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Introduction

Bermudagrass, *Cynodon dactylon* (L.) Pers, was one of the earliest grasses introduced into Oklahoma Agriculture. This species was first established from seed on the Oklahoma Agriculture Experiment Station at Stillwater in the spring of 1892 (1, 2).[2] Some plants survived the first winter and a selection was made therein which was subsequently referred to as "Hardy Bermuda". This selection was released to various parts of the territory and survived the winters of 1905 and 1906 in practically all areas except Beaver County in the Panhandle (3).

In 1902 John Fields reported that of all the grasses tried on the station only bermuda possessed the qualities required of a pasture grass for Oklahoma (2). In 1906 Fields noticed that many of the cultivated hillsides were eroding badly and recommended bermudagrass for stabilizing them. In 1910 Frances and Baird recommended bermudagrass for pasture in Oklahoma (4). These early researchers warned against planting bermudagrass on lands which were intended for future cultivation because of difficulties involved in eradication.

Active testing of bermudagrass strains was again initiated in Oklahoma in the 1930's and 1940's when efforts were undertaken to find soil binding grasses to aid in soil conservation and pasture programs. A rather extensive collection of local types as well as materials from other experiment stations in the South were assembled and tested at the main station in the late 1940's and early 1950's. From this material two varieties were released, Midland and Greenfield, which are the most extensively grown varieties within the state at present. Forage management and live-

[1]Department of Agronomy, Department of Agronomy, Oklahoma Agricultural Experiment Station and Department of Agronomy (Panhandle Research Station), respectively.
[2]Numbers in parentheses refer to literature cited. See page 4.

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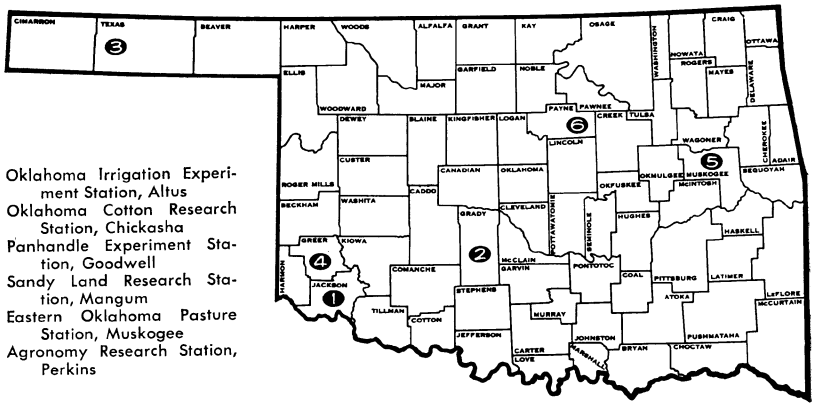
stock production studies with these grasses have been conducted by Elder and Murphy (8) and have clearly elucidated their value and potential under various treatments and stocking systems.

Establishment of Test Sites

Statewide tests were initiated in the summer of 1962 at the Eastern Oklahoma Pasture Station, Muskogee, on three soil types. Tests were established later at five additional locations. Varieties tested included Midland, Greenfield, Coastal, and an Oklahoma common type selection. Performance test sites are shown on the map in Figure 1.

Varieties at all locations were established by sod plantings in the spring or early summer. Individual plugs of sod were placed on centers one foot apart so as to facilitate rapid ground cover. Individual plots were 6 feet wide by 20 feet long with three feet alleys (bare ground) maintained between plots to avoid mixing varieties. Alleyways were sprayed with diluted diesel oil at approximately two weeks intervals throughout the growing season to prevent stolons from crossing into adjacent plots. Caddo switchgrass was established in the alleys at Perkins in lieu of using diesel oil. This practice was very effective in preventing the spread of bermudagrass between plots; but because of the rank growth of the switchgrass the plots suffered from shading, or were depleted of moisture, or both resulting in substantially reduced yields of forage at this location. Each entry was replicated four times at each location in randomized complete-block designs.



1. Oklahoma Irrigation Experiment Station, Altus
2. Oklahoma Cotton Research Station, Chickasha
3. Panhandle Experiment Station, Goodwell
4. Sandy Land Research Station, Mangum
5. Eastern Oklahoma Pasture Station, Muskogee
6. Agronomy Research Station, Perkins

Fertilizer Applications

One thousand pounds of lime and 200 pounds each of P_2O_5 and K_2O per acre were plowed down on plots at Muskogee prior to planting. After plantings were established at this station, approximately 50 pounds per acre of actual nitrogen was applied.

Plots at Chickasha, Mangum, Muskogee, and Perkins received an average of 50 to 100 pounds of nitrogen annually depending on local amounts of rainfall received. Plots at Altus received an average of 120 pounds of nitrogen per acre each year and 10 inches of irrigation water. Plots at Goodwell received 320 pounds of nitrogen and approximately 20 inches of irrigation water through the growing season each year.

