TECHNICAL NOTES

COFFEEVILLE PLANT MATERIALS CENTER

No. 4 Coffeeville, Mississippi 1985

INITIAL EVALUATION OF INDIANGRASSES

Abstract

Twenty-six accessions of indiangrass were evaluated from 1982 through 1984 using 'Lometa' for the standard. None was superior to Lometa for forage production and vigor. Some others appeared to have better form and seed production because Lometa lodged badly late in the season. Unless additional tests show other accessions to be superior, Lometa should be recommended for the Coffeeville service area.

Introduction

Indiangrass (Sorghastrum nutans (L.) Nash) is indigenous to much of the United States east of the Rocky Mountains. Nowhere is its presence more pronounced than in the Tall Grass Prairie where it grows from 3 to 7 feet tall. It is a preferred forage species and stands decrease with close grazing. With proper management it produces large quantities of high-quality foliage when green but has fair quality when mature. Growth of this warm-season grass begins in the spring from short, scaly rhizomes. It matures in late summer or autumn. Its greatest growth is in July and August when most of the pasture grasses are affected by drought. It has potential for use as a warm-season forage in the South where bahiagrass and bermudagrass are limited by drought and low fertility or by freezing temperatures, such as in the mountains of northern Arkansas.

Materials and Methods

Plant materials assembled at the Coffeeville Plant Materials Center for this initial evaluation included:

1) named cultivars,
2) accessions in advanced evaluations at other Centers,
3) accessions from a holding block at Coffeeville, and
4) field collections from the Southern States.

Plant materials received as seed were started in the greenhouse in February of 1982, and all were transplanted to the field May 5, 1982. Prior to planting, the field (Oaklimeter sil., 0-2% slope) had been pulverized and treated with methyl bromide for weed control. Fertilizer (13-13-13) had been applied at the rate of 600 lbs./acre.

Each accession was planted 60 cm. apart in a single row 6 meters long. Rows were 2 meters apart. The area was cultivated and fertilized when necessary.

Evaluations were made periodically throughout the growing season (1982-84) according to standard procedures described in the National Plant Materials Manual. Data were stored in the National Plant Materials Data Base at Ft. Collins, Colorado. Emphasis was placed or factors related to foliage and seed production, hardiness, and date of maturity. Lometa indiangrass (PI-434362) was the standard for comparison.

A few clippings were taken from selected rows. Samples were clipped at a height of 20 cm, oven dried, and sent to Mississippi State University for forage analysis in 1983 and 1984.

Results

Except for height and width measured in centimeters, other evaluations were rated subjectively on a scale of 1 to 9 with 1 considered to have the best appearance. Evaluations were grouped into catagories that were considered important for selection (forage, seed, form, and vigor). The visual rating (1-9) was subtracted from 10 to give the best the highest number. Then a composite score was calculated by an equation that gave higher values to accessions rated best in the individual evaluations. Decimals were moved so the scores would be in the 10 to 100 order of magnitude. Average scores were compared using the Duncan's Multiple Range test.

Scores for foliage production (FOL PROD) were computed by the equation

FOL PROD = FOL HT X FOL WD X (FOL ABN + FOL UNI) where:

1) FOL HT = Foliage height
2) FOL WD = Foliage width
3) FOL ABN = Foliage abundance.

Duncans' Multiple Range test showed differences as follows:

ACCESSION	MEAN SCORE	95% LEVEL	99% LEVEL
Lometa	355.7	a	a
434343	258.3	b	ab
21203	252.0	bc	abc
315746	214.0	bc	abcd
21195	213.0	bc	abcd
434359	199.3	bcd	bcde
12599	187.0	bcde	bcde
434351	178.3	bcdef	bcde
21207	155.7	cdefg	bcde
434360	152.7	cdefg	bcde
21198	148.0	cdefgh	bcde
21194	142.3	cdefgh	bcde
434355	136.3	cdefgh	bcde
434353	128.0	cdefgh	bcde
5146	116.0	defgh	bcde
Osage	111.0	defgh	bcde
434354	109.0	defgh	bcde
21201	105.0	defgh	bcde
434345	102.3	efgh	cde
Cheyenne (B)	94.7	efgh	de
12600	86.7	fgh	de
28301	84.0	gh	de
Rumsey	83.7	gh	de
Cheyenne (A)	78.0	gh	de
21192	72.0	gh	de
434352	66.3	gh	de
21193	53.7	h	e

Scores for seed production (SD PROD) were calculated by the equation SD PROD = SD AMT X SD FIL X (SD UNI + SD LOD) where:

