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CUMBERLAND SUDANGRASS

BY ELMER GRAY, J. K. UNDERWOOD,
H. A. FRIBOURG, J. S. RICE

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The University of Tennessee
Agricultural Experiment Station
John A. Ewing, Director
Knoxville

DISCUSSION AND SUMMARY

SUMMER annual forage sorghums, including sweet sorghums, sorghum-sudangrass hybrids, and sudangrasses, are important in the forage program in many areas of the United States. They produce a high quality forage during the summer when many of the cool-season forage crops are not very productive. Although there has been an increase in acreage of summer annual forage sorghums in recent years, the relative importance of sudangrass types has decreased. This has resulted partly because of the higher yielding ability of the hybrids. However, the fine stems and low prussic acid potential of sudangrass types are desirable characteristics of forage sorghums.

The variety Cumberland is a sudangrass type. It has yielded more dry matter than other sudangrasses in Tennessee; its prussic acid potential is as low as that of any other variety. Results from yield tests conducted in several states indicate that Cumberland has a wide area of adaptation. The level of resistance to leaf diseases in Cumberland has been superior to that of Common sudangrass and about equal to that of other sudangrass varieties.

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CUMBERLAND SUDANGRASS

by

Elmer Gray, J. K. Underwood, H. A. Fribourg, and J. S. Rice*

CUMBERLAND, a new variety of sudangrass, was released in March, 1967 by the University of Tennessee Agricultural Experiment Station. During the experimental and evaluation stages, this variety was referred to as Tennessee Synthetic 1.

The acreage of summer annual grasses-pearl-millet, sudangrasses, and sorghum-sudangrass hybrids in Tennessee has increased rapidly in recent years. Increase in acreage of the sorghum-sudangrass hybrids has been most striking.

HISTORY AND DESCRIPTION

Cumberland was developed at the Tennessee Agricultural Experiment Station, Knoxville, in the early 1950's. Its parents include Line 17 of California 23, a vigorous selection of Common sudangrass; Leoti, a sweet, juicy, forage-type sorghum; and Piper, a disease-resistant sudangrass variety, low in prussic acid, developed at the University of Wisconsin. California 23-17 was crossed with Leoti, and also with Piper. The two resulting F_1 progenies were crossed: (California 23 x Leoti) X (California 23-17 x Piper). From the progeny of this second cross, lines SG 2-7, SG 3-7, and SG 1-16 were selected. Equal weights of seed of these lines were mixed and grown under isolation to produce first synthetic generation seed.

Cumberland has many of the characteristics associated with the true sudangrasses. The seed is brownish in color and the glumes or chaff of mature seed vary from brown to reddish-purple to black. Stems are long and narrow, and the panicle is spreading.

* Assistant Professor, Associate Professor (retired), Associate Professor, and Assistant-in-charge, respectively, Department of Agronomy.

YIELD PERFORMANCE

Cumberland has been included in the forage sorghum variety tests for a number of years at several locations in Tennessee. In order to evaluate the growth characteristics and yield of the varieties in these tests, they were cut when the growth reached a height of 30 to 36 inches. The forage was dried and weighed for yield determination. A stubble height of 6 to 8 inches was left to

Table 1. Yields of Cumberland, Greenleaf, and Piper sudangrasses at 5 locations in Tennessee