Herbicide Treatment

Plots at all locations were sprayed with ½ to ¾ pounds active 2,4-D per acre in late April or early May each year for control of broad-leaved weeds. No treatments were made for control of annual grasses.

Time and Method of Harvest

Plots were harvested when the forage was six to eight inches high or during stress periods when plants were showing large numbers of seed heads. Available moisture prior to and during the growing season governed the number of harvests possible at any one location in any particular year. Plots were harvested two to five times per year at most locations.

Varietal History and Descriptions

Midland

Midland bermudagrass was developed in Georgia by Glenn W. Burton. It is a hybrid between Coastal and a winter hardy Common-type bermudagrass from Indiana. Midland is a tall leafy type, (with dark green leaves), and produces a lax open sod. It has drought and cold tolerance, starts growth in early spring, and is highly resistant to foliar diseases. Its rhizomes are long and straight and do not form a dense mat below the ground surface as do the common types. Midland was released jointly by the Oklahoma Agricultural Experiment Station and by the Georgia Agricultural Experiment Station and Crops Research Division, Agricultural Research Service, United States Department of Agriculture in 1953 (6, 9).

Coastal

Coastal bermudagrass resulted from a natural cross at Tifton, Georgia, between Tift bermudagrass and a tall growing strain of bermudagrass from South Africa. The stems, stolons, and rhizomes of Coastal bermudagrass are larger and the internodes are much longer than in common types. The leaves are long and have a characteristic light green color. Coastal produces very few seed heads and those produced rarely contain viable seed. The variety has some resistance to *Helminthosporium* leaf spot. Coastal is widely adapted in the South from Texas to the Atlantic (5). It has suffered severe winter injury in the northern half of Oklahoma (6). Coastal bermudagrass was released by the Georgia Agricultural Experiment Station and the Crops Research Division, Agricultural Research Service, United States Department of Agriculture in 1943 (5, 9).

Greenfield

Greenfield bermudagrass was selected by W. C. Elder from a common type found growing on the Stillwater Station in 1947. Greenfield is intermediate between the coarse and very fine stem types of bermudagrass. It has a multitude of leaves which remain dark green throughout the growing season. The stolons are intermediate in length and the internodes are short. The exposed stolons are purple in color. The rhizomes are short, crooked, and numerous, forming a dense mat below the ground surface. It has an upright habit of growth, is winter hardy, makes early spring growth, and is adapted to all parts of Oklahoma where common type bermudagrass will grow. Greenfield was released by the Oklahoma Agricultural Experiment Station in 1954 (7, 9).

Common

Common types of bermudagrass are highly variable and can be found growing more or less unattended in many areas of the state. Such types may be coarse or fine stemmed and tall or somewhat dwarfed. The common type reported in these trials was selected in 1962 from an abandoned farmstead at the west end of lake Carl Blackwell. The material was growing on what appeared to have once been a barnyard. This selection is a tall upright growing type that is rather fine stemmed, and produces an abundance of dark green leaves.

Panhandle Selection No. 1

A fine stemmed common type selected at Goodwell, Oklahoma. It is an extremely hardy and aggressive type. Its origin is unknown. This

selection was tested at Goodwell only.

Panhandle Selection No. 2

A coarse stemmed common type collected 10 miles north of Guymon in Texas County on the Leo H. Bauer farm. It is winter hardy and has existed on the Bauer farm since the early 1930's. This selection was tested at Goodwell only.

Rainfall and Irrigation

Total forage production of bermudagrass is highly correlated with annual rainfall, seasonal rainfall distribution, fertilizer amendments, inherent soil fertility, soil type, and possibly other factors. Amounts of rainfall and irrigation water received at the various test locations are listed in Table 1. Amounts of fertilizer applied at each location have already been discribed. Soil types are given in Tables 2 through 9.

Results and Discussion

State-wide averages (Table 10) show a difference of approximately 2250 pounds of oven-dry forage between the top and lowest yielding varieties at six locations based on two to seven years of testing. Coastal and Midland, the top yielding varieties, showed a difference of only 9 pounds forage per acre per year. Even though Coastal produces as much forage as Midland, it is not generally recommended for planting in Oklahoma and particularly in the northern part of the state. There may be some advantage to growing Coastal in the Southern part of the state where winter injury is not as severe. One can, however, expect partial loss of stands of Coastal each year if grown in the northern half of the state. Coastal is about three weeks later than Midland in initiating spring growth at the Perkins and Muskogee stations. Also a fairly large portion of the yield of Coastal for the first harvest at the Perkins and Muskogee stations consisted of annual grasses and weeds that were resistant to 2,4-D. Coastal does make excellent growth from mid-summer into the fall months.

