and an introduction from South Africa.

Description

Coastal Bermuda is distinguished from common Bermuda in a number of ways. Stems, stolons, and rhizomes of Coastal are larger and have longer internodes, Figure 1. The leaves are longer, form a more acute angle with the stem, and are usually lighter green in color than leaves of common Bermuda.

Coastal plants grow taller than common Bermuda, and may exceed 20 inches in height. Whereas common Bermuda has seedheads in abundance under usual conditions, Coastal produces fewer heads and these rarely contain viable seed. Consequently, Coastal Bermuda must be planted from sprigs.

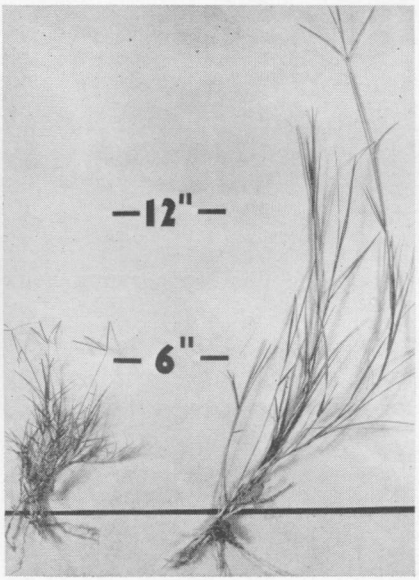

FIG. 1. Plant characteristics of common (left) and Coastal Bermudagrass are compared in the photograph.

Coastal Bermuda is more resistant to Helminthosporium leafspot, a disease that may cause the leaves of common Bermuda to turn brown during late summer. However, in certain years Coastal Bermuda may also be seriously damaged by this disease in the humid Gulf Coast area of the State.

Coastal Bermuda is apparently immune to the root-knot nematode. Thus, it will succeed on land where nematode-susceptible common Bermuda is unable to make vigorous growth. Numerous tests have shown that Coastal spreads faster and is more resistant to weed encroachment than common Bermuda.

Adaptation

Coastal Bermuda is sufficiently cold hardy to be planted anywhere in the State, but is productive over a shorter period of the year in the Tennessee Valley than in southern Alabama. Oven-

TABLE 2. DRY FORAGE YIELDS OF COASTAL AND COMMON BERMUDA AT THREE LOCATIONS

Location and years of test	Nitrogen applied per acre per year	Dry forage yield per acre	
		Coastal	Common
	Lb.	*Lb.*	*Lb.*
Belle Mina, 1956-58	200	10,299	8,505
Camp Hill, 1956-58	0	2,417	2,486
	150	5,373	4,036
Headland, 1953-59	0	2,597	1,698
	160	7,293	4,671

dry forage yields of Coastal and common Bermuda are given in Table 2. Throughout this bulletin forage yields are reported as oven-dry weight. This is drier than normally cured dry hay, which usually contains about 12 to 15 per cent moisture.

When clipped frequently to simulate close grazing and high rates of nitrogen applied, Coastal Bermuda has outyielded common Bermuda over the entire State. Where no nitrogen was applied, the difference has been much less. In some years common Bermuda may commence growth slightly earlier in spring than Coastal Bermuda.

When compared with other perennial warm season grasses at many locations over the State, forage yield of Coastal Bermuda was generally equal to or better than any other species tested, Table 3. Coastal Bermuda has been somewhat less satisfactory under conditions of poor drainage in the spring, as experienced

TABLE 3. DRY FORAGE YIELDS FROM FOUR WARM SEASON PERENNIAL GRASSES AT NINE LOCATIONS

Location and years of test	Nitrogen applied per acre per year	Dry forage yield per acre			
		Coastal Bermuda	Pensacola Bahia	Argentine Bahia	Dallis
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Tuskegee, 1955-59	150	7,304	8,478	7,935	6,205
Prattville, 1955-59	150	10,278	10,266	8,869	4,177[2]
Brewton, 1954-58	200	4,984	5,519	5,309	2,920
Marion Junction, 1957-59	150	6,961	3,156	4,208	4,595
Alexandria, 1957-59	150	10,720	6,832	1,400[1]	4,113
Belle Mina, 1956-58	200	10,299	6,658	.....	4,004
Camp Hill, 1956-58	150	5,373	6,107	.....	3,985
Auburn, 1956-59	200	8,438	8,445	.....	4,128
Headland, 1953-59	160	7,293	7,045	.....	.....
Tallassee, 1958-59	200	17,420	9,441	7,911	6,783

[1] Argentine Bahia winterkilled after the first year. Yield figure is for 1957 only.
[2] Yield figure is average of only 3 years as the stand disappeared.

in the test at Tuskegee on Boswell fine sandy loam. For good results, poorly-drained areas should be avoided when establishing Coastal Bermuda.

