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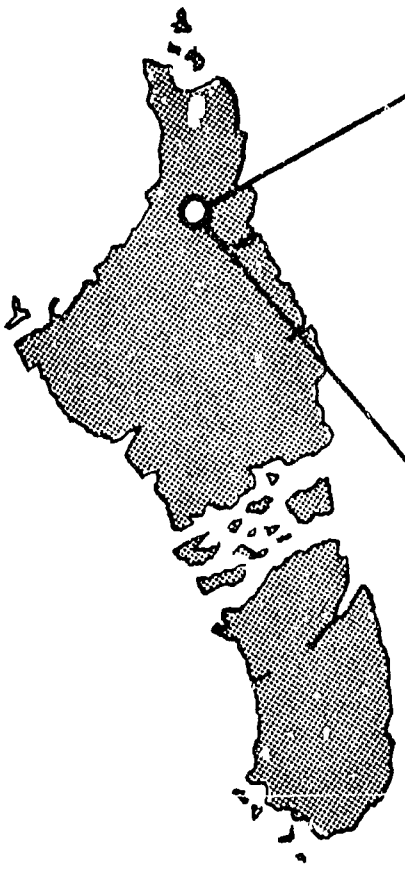

Bahamas Agricultural Research Training And Development Project

PERFORMANCE OF FOUR NAPIER GRASS VARIETIES

A.E. & R.S. BAHAMAS
FINAL REPORT NO. 23

Final Report No. 23
October, 1977

BAHAMAS AGRICULTURAL
RESEARCH, TRAINING AND
DEVELOPMENT PROJECT

Performance of Four Cultivars of Elephantgrass at the BARTAD Project, Andros Island, Bahamas

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Elephantgrass (Pennisetum purpureum), also known as napiergrass, is a native of tropical Africa, but has been grown in many other tropical countries of the world, including several islands of the Bahamas. It is mainly suited to coastal climates with an annual rainfall over 40 inches, but has also been grown successfully in frost-free sub-coastal areas with rainfall down to 30 inches.

A tall, cane-like, bunch type perennial used principally for silage and soilage, and occasionally pasture, elephantgrass has an extensive and deep root system and is, therefore, strongly drought tolerant Its main growth period is summer when temperatures, humidity and rainfall are highest. Little growth occurs during cooler months, and it is susceptable to frost.

Elephantgrass is tolerant of a wide range of soils, but does not stand flooding or water-logging. It makes its best growth on deep, loamy soils of moderate to high fertility.

It is propagated principally by stem cuttings containing 2-3 nodes.

While elephantgrass is grown on Andros Island, no information is available on the performance of the locally grown material. This study was initiated, therefore, to determine the performance of the local cultivar and to compare its performance with three newer cultivars.

SOIL AND WATER

Soils at the BARTAD site are composed of oolitic limestone sediments formed during the Plicestoncene Era. Solution of the limestone by rain and sea water during the ice age resulted in the typical flat topography containing numerous sink holes and solution channels. The water table at the experimental site is approximately 4 feet below the soil surface.

The pH values of the soils on site range from 7.8 to 8.2. Typically for the site, soil P levels are very low, K levels are low to medium, calcium levels are very high, and magnesium levels medium. Typical soil levels of several other elements are: aluminum .20 ppm (very low), manganese 3 ppm (very low), iron 10 ppm (low), copper 14 ppm (normal), zinc less than 20 ppm (low), and sodium less than 50 ppm (normal).

Rainfall and temperature data for the period of the study taken from official BARTAD records are given in Table 1. Precipitation at the site ranges from 46-52 inches annually with the dry season beginning in December and ending in May. However, as indicated in Table 1, seasonal rainfall from year to year may be highly variable and has a marked influence on total and seasonal crop production.

Table 1. Average Temperature and Rainfall Data by Months, Jan. 1975 - Sept., 1977 (BARTAD)

	1975				1976				1977			
	Rainfall Inches	Temperature F° Avg.	Min.	Max.	Rainfall Inches	Temperature F° Avg.	Min.	Max.	Rainfall Inches	Temperature Avg.	Min.	Max.
January	4.43	70	51	84	.55	64	42	80	.61	63	28	84
February	3.65	70	55	86	3.95	66	44	84	1.80	66	48	89
March	1.42	69	47	88	.16	72	50	86	.46	73	51	88
April	.69	73	51	89	1.14	73	52	87	.66	73	50	90
May	5.63	75	59	90	6.85	77	62	89	14.73	83	62	94
June	6.75	78	63	91	14.35	76	62	86	6.59	78	65	91
July	5.19	79	66	90	.89	79	67	94	3.87	80	68	91
August	2.33	80	63	91	4.30	79	66	92	5.33	80	72	89
September	5.39	80	68	89	7.48	78	64	91	10.25	79	70	88
October	4.41	78	60	88	7.93	76	56	90				
November	6.44	74	50	85	3.78	74	55	91				
December	1.80	68	48	83	2.23	70	42	85				
Total	48.13				53.88							

MATERIALS AND METHODS

Cultivars:

Cultivars used in this trial were chosen in consultation with Dr. Jose Vincente-Chandler, Puerto Rico Agricultural Experiment Station, and Dr. A. J. Oakes, USDA-ARS, Beltsville, Maryland, and include the following:

Common - collected from a planting of unknown origin already growing on North Andros.

