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Acceptability Trials On Buffel Grass (*Cenchrus ciliaris*) and Guinea Grass Hybrid (*Pannicum maximum*), as Compared with Napier (Merker) Grass (*Pennisetum purpureum*)

L. Rivera Brenes, J. A. Arroyo, and A. Acosta Matienzo[1]

INTRODUCTION

Buffel grass (*Cenchrus ciliaris*) was introduced by this Station from the U.S. Department of Agriculture in 1952–53. This grass was submitted to a series of trials by the Plant Breeding Department and compared favorably with common Guinea grass in yield of dry matter per acre. Guinea grass hybrid (*Pannicum maximum*) was developed by this Station in 1964. It is a cross between common and coarse Guinea grasses. This is an extremely vigorous and disease-resistant grass. It has outyielded common Guinea grass (*3*).[2]

Both grasses were transferred to the Animal Husbandry Department for further evaluation and an experiment was established at the Gurabo Substation to compare them as to the acceptability by cows. Napier (Merker) grass (*Pennisetum purpureum*), one of the most palatable grasses we have, was used as standard for comparison (*1,2*).

REVIEW OF LITERATURE

Palatability has been determined for various forages at this Station. These were Napier grass, (*Pennisetum purpureum*), Venezuela grass (*Paspalum fasciculatum*), Plantain pseudostalks (*Musa paradisiaca*) (*1*), Giant Pangola (*Digitaria valida*), and Signal grass (*Brachiaria brizantha*) (*2*). All except Venezuela grass are considered good palatable forages.

We consider it unnecessary to review the literature showing the effect of age or maturity on the dry-matter, fiber, and protein contents of the

[1] Head and Assistant Nutritionist, respectively, Animal Husbandry Department, and Assistant Agronomist, Gurabo Substation, Agricultural Experiment Station, Mayagüez Campus, University of Puerto Rico, Río Piedras, P.R.

[2] Numbers in parentheses refer to Literature Cited, pp. 83–4.

principally grammineous forages. It has been demonstrated widely that, as age of a forage increases, the percentage of fiber increases and that of protein decreases.

PROCEDURE

The experiment consisted of four trials comparing the three grasses mentioned above, using three groups of three cows each, following a 3 × 3 Latin-square design. The animals received a 7-day prefeeding and 7-day collection period for a total of 42 days in each trial.

The four trials were planned more or less to span the recognized growing seasons in the Island, and the following ages in days: 49 to 55, 63 to 69, 77 to 83, 83 to 89, 97 to 103, and 111 to 117.

The November-to-January trial covered the growth attained during September, October, and part of November. That of March and May covered the growth during February, March, and April, and that of August and September the growth during June, July, and August.

The grasses were planted in three adjacent plots, three-fourths of an acre in size each. Before starting each trial the grasses were mowed to about 4 inches from the ground, and fertilized at the rate of 400 pounds of N (181.8 kg.), 300 pounds of P_2O_5 (131.8 kg.), and 300 pounds of K_2O (131.8 kg.) per acre per year. One-sixth of these amounts was applied as if the grasses were to be harvested six times during the year.

Nine mature Holstein cows were used in each trial, one of which was fistulated for the collection of rumen fluid for digestibility determinations. Most of them were dry and open, and a few less than 3 months pregnant.

Enough grass was cut each morning from each plot to feed the three cows in each group. All forage offered, as well as that refused, was weighed and sampled to compute green- and dry-matter consumption, and for crude-protein analysis.

This work was done at the Gurabo Substation.

RESULTS AND DISCUSSION

Results on the average consumption of fresh forage and dry matter and crude protein and dry-matter content are presented in table 1. All ages and trials were assembled for each grass individually.

The statistical comparisons of the results in table 1 are presented in table 2. Dr. B. G. Capó's "T" tables (unpublished), based on Duncan's multiple-range tests, were used for tests of significance.