Coastal Bermuda is an excellent plant for soil conservation. It forms a dense sod with a deep, extensive root system that holds soil in place. On steep hillsides subject to severe erosion, this grass will conserve the soil while furnishing forage for livestock. An often-overlooked advantage of Coastal Bermuda is that it does not spread from seed as do many other forage grasses. Thus, it is less likely to become a pest and spread from pastures into areas where it is not wanted.

Establishment

Coastal Bermuda must be planted from sprigs. This involves problems not encountered with grasses that are established from seed. Certified sprigs are the best guarantee of purity. For planting a large acreage of Coastal Bermuda, it will pay a farmer to establish his own nursery on well-drained soil that is free of common Bermuda.

Planting sprigs in moist soil as soon as possible after digging prevents drying and results in a better stand. Many stand failures occur because sprigs dry before planting. It is recommended that planting be done on a well-prepared seedbed as free as possible of common Bermuda. Sprigging Coastal Bermuda in a dense stand of common Bermuda will not give a good stand, as revealed by Georgia research *(9)*. Herbicides, when correctly applied, have proved to be highly effective in controlling common Bermudagrass *(11)*. Previously, common Bermuda has been destroyed by plowing, raking, and burning during dry periods.

Before planting it is recommended that lime and fertilizer be applied according to soil test recommendations from the Auburn Agricultural Experiment Station Soil Testing Laboratory. Where row plantings are made, it is desirable to apply fertilizer in the row. Planting in rows 3 feet apart and 18 inches in the row will require 8 to 10 bushels of sprigs per acre. Broadcast planting requires a much larger quantity of sprigs. An advantage of row plantings is that weeds can be controlled by cultivation while the grass is becoming established. Herbicides such as 2,4-D may also be useful in removing competition from broadleaf weeds.

Fertilization

Established Coastal Bermuda stands require fertilization for satisfactory production, preferably according to soil test recommendedations. In the absence of a soil test, an application of 16 pounds per acre nitrogen and 48 pounds per acre each of P_2O_5 and K_2O is recommended. As soon as the stand is established, a topdressing of 45 pounds of nitrogen is needed. In succeeding years, a spring application of 56 pounds per acre each of P_2O_5 and K_2O is recommended. In the absence of legumes and if the grass is to be used for grazing only, an application of 30 pounds per acre of nitrogen is needed in April and again in June. For production of grazing and hay, 40 to 50 pounds per acre of nitrogen is needed several times during the season up to a total of 200 pounds.

Where winter legumes are grown on the grass sod, a different management system is recommended. This system calls for pastures to be closely grazed or mowed in the fall, with 56 pounds per acre each of P_2O_5 and K_2O applied before planting the legume. When legume stands are good, the spring topdressing of nitrogen can be omitted. For high hay yields however, the grass must be topdressed in late June or July.

Hay Production

Coastal Bermuda has unusual potential as a hay crop, Figure 2. It gives excellent growth response to high rates of nitrogen fertilizer. Over a 4-year period, irrigated Coastal Bermuda in east Texas *(5)* produced an average of 13 tons of 13 per cent protein hay per acre when fertilized with 1,000 pounds of nitrogen annually. In Georgia *(10)*, over 13 tons of 15 per cent protein hay per acre was obtained when 900 pounds of nitrogen was applied in a year having good rainfall. Work in Florida *(7)* has also demonstrated the high yield potential of this grass receiving high rates of nitrogen. Georgia results *(12)* also indicate that Coastal Bermuda gives excellent response to irrigation. However, results of tests in Alabama show that Coastal Bermuda is less likely to give a profitable response to irrigation than many other grasses.

As shown in Figure 3, this grass has given excellent response to nitrogen in Alabama. In an experiment at the Wiregrass Substation, Headland, the grasses were cut at 4-week intervals and the nitrogen applied in equal applications on March 1, May 15,

FIG. 2. Coastal Bermudagrass makes dense growth, as shown in this photograph.

and August 1 of each year. Coastal Bermuda gave a better response to high rates of nitrogen than did common Bermuda. With the 0 and 80-pound per acre nitrogen rates, Coastal Bermuda outyielded common Bermuda but gave slightly lower production than Pensacola Bahia.

Nitrogen fertilization increases the crude protein content of Coastal Bermuda hay. Research in Georgia, Table 4, shows that this increase in crude protein occurred regardless of the time intervals between clipping. Although the crude protein content is highest when Coastal is clipped frequently, highest forage yields were generally obtained when clipped at 6-week intervals.