Merker - the most widely used variety in Puerto Rico because of its resistance to a fungus (Helminthosporium sacchari) which seriously affects common elephantgrass in that country. Material evaluated in this trial was an increase of Merker brought in from Puerto Rico in January, 1974.

Merkeron - a hybrid similar in growth characteristics to Merker except that it has somewhat smaller stems and is leafier. The material evaluated in this trial was an increase of Merkeron (P.R.P.I. 7350) brought in from Puerto Rico in January, 1974.

USDA Experimental - an experimental cultivar originally collected in Africa in 1964 by Dr. A. J. Oakes and increased by the Soil Conservation Service in Florida as USDA P.I. 300086. The material evaluated in this trial was an increase of material provided by Oakes from the Florida Soil Conservation Service.

Land Preparation:

The area in which the experiment was established was rough cleared in the fall of 1973, disked several times with the D-8 tractor and Rome disk and then rolled several times with a grid roller.

Prior to planting in 1975 larger rocks were removed with a rock rake mounted on the rear of a wheeled tractor. The area was then redisked with a small disk, cultipacked and prepared for planting.

Fertilization:

The over-all fertility program was based on soil samples taken at the time the project was initiated. A total of 1500 pounds per acre of an 8-18-8 special mix fertilizer containing micro-nutrients was broadcast by hand and disked in to a depth of approximately three inches prior to planting. Sources of primary plant foods in the fertilizer were: sulfate of ammonia, monoammonium phosphate, sulfate-potash-magnesium, and ammonium nitrate. Amounts and sources of secondary plant foods were: magnesium M_gO 6.75% (sulfate-potash-magnesium), manganese MnO 1.70% (maganese frit), boron B_2O_3 .28% (borax), copper CuO .93% (copper sulfate), and zinc ZnO 1.9% (zinc sulfate).

Forty pounds per acre of nitrogen (N) from sulfate of ammonia were broadcast after each harvest. Once a year 200 pounds per acre of P_2O_5 from triple superphosphate (0-46-0) and 200 pounds per acre of K_2O from sulphase-potash-magnesium (0-0-22) were broadcast over all plots.

Establishment:

Following fertilization and disking the plot area was cultipacked. The planting material used in this trial was obtained from observational plots planted in 1974. The stems were cut into pieces containing 3-5 nodes and hand planted on July 23, 1975 in 30 inch rows with approximately one foot spacing within rows. There were four rows in each 10' x 12' plot. A randomized block design with four replications was used.

Harvest Methods:

Harvesting was done with a Carter self-propelled flail harvester 36 inches wide. Plots harvested for yield were 5' wide by 7' long. The total sample was weighed and a subsample taken for moisture determination.

Moisture samples were dried in a fuel-oil heated forced air dryer at 135°F for seven days. After weighing the dry subsamples were composited across replications and ground through 1 mm screen in a Wiley Mill. Ground samples were analyzed for crude protein and IVDMD (in vitro dry matter disappearance) at The Pennsylvania State University.

Composited samples for one harvest that had been saved for grinding and analysis were destroyed in a dryer fire.

RESULTS AND DISCUSSION

Dry Matter Yields:

Dry matter yields of the four cultivars for a period of 18 months (12 harvests) are presented in Tables 2 and 3. Total yields are shown in Table 4. As indicated, the first harvest was made March 8, 1976, approximately 7 months after planting. Cutting intervals ranged from 35 to 87 days depending on rainfall, temperature, daylength and other factors.

Total dry matter yields for the one and one-half year period ranged from 7.70 to 8.85 T/A, (Table 4). There were no significantly differences among cultivars in total dry matter yield.

Dry matter yields declined near the end of the first year and remained at a lower level during the second six months. This decline was probably caused by two factors: one, the first recorded frost for Andros occured during January 1977, and all cultivars suffered damage. Two, the cutting intervals were shorter.

Forage Quality:

Crude protein values for the four cultivars are presented in Table 5. The average percentages were very similar ranging from 7.26 to 7.76%.

Table 2. Dry Matter Yield of Four Elephantgrass Cultivars for the First Seven Harvests (Approximately One Year).