As in previous experiments (*1,2*), it is important to note in table 1 that the cows consumed more fresh Napier grass than either of the two other grasses under study, on both a per-animal and a per-hundredweight of

live-weight basis. They also consumed more Guinea grass hybrid than Buffel grass. The differences were significant.

It is also interesting to note that, when the consumption was computed on the basis of dry matter per cow per day and per 100 pounds of live

TABLE 1.—*Average consumption of fresh forage and dry matter, and average content of dry matter and crude protein for all 3 grasses*

Grass and quanity	Average consumption—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter	Crude protein
	Green forage	Dry matter	Green forage	Dry matter		
Buffel.....lb.	52.57	16.75	4.36	1.39	31.37	5.32
.....kg.	23.90	7.60	1.98	.63		
Guinea.....lb.	66.42	18.02	5.61	1.50	27.31	5.49
Hybrid.....kg.	30.20	8.20	2.55	.68		
Napier.....lb.	86.99	18.54	7.21	1.54	21.83	5.95
.....kg.	39.54	8.41	3.28	.70		

TABLE 2.—*T values on the comparison of the 3 grasses as to fresh-forage and dry-matter consumption; and average content of dry matter and crude protein, as shown in table 1*[1]

Grasses	Consumption—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter	Crude protein
	Green forage	Dry matter	Green forage	Dry matter		
Buffel *vs.* Guinea Hybird	2.73*	1.18	2.81*	1.20	5.43**	0.74
Buffel *vs.* Napier	6.77**	1.66	6.44**	1.60	12.27**	2.72*
Guinea Hybrid *vs.* Napier	4.05**	.48	3.63**	.39	6.84**	1.98

[1] * Significant at 5-percent level; ** significant at 1-percent level.

weight, no significant differences were found among them (table 2). This was also true in other experiments (*3*), indicating that the dry-matter content of a fresh forage is apparently a factor determining the intake, or at least has a considerable influence on the amount of intake. In grasses well accepted by cattle the dry-matter intake per unit of weight, in our case, per 100 pounds of live weight, is apparently a better measure of acceptability. It is a well-known fact that the stage of maturity of a forage

TABLE 3.—*Average consumption of fresh forage and dry matter, and average content of dry matter and crude protein*[1]

Age of grasses (days)	Consumption[2]—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter	Crude protein
	Green forage	Dry matter	Green forage	Dry matter		
49–55	76.16	16.44	6.12	1.37	23.80	6.82
	34.61	7.47	2.80	.62		
63–69	70.28	18.50	5.80	1.53	27.35	5.26
	31.94	8.40	2.60	.70		
77–83	62.54	18.37	5.25	1.53	29.66	4.67
	28.43	8.35	2.40	.70		
83–89	77.24	23.10	6.41	1.92	30.98	5.63
	35.0	10.50	2.90	.87		
97–103	68.57	25.59	5.59	2.03	37.86	5.28
	31.17	11.66	2.70	.92		
111–117	62.13	23.41	5.19	1.95	38.4	3.91
	28.24	10.64	2.36	.90		

[1] Data for all the grasses were pooled together by age, in days.
[2] Upper numerals in columns below are pounds; lower numerals are kilograms.

TABLE 4.—*T values for differences in fresh-forage and dry-matter consumption, and protein and dry-matter content for all 3 grasses pooled together by age in days, as shown in table 3*