Applications of nitrogen to Coastal Bermuda have had little effect on such chemical components of the forage as fat, fiber, and minerals *(2, 5)*. Research in Alabama showed that the cellulose content of stems and leaves was similar and was not affected by nitrogen fertilization *(1)*.

Coastal Bermuda cures faster than most legume hay plants because of its lower water content and small stems. When cut at the hay stage it usually contains about 30 to 35 per cent dry mat-

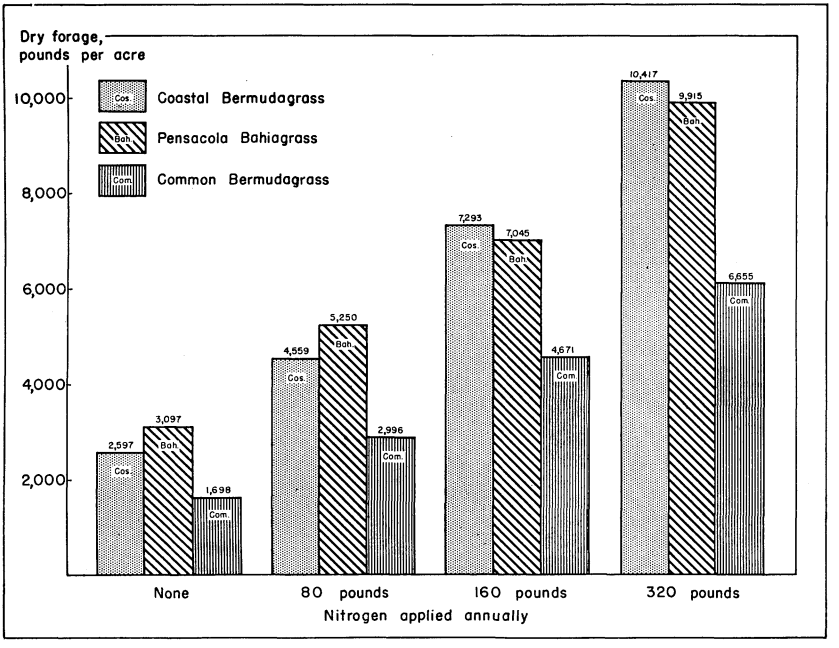

FIG. 3. Rate of nitrogen affects forage yields of Coastal Bermudagrass, common Bermuda, and Pensacola Bahiagrass, as illustrated by the graph. Data used are from results of 1953-59 studies at the Wiregrass Substation, Headland.

ter. Because it cures fast, Coastal Bermuda can be harvested during wet periods of the year when curing time is limited.

Hay harvested at monthly intervals from fertilized Coastal Bermuda at Auburn consisted of up to 90 per cent leaves in midsummer. However, during September and October, leaf percent-

TABLE 4. EFFECT OF NITROGEN RATE AND CLIPPING FREQUENCY ON CRUDE PROTEIN PERCENTAGE OF OVEN-DRY COASTAL BERMUDAGRASS DURING A 24-WEEK PERIOD, TIFTON, GEORGIA[1], 1953

Clipping frequency	Crude protein content from five rates of nitrogen, pounds per acre				
	0	100	300	600	900
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
2 weeks	9.98	13.60	17.39	20.85	22.86
3 weeks	9.65	12.89	16.60	18.80	20.83
4 weeks	9.25	11.19	15.23	16.98	19.56
6 weeks	7.58	7.76	11.28	13.83	15.34
8 weeks	6.88	8.44	10.36	12.20	13.33

[1] From Literature Cited (*10*), The Effect of Nitrogen Rate and Clipping Frequency upon the Yield, Protein Content, and Certain Morphological Characteristics of Coastal Bermudagrass (*Cynodon dactylon* (L) Pers.)

age dropped to about 75 per cent. The higher percentage of stems in late-harvested Coastal Bermuda decreases hay quality.

Much Coastal Bermuda hay harvested on farms is of low quality. Delayed cutting and exposure to rain and sun after cutting are partly responsible for this problem. Generally, cutting at a frequency of 5 to 6 weeks and prompt storage will materially improve palatability, protein content, and digestibility of the hay.

It is often necessary to judge age and quality of Coastal Bermuda hay by physical appearance. Good hay has a bright green color. A bleached white appearance indicates undue exposure to sun and rain. Average stem length of Coastal Bermuda hay cut at 6-week intervals will be less than 18 inches *(10)*. This is considered the maximum average length for good quality Coastal Bermuda hay.