Midland and Coastal are well adapted to the deep sandy soils of the Mangum station. These two varieties consistently outyielded Greenfield and the common type selection by 55 to 80 percent from year to year at this station.

Because of the widespread adaptability of Midland over the entire state of Oklahoma, it is generally recommended that one choose this variety to establish new plantings until such time as a new improved variety is developed.

Table 1. Seasonal distribution of rainfall and irrigation water at test locations.

Locations	Rainfall (R) or irrigation (I)	Year	JFM*	A-S*	OND*	Total
Altus	R	1967	0.69	8.62	2.19	11.50
	I		4.00	8.00	0.00	12.00
	Total		4.69	16.62	2.19	23.50
	R	1968	5.75	18.02	4.55	28.32
	I		0.00	8.00	0.00	8.00
	Total		5.75	26.02	4.55	36.32
	R	1969	3.22	18.00	2.88	24.10
	I		0.00	9.00	0.00	9.00
	Total		3.22	27.00	2.88	33.10
Chickasha	R	1965	3.29	19.84	2.11	25.24
	R	1966	3.45	19.65	1.23	24.33
	R	1967	2.66	20.49	3.45	26.60
	R	1968	5.77	17.48	7.25	30.50
	R	1969	5.39	15.54	2.57	23.53
	R	1970	3.23	14.20	3.37	20.80
Goodwell	R	1965	0.56	13.71	2.10	16.37
	I		0.00	19.00	2.50	21.50
	Total		0.56	32.71	4.60	37.87
	R	1966	0.18	12.72	0.23	13.12
	I		0.00	17.50	2.50	20.00
	Total		0.18	30.22	2.73	33.13
	R	1967	0.05	16.29	1.52	17.86
	I		4.00	19.00	3.50	26.50
	Total		4.05	35.29	5.02	44.36
	R	1968	1.02	12.60	3.96	17.58
	I		8.00	21.00	0.00	29.00
	Total		9.02	33.60	3.96	46.58
Mangum	R	1966	2.17	12.24	1.42	15.83
	R	1967	1.08	10.93	3.10	15.11
	R	1968	4.81	16.89	7.74	29.44
	R	1969	4.02	18.49	2.49	25.00
	R	1970	2.87	14.65	2.12	19.64
Muskogee	R	1963	3.16	17.01	3.58	23.75
	R	1964	5.48	24.72	5.21	35.41
	R	1965	5.52	19.96	2.76	28.24
	R	1966	6.28	17.34	4.48	28.10
	R	1967	3.71	25.58	10.41	39.70
	R	1968	10.41	24.54	11.22	46.17
	R	1969	10.81	15.35	11.19	37.35
Perkins	R	1966	2.88	18.65	1.77	23.30
	R	1967	3.22	25.85	4.36	33.43

* JFM = January, February, and March
A-S = April through September
OND = October, November, and December

Propagation Materials

Bermudagrass plantings should always be made by using small pieces of sod or by use of rhizomes. Bermudagrass is a cross-fertilized species, and most varieties are highly heterozygous genetically. Stands established from seeds will not breed true to variety because of genetic segregation, and one will obtain a wide range of plant types. Performance of stands established by seed in terms of forage production is markedly reduced when compared to stands established by sod or rhizomes.

Forage Yields

Yields per acre of oven-dry forage may be observed in Table 2 for Altus; Table 3 for Chickasha; Table 4 for Goodwell; Table 5 for Mangum; Tables 6, 7, and 8 for Muskogee; and Table 9 for Perkins. Table 10 shows average yields over years at each location. Yields at Goodwell were not presented in the averages because Coastal and the Common type selection used at the other test sites were not included in the Goodwell test.

Table 2. Forage yields of bermudagrass at Altus. Soil type: Tillman-Hollister clay loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	3	4	4	
Variety	1967	1968	1969	Average
Coastal	10652	13418	5196	9755
Midland	9042	12205	5455	8900
Greenfield	5929	9864	2856	6216
Common	4814	8030	2865	5253

LSD
1967: .05 = 1767, .01 = 2538
1968: .05 = 1634, .01 = 2347
1969: .05 = 1190, .01 = 1485

Table 3. Forage yields of bermudagrass at Chickasha. Soil type: McClain clay loam. Yields given in pounds per acre of oven dry-forage.

Number of Harvests	4	3	3	3	4	2	
Variety	1965	1966	1967	1968	1969	1970	Average
Coastal	15442	10169	13330	9650	13855	1717	10694
Midland	14592	11155	12173	8526	12516	2478	10240
Greenfield	11085	10038	10440	9291	11973	2837	9278
Common	10920	10342	10147	9779	11668	3104	9327

LSD
1965: .05 = 2517, .01 = 3903
1966 through 1970: Variety means not significantly different at the 0.05 probability level.