1) SD AMT = Seedhead amount
2) SD FIL = Seed fill
3) SD UNI = Seed uniformity
4) SD LOD = Lodging

Differences by the Duncan's Multiple Range test are as follows:

ACCESSION	MEAN SCORE	95% LEVEL	99% LEVEL
315746	112.0	a	a
434351	91.0	ab	ab
21192	86.0	abc	ab
21198	80.3	abcd	ab
21203	74.7	abcde	ab
21195	74.3	abcde	ab
434343	72.3	abcde	ab
5146	72.3	abcde	ab
21194	68.3	bcde	ab
21193	65.3	bcde	ab
434354	63.7	bcde	ab
434359	63.3	bcde	ab
Osage	63.0	bcde	ab
21201	56.7	bcde	ab
434353	52.3	bcde	ab
12600	50.0	bcde	ab
434355	49.0	bcde	ab
434352	49.0	bcde	ab
12599	49.0	bcde	ab
434345	46.3	cde	ab
Cheyenne (A)	44.0	cde	ab
Lometa	43.0	de	ab
434360	40.0	de	b
28301	39.0	de	b
Cheyenne (B)	37.7	de	b
Rumsey	36.7	e	b
21207	35.3	e	b

Scores for upright form (FORM) were calculated by the equation FORM = ((SD HT - FOL HT)/2) X (FOL ABN + SD LOD) where:

1) SD HT = Seedhead height
2) FOL HT = Foliage height
3) FOL ABN = Foliage abundance
4) SD LOD = Lodging

Differences by the Duncan's Multiple Range test are as follows:

ACCESSION	MEAN SCORE	95% LEVEL	99% LEVEL
315746	271.7	a	a
434359	265.7	ab	ab
21195	264.3	ab	abc
12599	257.3	abc	abc

5146	257.0	abc	abc
21203	248.7	abcd	abcd
434351	244.7	abcde	abcde
21194	243.3	abcdef	abcde
434343	224.0	abcdefg	abcdef
434355	218.7	bcdefgh	abcdef
21201	217.7	bcdefgh	abcdef
21198	214.7	cdefghi	abcdef
Lometa	204.7	defghij	abcdef
28301	197.7	efghij	abcdef
21207	196.0	efghij	abcdef
Rumsey	196.0	efghij	abcdef
12600	195.0	fghij	abcdef
434360	192.0	ghij	bcdef
434345	186.0	ghij	cdef
Cheyenne (A)	177.0	ghij	def
434353	176.7	ghij	def
21193	174.7	hij	def
Osage	174.3	hij	def
434352	173.7	hij	def
434345	173.3	hij	def
21192	168.0	ij	ef
Cheyenne (B)	157.7	j	f

Vigor (VIG) or overall appearance was calculated by the equation VIG = (V1 + V2)/2 where:

1) V1 = Early season vigor
2) V2 = Late season vigor

Differences by the Duncan's Multiple Range test are as follows:

ACCESSION	MEAN SCORE	95% LEVEL	99% LEVEL
Lometa	88.3	a	a
12599	85.0	ab	ab
21203	83.3	abc	abc
21195	80.0	abcd	abcd
21194	78.3	abcde	abcde
434360	75.0	abcdef	abcdef
434343	75.0	abcdef	abcdef
315746	75.0	abcdef	abcdef
21207	75.0	abcdef	abcdef
434359	73.3	bcdefg	abcdef
434351	73.3	bcdefg	abcdef
Rumsey	73.3	bcdefg	abcdef
21198	71.7	bcdefg	abcdef
434353	70.0	cdefgh	abcdef
5146	70.0	cdefgh	abcdef
21201	68.3	defghi	abcdef
Osage	68.3	defghi	abcdef
21193	66.7	defghi	abcdef
434355	65.0	efghi	bcdef
Cheyenne (A)	65.0	efghi	bcdef
Cheyenne (B)	65.0	efghi	bcdef
434354	61.7	fghi	cdef
28301	60.0	ghi	def

21192	60.0	ghi	cdef
12600	60.0	ghi	def
434354	56.7	hi	ef
434352	55.0	i	f

Date of maturity was shown to be related to the location where the accession was collected. The northern most ecotypes matured almost 2 months earlier than those collected in the South. The origin of some ecotypes is presently unknown. Average dates of maturity and origin for the various accessions is as follows:

ACCESSION	MATURITY DATE	STATE COLLECTED
21193	Sept. 6	West Virginia
21192	Sept. 7	West Virginia
21194	Sept. 11	West Virginia
434352	Sept. 15	
Osage	Sept. 28	Kansas
5146	Sept. 29	Missouri?
21195	Sept. 29	Kentucky?
Cheyenne	Sept. 30	Oklahoma
Rumsey	Oct. 1	Illinois
28301	Oct. 2	Arkansas
12600	Oct. 21	Arkansas
434353	Oct. 25	
434354	Oct. 28	
21198	Oct. 28	Georgia
21201	Oct. 28	Georgia
434359	Oct. 28	Arkansas
434355	Oct. 30	
12599	Nov. 1	Arkansas
315746	Nov. 5	Mississippi
21203	Nov. 6	Georgia
Lometa	Nov. 7	Texas
434360	Nov. 11	Louisiana
434343	Nov. 15	Mississippi
434351	Nov. 15	
21207	Nov. 16	Alabama
434345	Nov. 19	Georgia

Discussion

Data from initial evaluation of these indiangrasses show considerable variation among ecotypes. If one uses the 99 percent confidence level for foliage productivity and the 95 percent level for the other categories, a conclusion could be drawn that there is no difference in several accessions for each of the 4 categories.

FOLIAGE	VIGOR	SEED	FORM
Lometa	Lometa	315746	315746
434343	12599	434351	434359
21203	21203	21192	21195
315746	21195	21198	12599
21295	21194	21203	5146
	434360	21195	21203
	434343	434343	434351
	315746	5146	21194
	21207		434343

Of the 26 accessions in the test, 12 are in one of the preceeding categories. Four accessions are listed under all categories. The four "superior" accessions selected by this method are:

315746 Collected in Yalobusha Co., Mississippi by V. E. Ahlrich.
434343 Collected in Yalobusha Co., Mississippi by V. E. Ahlrich.
21203 Collected in Georgia by H. J. Haynsworth.
21195 From Quicksand, Kentucky Plant Materials Center.

Of the named varieties in the test, only Lomèta was listed as superior in any category. It was equal to or better than any other for foliage productivity and vigor. The only problem with Lometa was lodging late in the season.

Data for these initial evaluations are mostly qualitative rather than quantitative. However, in 1984 a few clippings were taken September 10 from the four rows that were considered best at that time. Samples were taken from a linear meter of row. Plot size for calculating tons/acre was 1 x 1/2 meter, but in clipping, the width was not this precise. Oven dry weights in tons/acre (grams/plot) were as follows:

	LOMETA	315746	12599	21207	ALL
	20.7 (2400)	25.7 (2975)	19.8 (2300)	26.7 (3100)	
	16.8 (1950)	16.2 (1875)	20.7 (2400)	27.2 (3150)	
Average	18.8 (2175)	20.9 (2425)	20.3 (2350)	27.0 (3125)	21.7 (2518)

It is ironic that dry weight for Lometa was the least here, and 21207 that appeared only in the VIGOR list produced the most. The reason for this lack of correlation of dry weight with the calculated scores is not known. It may be that the samples were taken from the best part of the row and are not representative of the entire row. It may mean that the scores from qualatative evaluations can not be used to indicate production. Regardless of the reason, the number of samples were too few to show a difference at the 95 percent confidence level. Advanced evaluations with more quantative data would be necessary to draw other conclusions.

In 1983 and 1984 samples were clipped in mid-September and sent to the Forage Laboratory at Mississippi State University with the following results.

	Calculated Digestible Protein (%)	Calculated TDN (%)	Energy Therms/cwt
Lometa			
1983	3.68	52.11	37.96
1984	2.64	45.83	29.21
Average	3.16	48.97	33.57
315746			
1983	4.33	55.47	42.64
1984	2.65	49.74	34.66
Average	3.49	52.60	38.65
12599			
1983	3.91	50.19	35.14
1984	4.18	52.41	38.38
Average	4.04	51.30	36.83

21207			
1983	3.39	50.09	35.14
1984	2.64	51.57	37.20
Average	3.01	50.83	36.17
ALL			
1983	3.82	51.96	37.72
1984	3.02	49.88	34.86
Average	3.42	50.92	36.29

Again, the data are two few to show statistically that one accession has the best forage quality, but they do indicate what the forage quality is when the plant is approaching maturity.