The feeding value of Coastal Bermuda hay is dependent to a large extent on fertilizer level, stage of maturity, and season of the year when cut. Other factors that affect its value are the level of concentrates in the ration and the kind of livestock being fed.

Coastal Bermuda hay has been satisfactory for wintering brood cows *(8)*. However, Georgia research *(8)* with steers shows that satisfactory gains and animal finish were not obtained with Coastal Bermuda hay containing 9 per cent crude protein unless large amounts of grain were fed.

Alabama work with dairy cattle *(6)* showed that Coastal Bermudagrass hay having a crude protein content of 10.8 per cent was a poor substitute for 18 per cent protein alfalfa hay when concentrate was fed at the rate of 1 pound to 3 pounds of 4 per cent fat milk. However, this study indicated that Coastal hay may be almost equal to alfalfa when the rate of concentrate feeding is 1 pound to 2 pounds of milk.

Pasture

Beef Cattle. Grazing experiments have shown that Coastal Bermuda pastures are capable of producing high per acre beef gains when stocked to capacity with steers. However, daily gains per steer have often been low. Average daily gain per animal in Alabama tests range from less than 0.8 pound at the Piedmont Substation, Camp Hill, to about 1.25 pounds at Headland. Daily gain per steer did not increase as larger quantities of nitrogen were applied.

TABLE 5. FORAGE YIELD AND STEER GAIN ON THREE SUMMER GRASSES AT THE WIREGRASS SUBSTATION, 1953-57 AVERAGES

Grass	Nitrogen applied per acre	Oven-dry forage yield per acre	Steer gain per acre	Average daily stocking rate, steers per acre
	Lb.	*Lb.*	*Lb.*	*No.*
Coastal Bermuda	0	5,050	254	1.35
	80	7,813	337	1.71
	160	11,303	482	2.63
	320	13,419	625	3.49
Pensacola Bahia	0	3,205	221	1.25
	80	5,482	291	1.79
	160	6,473	353	2.02
Common Bermuda	0	2,484	102	0.74
	80	5,159	226	1.40
	160	7,401	295	1.81

Steer grazing data obtained over a 5-year period in cooperation with the Animal Husbandry and Nutrition Department and Wiregrass Substation point out the superiority of Coastal Bermuda in steer gain per acre, Table 5. In this experiment, pastures were stocked with enough yearling steers to utilize the forage at each season of the year. Average annual length of grazing season was 168 days. Coastal Bermuda was much more responsive to high rates of nitrogen than common Bermuda or Pensacola Bahia. In addition, nitrogen fertilization increased the crude protein content of the herbage. Where 320 pounds per acre of nitrogen was applied annually, average steer gain per acre per year was 625 pounds for the 5-year period. Coastal Bermuda without nitrogen fertilizer but with some legume growth produced about 250 pounds of steer gain per acre annually. Application of nitrogen resulted in larger total gains from Coastal Bermuda than from Pensacola Bahia or common Bermuda.

Slaughter finish of yearling animals grazing Coastal Bermuda has not been satisfactory. In the experiments at the Wiregrass Substation, the cattle were predominantly Utility when removed from pasture at the end of summer.

High rates of nitrogen are recommended for increasing the forage yield and protein content of Coastal Bermuda pastures. This raises the question of how nitrogen fertilization affects forage palatability to livestock. Georgia grazing tests with steers *(3)* showed that palatability was substantially improved by nitrogen fertilization. Even with an unusually high rate of 1,500 pounds

per acre, there was no evidence that nitrogen decreased palatability.

Dairy Cattle. Coastal Bermuda pasture cannot be recommended as the sole source of roughage for high-producing dairy cows, based on studies in cooperation with the Department of Dairy Husbandry over a 3-year period. Cows on Coastal Bermuda, Pensacola Bahia, and Dallisgrass fertilized with 250 to 300 pounds of nitrogen per acre showed comparable lactation response. These species failed to support high milk production and were inferior to alfalfa hay. Cows in these experiments received a concentrate mixture at the rate of 1 pound per 4 pounds of 4 per cent fat milk.

Irrigation gave a small increase in forage yield, but it did not change the downward trend in lactation. Likewise, rotational grazing of Coastal Bermuda offered no advantage from the standpoint of milk production. The crude protein content of herbage in these pastures declined from over 15 per cent in May down to about 10 per cent in October. Probably Coastal Bermuda pasture can best be used in the dairy program as a low cost roughage for heifers and dry cows.

Grazing Management. For good quality grazing, plants must be kept in an immature state and not allowed to grow too tall. Best results are obtained by fencing a large pasture into smaller units, so animals can be rotated among the areas and surplus forage cut for hay.