Age of grasses (days)	Consumption—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter[1]	Crude protein[1]
	Green forage	Dry matter[1]	Green forage	Dry matter[1]		
49–55						
vs.						
63–69	0.52	1.76	0.66	1.48	4.08**	6.27**
77–83	1.64	1.41	1.55	1.33	5.76**	7.37**
83–89	.57	4.37**	.45	4.09**	6.32**	3.67**
97–103	.64	5.92**	.85	4.91**	12.39**	4.76**
111–117	1.53	4.57**	1.48	4.31**	12.87**	8.95**
63–69						
vs.						
77–83	1.20	.09	.98	.06	2.27*	2.01
83–89	.97	3.02*	.96	2.95**	3.20**	1.13
97–103	.24	4.65**	.34	3.77**	9.27**	.04
111–117	1.13	3.22*	.97	3.17**	9.75**	4.15**
83–89						
vs.						
97–103	.91	1.23	.98	.62	4.58**	0.82
111–117	1.59	.16	1.46	.17	4.95**	3.98**
97–103						
vs.						
111–117	.64	1.08	.48	.45	.37	3.16**

[1] * Significant at 5-percent level; ** significant at 1-percent level.

adversely affects the amount consumed. Cows consume less fresh material as the forage matures. Table 3 shows the consumption of fresh forage and dry matter for all three grasses together by ages, and the average dry-matter and protein contents.

Although significant differences in dry-matter content were found among ages, at all ages tested (table 4), no significant differences were found in the consumption of dry matter per 100 pounds of live weight—until the grasses were more than 83 days old. From 83 to 89 up to 111 to 117 no difference was found in consumption. Apparently a peak is reached at 89 days of age or maturity.

The statistical analysis of the data in table 3 is presented in table 4.

Table 5 shows the consumption of fresh forage and dry matter for various periods of the year, and the years. The data for all grasses were pooled together for each period, average percentage of dry matter and crude protein included.

Statistical analyses of the differences found in the average green and dry-matter consumption, and average dry-matter and crude-protein contents of the grasses pooled together by seasons of the year and different years are shown in table 6.

When the grasses were studied according to the time of the year during which the trials were made, as shown in table 5, the average dry-matter content was significantly higher for March–June and July–August periods. Significantly more dry matter was also consumed during these same periods (table 6).

The crude-protein content was significantly higher for the November–December periods.

SUMMARY

An acceptability test was conducted for Buffel grass (*Cenchrus ciliaris*). and Guinea grass hybrid (*Pannicum maximum*). Napier grass (*Pennisetum purpureum*) was used as the standard for comparison. A 3 × 3 latin-square design was followed.

The experiment was made during the more or less recognized growing seasons in the Island, and the ages tested were 49 to 55, 63 to 69, 77 to 83, 83 to 89, 97 to 103, and 111 to 117 days.

Total consumption of chopped green material and dry-matter intake per cow, per day, per 100 pounds of live weight, were used as criteria for comparison.

All three grasses were equally accepted on the basis of dry-matter intake per 100 pounds of live weight.

Other important observations for grasses of the same age or stage of maturity were the following:

TABLE 5.—*Average consumption of fresh forage and dry matter for all 3 grasses pooled for different seasons and years, average percentage of dry matter and crude protein included*

Date of trials	Consumption[1]—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter	Crude protein (dry basis)
	Green forage	Dry matter	Green forage	Dry matter		
Dec. 6 to Dec. 20, 1963	66.70	14.57	5.50	1.20	23.00	6.22
	30.31	6.62	2.50	.55		
Nov. 2 to Dec. 6, 1964	73.18	15.01	6.05	1.24	21.28	6.02
	33.26	6.82	2.75	.56		
Mar. 30 to May 3, 1965	69.31	24.03	5.73	1.97	35.75	4.94
	31.50	10.92	2.60	.9		
July 6 to Aug. 9, 1965	65.43	17.47	5.73	1.50	27.72	5.17
	29.74	8.00	2.60	.68		

[1] Upper numerals in columns below are pounds; lower numerals are kilograms.