Location	Year	Number of harvests	Dry Matter Yield		
			Cumberland	Greenleaf	Piper
			Tons per acre		
Springfield	1956	5	5.21	5.15	5.63
	1957	5	3.20	3.53	3.36
	1958	4	3.81	3.62	3.09
	1959	4	4.06	3.47	3.19
	1960	5	4.01	3.47	3.30
	1961	3	3.73	2.75	2.36
	1962	4	4.04	2.96	2.55
	1963	4	5.59	4.71	3.32
	1964	4	3.63	2.61	2.78
Average			4.13	3.58	3.29
Knoxville	1956	3	1.97	1.97	2.71
	1957	5	1.33	1.36	1.54
	1959	5	1.43	2.21	2.05
	1960	3	2.62	2.32	2.23
	1961	5	9.40	2.77	8.01
	1962	6	2.86	1.99	2.17
	1963	6	2.06	1.86	1.58
	1964	6	2.68	2.27	1.94
	1965	5	4.92	4.18	4.02
Average			3.25	2.32	2.92
Spring Hill	1956	4	5.34	5.92	5.81
	1957	4	6.35	5.88	6.03
	1958	4	3.93	3.01	2.78
	1960	4	6.38	5.15	5.06
	1961	4	5.12	5.18	4.50
	1962	5	3.43	2.72	2.42
	1963	4	4.33	3.17	3.81
	1964	4	3.59	3.00	3.74
	1965	5	3.80	3.32	3.44
Average			4.70	4.15	4.18
Jackson	1956	6	2.80	2.97	3.09
	1957	5	2.24	2.26	1.91
	1958	6	1.84	1.43	1.84
	1959	5	2.05	1.42	1.48
	1960	6	4.01	4.20	3.41
	1961	6	4.01	3.51	3.26
	1962	6	2.64	2.24	2.77
	1963	5	3.20	2.85	2.91
	1964	7	2.21	2.09	2.03
Average			2.78	2.55	2.52
Crossville	1964	5	2.85	—	2.18
Average all locations			3.69	3.15	3.18

permit rapid recovery and regrowth. Depending on seasonal conditions, anywhere from 3 to 7 cuttings were obtained per season. Results of the trials have been published (3, 4); however, yield data for Cumberland and two other sudangrass varieties recommended¹ for Tennessee, Greenleaf and Piper, are presented in Table 1. Cumberland yielded more than Greenleaf or Piper as an average at each location where the three were compared. Considering all locations and years, Cumberland exceeded Greenleaf and Piper in yield by about 15% or 0.5 tons of dry matter per acre per year (Table 1).

Although the sudangrasses are often exceeded in dry matter production by some hybrids, the yield of Cumberland has surpassed the minimum yield of 3.5 tons per acre which is used at present as the minimum needed for a forage sorghum hybrid to be recommended in Tennessee (4).

Cumberland was included in USDA Grass Tests in several states (Table 2)². Some of these tests were managed for green-chop and some for silage. Since Cumberland was higher yielding than either Greenleaf or Piper in most of these tests, it apparently has a wide area of adaptation.

Table 2. Comparison of dry matter yields of Cumberland, Greenleaf, and Piper sudangrass when grown in Tennessee and other states

Number of times ranked	Tennessee ¹			Other States ²		
	Cumberland	Greenleaf	Piper	Cumberland	Greenleaf	Piper
First	24	6	6	27	6	18
Second	6	18	12	18	18	15
Third	5	11	18	6	27	18

¹ Cumberland tied once with Piper for first, and once with Greenleaf for second.

² Other states include: Arkansas, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Mississippi, Oklahoma, South Carolina, Texas, Virginia and Washington. Based on results from USDA Grass Tests, 1962-65.

Yields of Cumberland have been studied primarily in the first synthetic generation, but yields of various other synthetic generations have been obtained (Table 3). There were some differences in yields among synthetic generations, but all the generations were not compared at the same location. There were few yield differences

¹ Greenleaf was dropped 5 years ago from the recommended list.

² USDA Grass Tests for 1962-65. Unpublished data.

due to generations when comparisons were made the same year at a given location.

Table 3. Yields of dry matter of certain synthetic generations of Cumberland sudangrass when grown in Tennessee

Location	Year	Synthetic Generation			
		1	2	3	5
		Tons per acre			
Springfield	1961	3.73	3.57	—	—
	1962	4.04	—	3.69	—
Spring Hill	1961	5.12	4.63	—	—
	1962	3.43	—	3.21	—
Jackson	1961	4.01	3.89	—	—
	1962	2.64	—	2.55	—
Knoxville	1961	9.40	9.37	—	—
	1962	2.86	—	2.40	—
	1963	3.46	—	—	4.24
	1964	3.07	—	—	3.21
	1966	2.19	—	—	2.72

Yields of the component lines and various combinations of the component lines of Cumberland were compared over a 4-year period (Table 4). There were no statistically significant differences among yields within any year.