Cattle droppings are usually a problem in pasture as livestock will not eat rank growth around them. Droppings can be scattered when pasture growth is short by using a drag or spike-tooth harrow. Under continuous grazing, forage removal becomes uneven, resulting in large clumps of coarse unpalatable grass. Clipping with a rotary or sickle-type mower removes unpalatable herbage and causes the plants to put out tender new growth.

Legumes with Coastal Bermuda

Growing an annual legume in association with Coastal Bermuda has two advantages: (1) The grazing season is extended by several months and good quality forage is available when summer grasses are dormant; and (2) the legume supplies nitrogen to the grass, thus stimulating growth of the Coastal Bermuda in early summer, Figure 4.

FIG. 4. This heavy growth of Coastal Bermudagrass is where a good stand of Auburn woollypod vetch was grown the preceding winter and no commercial nitrogen was applied. The photograph was made June 11.

Annual legumes greatly increased productivity of Coastal Bermuda in clipping tests at three locations in the State, Table 6. Legumes in the pasture sward more than doubled yield of the Coastal Bermuda in the absence of nitrogen fertilizer. The value of legumes was demonstrated even when nitrogen was applied. Research results in Georgia *(12)* show that when a winter legume is grown, it is profitable to apply up to 200 pounds per acre of nitrogen.

TABLE 6. EFFECT OF LEGUMES ON ANNUAL DRY MATTER PRODUCTION OF COASTAL BERMUDA

Mixture	Dry matter yield, three locations and two nitrogen rates, per acre					
	Camp Hill, 1956-58		Auburn, 1956-59		Headland, 1956-59	
	0 N	150 lb. N	0 N	200 lb. N	0 N	160 lb. N
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Coastal Bermuda	2,417	5,373	2,266	8,438	1,667	5,852
Coastal Bermuda + crimson clover	5,135	7,699	6,629	11,924	3,228	7,943
Coastal Bermuda + woollypod vetch	3,868	7,524	6,386	11,626	4,121	8,356
Coastal Bermuda + white clover	4.871	5,970	------	------	------	------

Crimson clover and woollypod vetch have generally given the highest legume yields. White clover stands are often difficult to obtain on Coastal Bermuda sod unless moisture conditions are unusually good. Results at the Wiregrass Substation from 1953 to 1959 showed almost complete stand failure of white clover each year.

Crimson clover yields from clipping tests are often larger than those from vetch. Vetch is likely to be damaged more than crimson clover by close, frequent cutting, resulting in poor recovery growth. Actually, under pasture conditions the defoliation is more gradual, thus permitting the vetch to continue growth over a longer period.

The effect of woollypod vetch growth in extending the productive season of a Coastal Bermuda sod is shown in Figure 5. Generally, vetch has extended the grazing season by at least 2 months in the spring and increased midsummer growth of grass. The low production in June was because of drought. Nitrogen fertilization

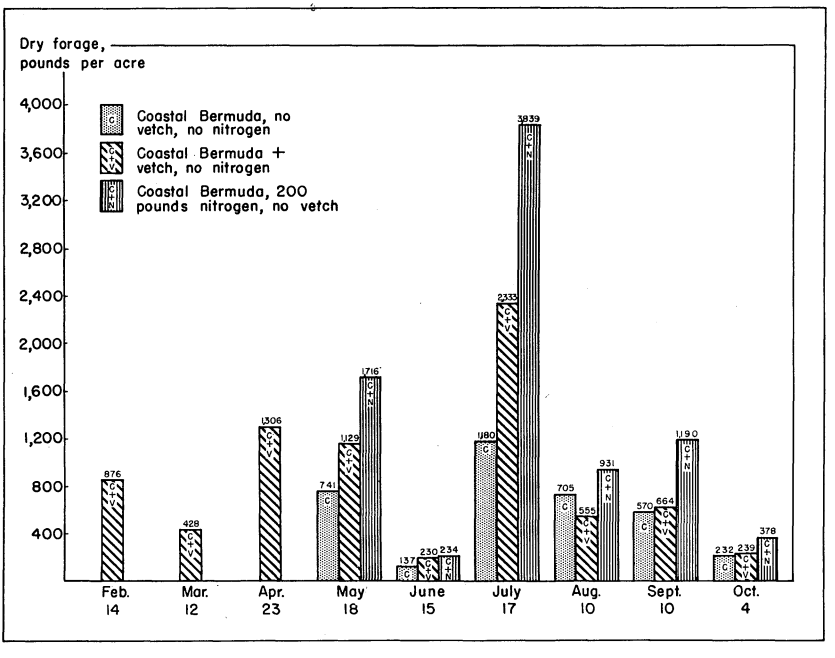

FIG. 5. Seasonal forage production of Coastal Bermudagrass is affected by vetch growth and nitrogen application, as illustrated by the graph above. Nitrogen was applied at rate of 50 pounds per acre on March 15, May 5, June 25, and August 15. Forage harvested before May was entirely vetch. Data given are 1956 results obtained in a project at the Dairy Research Unit, Auburn.