TABLE 6.—*T values for differences in fresh-forage and dry-matter consumption for all 3 grasses pooled together for different seasons and years, as shown in table 5*[1]

Date of trials	Consumption—				Average percentage content of—	
	Per cow per day		Per hundredweight of live weight		Dry matter	Crude protein
	Green forage	Dry matter	Green forage	Dry matter		
Dec. 6 to 26, 1963						
vs.						
Nov. 2 to Dec. 6, 1964	1.01	0.32	0.98	0.33	1.69	0.68
Mar. 30 to May 3, 1965	.41	6.92**	.41	6.39**	12.53**	4.38**
July 5 to Aug. 9, 1965	.20	2.12	.24	2.51*	4.64**	3.59**
Nov. 2 to Dec. 6, 1964						
vs.						
Mar. 30 to May 3, 1965	.70	7.74**	.66	7.11**	16.68**	3.70**
July 6 to Aug. 9, 1965	1.41	2.11	.87	2.56*	7.42**	3.41**
Mar. 30 to May 3, 1965						
vs.						
July 6 to Aug. 9, 1965	.71	5.63**	.21	4.54**	9.25**	1.03

[1] * Significant at 5-percent level; ** significant at 1-percent level.

1. Cows consumed more fresh material from grass of lower dry-matter content, giving an erroneous impression of better acceptability.

2. The dry-matter intake per 100 pounds of live weight increased significantly as the percentage of dry matter in the grasses increased up to about 89 days old.

From the results of this study it appears that cows consume less fresh material from a grass containing more dry matter, on a percentage basis. More information is needed to reach definite conclusions on this point.

RESUMEN

Se llevó a cabo una prueba con las yerbas Buffel (*Cenchrus ciliaris*) y Guinea híbrida (*Pannicum máximum*) en la cual se usó la yerba Napier (*Pennisetum purpureum*) como testigo, para comparar hasta qué grado el ganado prefería las yerbas anteriormente mencionadas. El diseño experimental se ajustó al cuadrado latino 3 × 3.

El experimento comprendió, más o menos, las estaciones reconocidas en la Isla para el mejor crecimiento de las yerbas, las cuales se cortaron de los 49 a los 55 días; de los 63 a los 69; de los 77 a los 83; de los 83 a los 89; de los 97 a los 103 y de los 111 a los 117 de sembradas.

El consumo total de yerba verde picada y de materia seca ingerida por vaca y por día, por cada 100 libras de peso en vivo, se usó como criterio para hacer la comparación.

Las tres yerbas fueron igualmente preferidas por las vacas, a base de la materia seca ingerida, por cada 100 libras de peso en vivo.

Las siguientes son otras observaciones importantes que se hicieron con yerbas de la misma edad o grado de madurez:

1. Las vacas consumieron mayor cantidad de yerba fresca de la que contenía menos materia seca, dando así una impresión errónea de que la preferían.

2. La ingerencia de materia seca por cada 100 libras de peso en vivo aumentó significativamente, según aumentó el porcentaje de materia seca en las yerbas hasta cerca de los 89 días de aumentó.

De los resultados de este experimento se desprende el hecho de que aparentemente las vacas consumen menos yerba fresca cuando ésta contiene más materia seca, a base de porcentaje. Se necesita más información para llegar a conclusiones definitivas sobre este particular.

LITERATURE CITED

1. Rivera Brenes, L., Herencia, J., Arroyo, J. A., and Cabrera, J. I., Palatability trials on Merker grass (*Pennisetum purpureum*), Venezuela grass (*Paspalum fasciculatum*), and Plantain pseudostalks (*Musa paradisiaca*), *J. Agr. Univ. P.R.*, *43* (4): 249–54, October 1959.

2. Rivera Brenes, L., Arroyo, J. A., Cestero, H., and Sierra, A., Palatability tests on Giant Pangola (*Digitaria valida*) and Signal Grass (*Brachiaria brizantha*) as compared to Napier (Merker) Grass (*Pennisetum purpureum*), *J. Agr. Univ. P.R.*, *45* (3): 147–150, July 1961.
3. Unpublished information from the Department of Plant Breeding, Agricultural Experiment Station, Mayagüez Campus, University of Puerto Rico, Río Piedras, P.R.