Cultivar	Harvest Date							
	3/8/76	5/18/76	7/22/76	9/15/76	12/11/76	2/4/77	3/11/77	Total
	DM Tons/A							
Common	.22	.84	1.42	1.04	1.24	.62	.37	5.75
Merker	.50	1.20	1.27	1.02	1.04	.42	.27	5.72
Merkeron	.29	1.10	1.37	1.67	1.00	.41	.24	6.08
"USDA"	.57	1.08	1.52	.78	1.01	.49	.28	5.73
L.S.D. .05	.29	.30	.40	.45	.22	.13	.10	1.17

Table 3. Dry Matter Yield of Four Elephantgrass Cultivars for the Second Five Harvests (Approximately One Half Year).

Cultivar	Harvest Date					
	4/19/77	5/24/77	6/24/77	7/29/77	9/2/77	Total
	DM Tons/A					
Common	.46	.31	.94	.71	.45	2.87
Merker	.30	.28	.59	.56	.45	2.18
Merkeron	.48	.43	.82	.62	.42	2.78
"USDA"	.31	.27	.55	.53	.31	1.96
L.S.D. .05	.12	.04	.16	.30	.23	.43

Table 4. Eighteen Months Total Dry Matter Yield of Four Elephantgrass Cultivars, March, 1976 to September, 1977.

Cultivar	First 12 Months	Second 6 Months	Total
	-----DM Tons/A----------		
Common	5.75	2.87	8.62
Merker	5.72	2.18	7.90
Merkeron	6.08	2.77	8.85
USDA	5.73	1.97	7.70
L.S.D. .05	1.17	.43	1.36

Table 5. Crude Protein Percentages of Four Elephantgrass Cultivars Over An Approximate 12 Months Period.

	Harvest Date							
Cultivars	3/8/76	5/18/76	7/22/76	9/15/76	12/11/76	2/4/77	3/11/77	Avg.
Common	7.48	5.83	5.13	5.64	Missing (1)	6.19	14.61	7.48
Merker	6.96	6.37	4.32	5.06		6.35	14.63	7.28
Merkeron	8.19	6.01	4.40	5.51		6.44	15.62	7.69
USDA	7.45	7.30	4.21	4.13		6.51	13.60	7.20

(1)Missing samples were burned in a dry fire at the BARTAD site.

As can be seen in Table 5, the harvest on March 11, 1977 had much higher levels of crude protein. This was probably the result of a shorter harvest interval.

IVDMD percentages are presented in Table 6. Differences among cultivars are small (60.63% to 61.85%) and in general are considerably higher than values obtained for other perennial grasses at BARTAD. The IVDMD percentages are also higher for the March 11 harvest reflecting the shorter harvest interval.

Stand Persistance:

Stands for all cultivars were considered good to excellent and were similar for the twelve harvests.

Insect and Disease Problems:

There were no serious insect or disease problems.

APPLICATION OF FINDINGS TO ANDROS

The results of this study indicated that dry matter yields of from 5 to 6 T/A/year could be expected under normal conditions. These yields are comparable to those from other vegetatively propagated grasses (see Final Report #22, "Performance of Several Perennial Grasses Propagated Vegetatively at the BARTAD Project, North Andros Island, Bahamas").

Several small fields of elephantgrass have been established on the research station (approximately 20 acres total) and grazed with cattle. To date the forage production from these fields does not appear to equal the production of many of the other grass or grass-legume pastures on the farm.

Table 6. IVDMD Percentages of Four Elephantgrass Cultivars Over An Approximate 12 Months Period.

	Harvest Date							
Cultivars	3/8/76	5/18/76	7/22/76	9/15/76	12/11/76	2/4/77	3/11/77	Avg.
Common	64.63	62.26	59.41	61.93	Missing (1)	56.54	66.36	61.85
Merker	62.36	66.30	54.42	60.14		59.39	66.57	61.53
Merkeron	64.78	58.66	53.09	62.11		57.57	67.57	60.63
USDA	67.81	61.22	58.29	56.08		58.80	66.54	61.46

(1) Missing samples were burned in a dryer fire at the BARTAD site.

Based on the results from small plot trials, field observations, and the amount of labour needed to plant elephantgrass, it appears that under Androsian conditions elephantgrass should not be considered for pastures since other grasses can be established easier and will produce equal on better yields. Although elephantgrass should not be used for pastures, it could have a place in livestock operations for green chop, especially if grown under higher levels of fertility.

One possible problem with using the cultivar Merkeron is that under Androsian conditions it produces viable seed. This can be spread several hundred feet by winds, a feature that makes it a potential weed. Based on additional research, this ability to set viable seed might also make it possible to establish elephantgrass by seed.