TABLE 7. FORAGE PRODUCTION OF WINTER ANNUALS UNDER GRAZING PLANTED ON COASTAL BERMUDA SOD, TALLASSEE, WINTER 1955-56

Crop and nitrogen treatment	Dry forage per acre	Grazing period
	Lb.	
Crimson clover	Stand lost from drought	-------
Woollypod vetch	5,117	Feb. to May
Abruzzi rye + 120 lb. N/a	5,450	Late Dec. to May
Rye + 120 lb. N/a + vetch	7,129	Late Dec. to May

alone did not extend the productive season of the grass, but only resulted in additional growth in midsummer.

Vetch stands are generally easier to obtain than crimson clover because the larger seed and more vigorous seedlings permit deeper planting to take advantage of soil moisture. This advantage is illustrated by the forage yields from cage clippings harvested during one season from winter annuals planted on Coastal Bermuda sod at the Plant Breeding unit, Tallassee, Table 7. Fall drought eliminated crimson clover, whereas rye and vetch persisted and made good growth with November rain. In this experiment, sod-seeded rye gave good results. However, in other State tests, sod-seeding of small grains has generally given unsatisfactory results.

Stand failures of crimson clover have been more common than those of woollypod vetch planted on Coastal Bermuda sod. Fall droughts have generally been a serious deterrent to establishment of crimson clover on sod in the Wiregrass area.

Grazing studies also indicate the value of winter legumes with Coastal Bermuda. In the fall of 1957 the grazing paddocks at the Wiregrass Substation, previously referred to in Table 5, were seeded to woollypod vetch on the grass sod. During 1958, beef gains per acre were much higher than in any of the previous 5 years when vetch was not planted on the grass sod, Table 8. Gains per animal were also higher. Coastal Bermuda-vetch with no nitrogen gave a total beef gain per acre of 477 pounds with an average daily stocking rate of 2.1 steers per acre.

In a cooperative experiment with the Animal Husbandry and Nutrition Department and the Piedmont Substation, steers were grazed on Coastal Bermuda-crimson clover receiving no nitrogen fertilizer. The annual animal gain per acre was 301 pounds in 1956 and 406 pounds in 1957.

Results with brood cows and calves on Coastal Bermuda-leg-

TABLE 8. FORAGE YIELD AND STEER GAIN ON THREE SUMMER GRASSES WITH WOOLLYPOD VETCH, WIREGRASS SUBSTATION, 1958

Crop	Nitrogen applied per acre	Oven-dry forage yield, per acre	Steer gain per acre	Average daily stocking rate, steers/acre
	Lb.	*Lb.*	*Lb.*	*No.*
Coastal Bermuda + vetch	0	7,966	477	2.10
	80	6,318	534	2.29
	160	6,911	773	2.93
	320	9,706	806	3.60
Pensacola Bahia + vetch	0	4,191	335	1.65
	80	6,308	484	1.80
	160	9,067	456	2.03
Common Bermuda + vetch	0	4,392	331	1.21
	80	8,599	558	2.12
	160	9,712	487	2.69

ume swards have been encouraging. In these tests at Camp Hill during 1958, a total of 415 pounds calf gain per acre was obtained while grazing Coastal Bermuda-crimson clover. A combination of Coastal Bermuda-crimson clover-woollypod vetch in 1959 gave 387 pounds of calf gain per acre. Coastal Bermuda's greatest potential is probably as a forage plant for brood cows and calves, particularly on upland soils that tend to be droughty. The feed requirements of brood cows can be amply met with a forage such as Coastal Bermuda, particularly when grown with a winter legume.

OTHER BERMUDA VARIETIES

A number of other Bermuda varieties have been developed by selection and breeding. They are of little importance in the State. Results of tests with these varieties are briefly discussed.

Midland Bermuda

Midland is a hybrid between Coastal and a cold-resistant common Bermudagrass from Indiana. It is taller, leafier, and more disease resistant than common Bermuda and is more cold resistant than Coastal. However, once established, Coastal is sufficiently cold hardy for northern Alabama and trials in northern and central Alabama show no yield superiority of Midland over Coastal, Table 9. Midland has made more early spring growth than Coastal at Alexandria and Auburn but not at Belle Mina. Midland, like Coastal, must be established from sprigs.