Table 4. Yields of dry matter of component lines and various combinations of component lines of Cumberland sudangrass when grown at Knoxville, Tennessee¹

Line or Combination	Year ¹				Average
	1963	1964	1965	1966	
	Tons per acre				
SG 2-7	3.44	3.12	4.94	2.89	3.60
SG 3-7	3.68	3.37	4.83	2.72	3.65
SG 1-16	30.3	3.11	5.17	2.79	3.52
SG 2-7 selfed	3.19	3.14	4.99	2.68	3.50
SG 3-7 selfed	3.72	3.34	4.78	3.11	3.74
SG 1-16 selfed	3.00	2.90	4.69	2.94	3.38
SG 2-7 x SG 3-7	3.53	3.37	5.29	2.74	3.74
SG 3-7 x SG 1-16	3.51	3.13	5.55	2.58	3.69
SG 2-7 x SG 1-16	3.49	3.28	5.46	2.70	3.73
1:1 of SG 2-7 and SG 3-7 ²	3.46	—	4.96	2.88	3.77
1:1 of SG 2-7 and SG 1-16	3.06	—	5.32	2.69	3.69
1:1 of SG 3-7 and SG 1-16	3.32	—	5.19	2.46	3.66
1:1:1 of SG 2-7, SG 3-7 and SG 1-16	3.42	—	4.93	2.85	3.73

¹ There were no significant differences among yields within any year.

² Mixtures of seed; a 1:1 means a mixture of equal weights of seed of two lines.

Production by the forage sorghums usually is needed more in late than in early summer. Distribution of dry matter production of Cumberland throughout the season compares favorably with that of Greenleaf or Piper (Table 5). About one-half of its dry matter production came after August 1, and about one-fourth came after September 1.

Table 5. Seasonal distribution of dry matter production of Cumberland, Greenleaf and Piper sudangrasses when grown at 5 locations from 1955 to 1965 in Tennessee

Variety	Number of experiments	Adjusted ¹ Average yield	Percentage of yield				
			Before July 1	After July 1	After Aug. 1	After Sept. 1	After Oct. 1
		Tons	%	%	%	%	%
Cumberland	40	3.69	20	80	51	25	7
Greenleaf	42	3.12	18	82	51	23	6
Piper	43	3.17	22	78	45	19	5

Variety total for years and locations grown \times all years and locations base average

¹ Adjusted variety average =

Base total for same years and locations.

Base average is obtained from yield performance of Gahi-1 and Starr pearl millets, and Piper and Greenleaf sudangrasses.

PRUSSIC ACID POTENTIAL

All species and varieties of the *Sorghum* genus are believed to contain dhurrin, a precursor of prussic acid (2). Prussic acid is one of the most toxic poisons found in nature (5). Apparently, there have been very few cases of prussic acid poisoning of livestock in Tennessee.

Sudangrasses tend to be lower in prussic acid than the sorghum-sudangrass hybrids. Cumberland has been tested for prussic acid potential several times when grown in Tennessee (1, 6) (Table 6), and when grown in the USDA Grass Tests. The results indicate that the level of prussic acid potential of Cumberland is comparable to or lower than that of other sudangrass varieties.

DISEASE RESISTANCE

Leaf blight, incited by *Helminthosporium turcicum* Pass., is one of the most common leaf diseases of sorghum plants grown in this

Table 6. Prussic acid potential of whole plants of Cumberland, Greenleaf, and Piper sudangrasses grown at Knoxville, Tennessee

Stage of Growth	Year	Variety	Prussic acid potential of leaves
			ppm green weight
30 inches	1963	Cumberland	19
		Greenleaf	66
		Piper	33
15 inches	1964	Cumberland	2
		Greenleaf	14
		Piper	1
20 inches	1964	Cumberland	9
		Greenleaf	18
		Piper	6
30 inches	1964	Cumberland	1
		Greenleaf	5
		Piper	2
30 inches	1965	Cumberland	7
		Greenleaf	52
		Piper	11

area. Cumberland has a higher level of resistance to leaf diseases than does Common sudangrass. In tests conducted in Tennessee and other states, Cumberland has compared favorably with Greenleaf, Piper, and other varieties for disease resistance.

SEED INCREASE

Cumberland is a synthetic variety developed from lines SG 2-7, SG 3-7 and SG 1-16. Seed of these lines constitute breeder seed. Foundation seed, the first synthetic generation, is produced by planting a mixture of equal weights of viable seed of each of the three lines. According to the planned program of seed increase, no registered seed will be produced. Certified seed is produced from foundation seed.

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