Conclusion

This initial evaluation showed that indiangrasses collected in the Southeast performed better at the Coffeeville Plant Materials Center than those from other regions. Those originating to the north matured earlier, a characteristic that might be considered if an early maturing variety is desired. Lometa, which came from a comparable latitude in Texas, was the best of the released varieties. Coming from a drier climate, Lometa lodged badly late in the season. For this reason one of the Southeastern ecotypes would probably be a justifiable candidate for release in the Southeastern States. The problem would be acceptance of this type of grass instead of the traditional ones that can be grazed to the ground. Since acceptance may come with time, the germplasm for the assembly should not be lost. Consideration should be given to preserving seeds of the better accessions at the National Seed Storage Laboratory. A composite sample of all germplasm would also provide a gene pool for plant breeders and could be useful for seeding in a wide range of conditions where nature could select for the best adapted ecotypes.

TABLE I. EVALUATIONS FOR INDIANGRASSES AT COFFEEVILLE PMC
Project 281481R

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIG 1	VIG 2	SD AMT	SD FIL	SD UNI	SD LOD	SD HT	BOOT DATE	MATUR DATE
5146	82	122	70	5	5	90	3	5	5	3	5	1	170	07/13	09/28
	83	124	92	2	5	90	3	3	3	7	1	1	214	07/27	09/23
	84	120	60	3	1	90	1	3	1	2	1	1	230	07/16	10/06
12599	82	100	92	1	5	100	3	1	3	5	5	1	152	08/17	11/16
	83	126	126	1	3	100	1	1	4	9	3	3	190	08/07	10/20
	84	105	100	1	2	100	1	2	3	2	3	1	220	08/27	10/30
12600	82	92	51	3	1	100	3	5	3	5	5	1	135	08/17	10/14
	83	100	80	3	3	100	4	5	5	4	5	1	160	08/17	10/20
	84	80	65	4	2	100	3	4	3	4	5	1	180	08/27	10/30
21192	82	75	92	5	5	100	5	5	3	3	3	1	122	07/08	09/07
	83	75	70	5	1	100	5	3	3	3	1	1	183	07/01	08/17
	84	65	70	3	1	100	3	3	1	4	1	2	180	06/11	09/05
21193	82	61	50	5	3	100	3	3	3	5	5	1	125	07/11	09/28
	83	96	60	3	3	100	3	4	3	7	3	1	185	07/04	08/17
	84	65	60	4	5	100	3	4	1	3	1	1	160	06/11	09/05
21194	82	92	110	3	3	100	1	3	1	7	3	1	152	07/11	09/14
	83	112	76	3	3	100	3	3	1	7	1	1	200	06/20	09/13
	84	115	90	2	2	100	1	2	1	3	1	1	220	06/11	09/05
21195	82	100	70	3	3	100	3	3	1	3	3	1	183	07/13	09/28
	83	175	118	1	3	100	3	1	5	7	1	5	224	07/13	09/23
	84	130	90	1	1	100	1	1	1	3	1	3	230	07/16	10/06
21198	82	122	75	3	1	90	3	3	3	3	1	3	160	07/27	11/05
	83	144	118	3	4	90	3	3	3	3	3	3	185	08/04	10/20
	84	90	70	3	2	90	2	3	3	1	2	3	220	07/30	10/30
21201	82	115	75	3	3	100	3	3	3	3	5	1	183	07/27	11/05
	83	124	92	3	4	100	3	3	3	3	5	3	183	08/24	10/20
	84	50	70	3	4	100	3	4	3	6	4	1	200	07/16	10/30
21203	82	100	130	1	5	90	3	1	3	3	3	3	*	08/17	11/05
	83	124	183	1	1	90	1	1	5	3	3	5	213	09/13	11/07
	84	130	80	3	1	90	2	2	1	1	3	3	230	07/30	11/05