TABLE 9. YIELDS OF DRY FORAGE OF COASTAL, GREENFIELD, MIDLAND, AND SUWANEE BERMUDA AT SEVERAL LOCATIONS

Location and years of test	Nitrogen applied per acre per year	Dry forage yield per acre			
		Coastal	Greenfield	Midland	Suwanee
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Auburn, 1957-59	250	11,218	8,146	12,061	7,881
Alexandria, 1957-59	150	10,720	.....	10,657	.....
Belle Mina, 1956-58	200	10,811	.....	9,200	.....
Tallassee, 1958-59	200	17,420	.....	.....	15,195

Suwanee Bermuda

This variety is another hybrid developed at the Georgia Coastal Plain Experiment Station. It is similar to Coastal except that it makes a much more open sod, thus being less competitive with weeds. Suwanee is much more difficult to establish, because of more rapid drying out of sprigs after planting. Georgia research *(4)* indicates that on deep sandy soils of the Coastal Plain, Suwanee is higher yielding and more efficient in its use of nutrients and water. Suwanee has not demonstrated any advantage in Alabama and has yielded somewhat lower than Coastal, Table 9. Winterkilling has been a problem with Suwanee in the central part of the State, Figure 6.

Greenfield Bermuda

Greenfield is a winter hardy selection made from common Bermuda in Oklahoma. It has purple stolons with short rhizomes

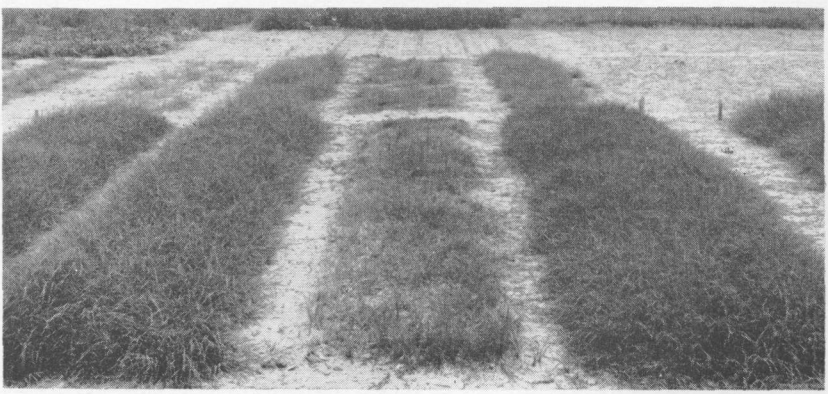

FIG. 6. Suwanee Bermudagrass stand (center) was lost during winter of 1957-58, as shown by photograph made May 1, 1958, at Auburn. Coastal, left, and Greenfield, right, Bermuda varieties were not damaged.

that form a dense sod. Propagation is by sprigs. In one experiment at Auburn over a 3-year period, it was considerably lower yielding than Coastal or Midland, Table 9.

NK-37 Bermuda

NK-37 is a giant common Bermuda selected in Arizona. This variety, planted from seed, has excellent seedling vigor and makes rapid growth after planting. Results of tests at Auburn, Table 10, show that NK-37 grew more rapidly and slightly outyielded Coastal during the establishment year. However, NK-37 was extremely susceptible to Helminthosporium leafspot, the disease appearing on the leaves in late summer. Stands of the variety have been badly damaged during the winter, resulting in very low production the following year, Figure 7. This variety is not recommended for planting in Alabama.

TABLE 10. DRY FORAGE YIELDS OF NK-37, COASTAL, AND COMMON BERMUDA, AUBURN, 1958-59

Variety[1]	Method of planting	Dry forage yield per acre	
		1958	1959
		Lb.	*Lb.*
Coastal	sprig	5,181	10,852
Common	seed	4,331	6,576
NK-37	seed	6,599	1,045
NK-37	sprig	6,658	486

[1] Nitrogen rate was 50 pounds per acre June 9, July 6, and August 6.