Table 4. Forage yields of bermudagrass at Goodwell. Soil type: Richfield silty clay loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	3	3	3	5	
Variety	1965	1966	1967	1968	Average
Midland	13845	13323	8741	9438	11337
Panhandle Selection No. 1	9264	12163	7297	7689	9103
Panhandle Selection No. 2	8950	12070	7074	6444	8635
Greenfield	8723	11691	7299	6001	8429

LSD
1965: .05 = 3234, .01 not significant
1966 and 1967: Variety means not significantly different at the 0.05 probability level.
1968: .05 = 1800, .01 = 2586

Table 5. Forage yields of bermudagrass at Mangum. Soil type: Meno sandy loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	5	4	4	4	4	
Variety	1966	1967	1968	1969	1970	Average
Coastal	7875	3512	5500	6099	5773	5752
Midland	7821	3993	4974	4565	6172	5505
Greenfield	2073	1506	3186	2668	1408	2168
Common	2369	1732	2632	3222	1752	2341

LSD
1966: .05 = 1411, .01 = 2027
1967: .05 = 1448, Variety means not significantly different at the 0.01 probability level.
1968: .05 = 1239, .01 = 1781
1969: .05 = 1266, .01 = 1819
1970: .05 = 3188, .01 = 4360

Table 6. Forage yields of bermudagrass at Muskogee I. Soil type: Bates loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	3	4	3	4	3	3	2	
Variety	1963	1964	1965	1966	1967	1968	1969	Average
Coastal	7323	3971	7068	5164	8527	5221	5696	6139
Midland	9950	5473	6880	5205	8068	4706	5354	6519
Greenfield	9859	4322	4461	3339	6509	4961	4599	5436
Common	7464	3503	4106	2683	6307	4324	4432	4688

LSD
1963 and 1964: Variety means not significantly different at the 0.05 probability level.
1965: .05 = 1764, .01 = 2535
1966: .05 = 976, .01 = 1403
1967: .05 = 1001, .01 = 1438
1968: Variety means not significantly different at the 0.05 probability level.
1969: .05 = 835, .01 not significant.

Table 7. Forage yields of bermudagrass at Muskogee II. Soil type: Bates loam-Collinsville fine sandy loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	3	4	3	4	
Variety	1963	1964	1965	1966	Average
Coastal	4668	4938	7046	5651	5576
Midland	7302	5766	7522	4544	6284
Greenfield	3449	4730	8003	4052	5058
Common	3544	3842	6703	3600	4422

LSD

1963: .05 = 2104, .01 = 3023
1964 through 1966: Variety means not significantly different at the 0.05 probability level.

Table 8. Forage yields of bermudagrass at Muskogee III. Soil type: Taloka silt loam. Yields given in pounds of oven-dry forage per acre.

Number of Harvests	3	4	3	4	3	3	2	
Variety	1963	1964	1965	1966	1967	1968	1969	Average
Coastal	7545	5018	9498	4200	7740	5608	6059	6524
Midland	8376	6120	9949	4506	7874	5706	5827	6908
Greenfield	7811	3534	6953	2475	5351	4822	4548	5070
Common	6184	3792	5696	2302	5858	4884	4250	4709

LSD

1963: Variety means not significantly different at the 0.05 probability level.
1964: .05 = 1449, .01 = 2083
1965: .05 = 2679, Variety means not significantly different at the 0.01 probability level.
1966: .05 = 1249, .01 = 1794
1967: .05 = 915, .01 = 1314
1968: Variety means not significantly different at the 0.05 probability level.
1969: .05 = 985, .01 = 1415

Table 9. Forage yields of bermudagrass at Perkins. Soil type: Vanoss fine sandy loam. Yields given in pounds per acre of oven-dry forage.

Number of Harvests	3	2	
Variety	1966	1967	Average
Coastal	4662	2962	3812
Midland	5370	2962	3832
Greenfield	3093	897	1995
Common	2635	941	1788

LSD

1966: .05 = 1074, .01 = 1543
1967: .05 = 737, .01 = 1059

Table 10. Average yields over years at each location.

Variety	Altus	Chickasha	Goodwell	Mangum	Muskogee I**	Muskogee II**	Muskogee III**	Perkins	Average*
Coastal	9755	10694	--	5752	6139	5576	6524	3812	6893
Midland	8900	10240	11337	5505	6519	6284	6908	3832	6884
Greenfield	6216	9278	8429	2168	5436	5053	5070	1995	5032
Common	5253	9327	--	2341	4688	4422	4709	1788	4647

* Yields from Goodwell were not included because of absence of Coastal and Common.
** Muskogee I = Bates loam, II = Bates loam-collinsville fine sandy loam, III = Taloka silt loam.

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