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIG 1	VIG 2	SD AMT	SD FIL	SD UNI	SD LOD	SD HT	BOOT DATE	MATUR DATE
21207	82	122	92	1	3	100	3	3	*	*	*	*	*	*	*
	83	110	98	1	3	100	3	1	5	9	3	5	200	09/13	11/18
	84	85	90	2	3	100	3	2	3	3	3	3	125	09/05	11/14
28301	82	92	30	5	7	90	5	7	5	9	7	1	152	08/17	11/05
	83	120	100	3	5	80	3	4	3	5	5	3	175	09/13	11/02
	84	90	80	3	5	90	2	3	3	3	5	1	180	07/30	10/30
315746	82	122	92	3	1	100	3	5	1	3	1	1	195	08/17	11/05
	83	183	100	1	4	100	3	1	1	2	1	3	200	09/13	11/10
	84	110	95	1	1	100	2	1	1	2	1	4	230	09/05	10/30
315747	82	100	61	3	1	100	1	3	5	9	1	1	152	07/27	10/05
	83	96	65	4	3	100	2	5	3	9	1	1	150	07/12	09/23
	84	80	60	4	1	100	2	3	3	3	1	1	190	07/16	10/06
421594	82	92	45	3	1	100	3	3	3	3	3	5	152	07/27	10/05
	83	128	92	3	1	100	1	3	5	7	3	7	183	07/12	09/13
	84	75	75	3	3	100	5	4	2	3	1	2	220	06/28	10/06
434343	82	140	152	1	3	100	3	3	1	3	3	5	183	07/13	11/10
	83	112	183	2	3	100	2	3	3	3	3	4	210	09/13	11/21
	84	75	100	2	1	100	2	2	2	4	1	3	220	09/04	11/15
434345	82	92	135	1	5	90	5	3	1	7	3	1	152	08/17	11/15
	83	100	100	5	6	90	6	5	5	9	3	1	130	09/13	11/21
	84	55	60	4	3	90	3	4	3	3	1	1	130	09/05	11/21
434350	82	92	61	3	3	100	3	3	3	5	3	5	175	07/13	10/05
	83	110	61	3	3	100	3	4	3	9	3	5	200	07/12	10/20
	84	85	60	4	4	100	5	3	1	3	4	3	220	06/25	09/05
434351	82	125	75	3	1	100	3	3	1	3	1	1	183	07/27	11/10
	83	152	92	1	1	100	1	3	3	3	3	5	195	09/13	11/21
	84	100	85	3	1	100	3	3	1	3	1	3	250	08/27	11/15
434352	82	61	31	5	5	100	7	5	7	5	5	1	122	07/27	09/21
	83	112	76	4	4	100	5	3	3	7	3	5	195	07/12	09/13
	84	80	70	3	3	100	4	3	1	3	2	2	220	06/25	09/05
434353	82	92	76	3	1	100	3	3	1	5	1	1	122	08/12	10/26
	83	112	114	3	1	100	3	3	3	9	1	1	130	08/17	10/20
	84	70	65	4	1	100	3	3	3	5	1	1	150	08/27	10/30

PI NUMBER	YR RC	FOL HT	FOL WD	FOL ABN	FOL UNI	% STD	VIG 1	VIG 2	SD AMT	SD FIL	SD UNI	SD LOD	SD HT	BOOT DATE	MATUR DATE
434354	82	100	92	3	3	100	5	5	3	7	3	1	183	07/27	11/05
	83	90	100	3	1	100	3	4	3	9	3	1	125	08/17	10/20
	84	60	60	4	1	100	2	4	3	4	1	1	150	07/30	10/30
434355	82	95	90	3	5	30	5	5	5	5	3	1	135	08/17	11/10
	83	122	100	3	3	30	1	3	5	9	5	3	152	08/23	10/20
	84	100	90	2	3	30	4	3	3	1	3	1	230	09/05	10/30
434359	82	135	92	1	1	100	3	1	3	3	1	1	195	08/17	11/05
	83	122	122	3	3	100	3	3	3	0	1	1	183	08/17	10/20
	84	100	85	3	1	100	3	3	2	2	2	1	220	09/05	10/30
434360	82	122	76	3	1	100	3	3	3	3	1	3	152	08/17	11/16
	83	130	92	2	3	100	2	2	5	9	3	6	150	09/13	11/18
	84	110	85	2	1	100	3	2	3	6	1	5	200	09/05	10/30
434362	82	152	75	1	1	100	1	1	3	3	1	5	152	08/12	11/05
	83	183	183	1	1	100	1	1	5	5	3	7	185	09/13	11/10
	84	120	120	1	1	100	1	1	5	3	3	7	180	09/05	11/06

Legend:

YR RC = Year of Record
FOL HT = Foliage Height (cm)
FOL WD = Foliage Width (cm)
FOL ABN = Foliage Abundance (a)
FOL UNI = Foliage Uniformity (a)
% STD = Percent Stand
VIG 1 = Early Season Vigor
VIG 2 = Mid-season Vigor
SD AMT = Seedhead Amount (a)
SD FIL = Seedhead Fill (a)
SD UNI = Seed Uniformity (a)
SD LOG = Lodging (a)
SD HT = Seedhead height (cm)
MATUR DATE = Date of Seed Maturation

(a) Rating scale = 1 to 9 with 1 best, 5 average, 9 very poor; 0 is none or dead

* - No data available. Average for other two years used in calculations.