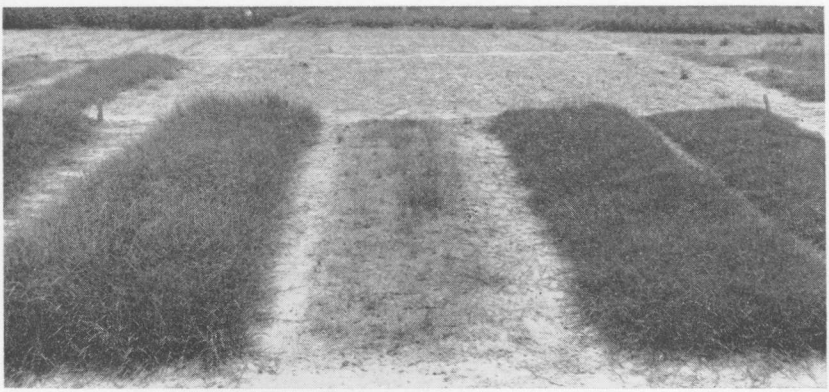

FIG. 7. Loss of NK-37 Bermudagrass (center) by disease and winterkilling is shown May 24 at Auburn. Midland is at left and common Bermuda at right.

SUMMARY

Common Bermuda, a vigorous perennial warm season grass, varies widely in plant characteristics, depending on the ecotype. None of the local Bermudagrass ecotypes in Alabama has equalled Coastal in production.

Coastal, a hybrid, is cold hardy enough for the entire State and has generally given forage yields equal to or better than other species tested. Hay yields of over 8 tons per acre have been obtained. It is not adapted to conditions of poor drainage.

Higher steer gains per acre have been achieved with Coastal Bermuda than with other perennial warm season grasses tested. However, daily gains per animal have not been high unless a winter legume was grown with the grass. Satisfactory results have been obtained with brood cows and calves on Coastal Bermuda and clover or vetch. Coastal Bermuda has failed to maintain a high level of lactation when used as the sole source of roughage for high-producing dairy cows.

Growing a winter legume on Coastal Bermuda sod has extended the grazing season, increased forage yield, and improved animal performance.

Midland Bermuda has given high forage yields but has shown no superiority over Coastal. Suwanee is difficult to establish and not cold hardy enough except in southern Alabama. Greenfield and NK-37 are inferior to Coastal and Midland.

LITERATURE CITED

(1) ANTHONY, W. B. Cellulose Content of the Leaves and Stems of Several Grasses and Relation of Season to Cellulose Digestibility. Jour. of Animal Sci. 15:1274. 1956.

(2) BURTON, G. W. Coastal Bermudagrass. Ga. Agr. Expt. Sta. Bul. N.S. 2:1-31. 1954.

(3) ---------- The Palatability of Coastal Bermudagrass (*Cynodon dactylon* (L) Pers.) as Influenced by Nitrogen Level and Age. Agron. Jour. 48:360-362. 1956.

(4) ----------AND DEVANE, E. H. Suwanee Bermudagrass. Ga. Coastal Plain Agr. Expt. Sta. Mimeo. 80: (1). 1953.

(5) FISHER, F. L. AND CALDWELL, A. G. The Effects of Heavy Rates of Fertilizers on Forage Production and Quality of Coastal Bermudagrass. Agron. Jour. 51:99-102. 1959.

(6) HAWKINS, G. E. Coastal Bermudagrass vs. Alfalfa Hay as A Dairy Feed. Auburn Univ. Agr. Expt. Sta. Highlights of Agricultural Research. Vol. 5, No. 3. 1958.

(7) MCCLOUD, D. E. Coastal Bermuda and Pangola Respond to High Nitrogen. Chilean Nitrate Farm Forum, No. 55. pages 10-11. December 1955.

(8) MCCORMICK, W. C., HALE, O. M., AND SOUTHWELL, B. L. Comparative Value of Coastal Bermudagrass Silage and Hay for Fattening Steers. Ga. Agr. Expt. Sta. Cir. N.S. 10:1-15. 1957.

(9) NEWTON, J. P., ELROD, J. M., CRAIGMILES, J. P., AND CROWDER, L. V. The Feasibility of Establishing Coastal Bermudagrass in a Common Bermuda Sod. Agron. Jour. 51:751-752. 1959.

(10) PRINE, G. M. AND BURTON, G. W. The Effect of Nitrogen Rate and Clipping Frequency upon the Yield, Protein Content, and Certain Morphological Characteristics of Coastal Bermudagrass (*Cynodon dactylon*, (L) Pers.). Agron. Jour. 48:296-301. 1956.

(11) SEARCY, V. S. Chemical Control of Johnson and Bermudagrass Now a Fact. Auburn Univ. Agr. Expt. Sta. Highlights of Agricultural Research. Vol. 4, No. 1. 1957.

(12) STEPHENS, J. L. AND MARCHANT, W. H. The Influence of Irrigation, Rates of Nitrogen, and Interplanted Crops on Forage Production of Coastal Bermudagrass. Ga. Agr. Expt. Sta. Cir. N.S. 12:1-15. 1958.

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