THE JOURNAL OF AGRICULTURE
OF THE UNIVERSITY OF PUERTO RICO

Issued quarterly by the Agricultural Experiment Station of the University of Puerto Rico, for the publication of articles by members of its personnel, or others, dealing with any of the more technical aspects of scientific agriculture in Puerto Rico or the Caribbean Area.

Vol. LI July 1967 No. 3

Comparison of Giant Pangola, Signal Grass, and Common Pangola as Pasture Crops in the Mountain Region of Puerto Rico

L. Rivera-Brenes, A. Rodríguez-Carbera, and H. Cestero [1]

INTRODUCTION

Giant Pangola (*Digitaria valida*, Stent) and Signal grass (*Brachiaria brizantha*, Stapf.) were introduced by this Agricultural Experiment Station a few years ago. The first came from Cuba (*10*)[2] and the second from Ceylon (*9*).

Anker-Langefoged, cited by Sotomayor *et al.* (*9*), reported outstanding success of Signal grass, in Ceylon. He said that its introduction revolutionized grassland farming there. One of the outstanding characteristics mentioned was that it grew well under shade, and it was proposed that it be planted under coconut trees.

Both of these, as well as other grasses, were submitted to a series of field tests by the Plant Breeding Department (*8*), having in mind the possibility or necessity of finding substitutes for the present most important grazing species, Common Pangola and Guinea grass, provided superior plants could be discovered, or in case a devastating pest or disease like the common Pangola virus occurs in Puerto Rico.

Palatability (*8*) and digestibility (*2*) tests were made by the Animal Husbandry Department and both grasses proved to be as palatable and as nutritious as Napier grass, and superior to it in dry-matter content. Afterwards it was decided to subject them to the animal stress in the mountainous regions where cattle-raising on pasture is most likely to develop in the future.

REVIEW OF LITERATURE

In a grazing trial comparing Guinea grass with the mixture of Para grass and tropical kudzu, and also tropical kudzu alone, Rivera Brenes, Marchán, and Cabrera (*5*) found that Guinea grass, fertilized with 180 pounds of

[1] Head of Animal Husbandry Department, Agronomist in Charge of Gurabo Substation, and Associate Animal Husbandman in Corozal Substation.

[2] Numbers in parenthesis refer to Literature Cited, p. 199.

N, 100 pounds of P_2O_5, and 50 pounds of K_2O per acre per year, had a carrying capacity of 1.17 standard dairy cow-days and 1.56 standard beef cow-days. In another grazing trial in the Lajas valley, Rivera-Brenes and Colón-Torres (*7*) found that Guinea grass, fertilized with 400 pounds of N per acre per year, had a carrying capacity of 1.19 standard dairy cow-days and 1.58 beef-cow days. Caro-Costas, Vicente, and Burleigh (*3*), working in the semiarid South Coast under irrigation, found that Pangola and Guinea grasses under heavy fertilization—840 pounds of N (382 kg.), 240 pounds of P_2O_5 (108 kg.), and 600 pounds of K_2O (273 kg) —had a carrying capacity of 1.36 and 1.67 standard dairy cow-days and 1.81 and 2.23 standard beef cow-days, respectively. With 180 pounds of N (82 kg.), 36 pounds of P_2O_5 (16.36 kg.), and 84 pounds of K_2O (38.18 kg.) per acre per year, the carrying capacity of Pangola grass pastures in the fertile lands of the Yabucoa valley was 1.12 standard dairy cow-days and 1.50 standard beef cow-days (*6*).

In a 5-year study using the same method of calculating the yield of TDN per acre and carrying capacity as in the experiment herein reported, Caro-Costas *et al.* (*4*) had the following results:

Average TDN per acre per year,
Pangola 7,425 pounds (3,375 kg.)
Guinea 7,983 do. (3,629 kg.)
Carrying capacity per acre per year,
Pangola
1.27 standard dairy cow-days
1.70 standard beef cow-days
Guinea
1.37 standard dairy cow-days
1.82 standard beef cow-days

One short ton of 14-4-10 fertilizer was used per acre per year, divided into four equal portions applied every 3 months. This was equivalent to 280 pounds of N (127.27 kg.), 80 pounds of P_2O_5 (36.36 kg.), and 200 pounds of K_2O (91 kg.).

PROCEDURE

Giant Pangola (*Digitaria valida* Stent) and Signal grass (*Brachiaria brizantha*) were submitted to a grazing trial with Common Pangola (*Digitaria decumbens*) as the check plot.

The experiment was established at the Corozal Substation located in the Mountainous Region of the Island.

Table 1 shows the rainfall at the Substation a few months before the experiment started and until it was finished.

The prevailing soil is a lateritic Cialitos clay with a slope ranging from

20 to 50 percent. The pH from 0 to 4 inches varied from 5.0 to 5.2, and at 4 to 8 inches it was 4.7[3].

The soil was treated with 2.5 short tons of lime per acre before planting, to bring the pH to about 6.0.

Pieces of stems planted as close together as possible were used in order to have the plots covered and ready to be grazed in the shortest possible time.

A randomized block design with four 1-acre replications of each grass was used. The 1-acre plots were subdivided into three paddocks for rotational grazing.

All grasses received 400 pounds of N (182 kg.), 300 pounds of P_2O_5 (136.36 kg.) and 300 pounds of K_2O (136.36 kg.) per acre per year, divided into three equal applications at 3-month intervals, and 1 short ton of lime per acre per year as a fourth application to maintain the pH of the soil at the desired level. The amount of N, P_2O_5, and K_2O per acre is the

TABLE 1.—*Rainfall distribution at Corozal Substation, P.R., from January 1964 to December 2, 1965, in inches*

Year	Rainfall for months indicated—												Total	
	1	2	3	4	5	6	7	8	9	10	11	12	Inches	Centimeters
1964	2.65	2.51	2.58	6.93	2.38	2.88	4.66	4.79	4.74	6.97	2.92	4.39	48.4	121.0
1965	4.62	1.71	1.62	4.24	22.46	4.97	6.76	10.71	7.40	4.76	8.10	0	77.35	193.35

standard we had set for all grazing trials in which grasses were being compared.

Dairy heifers (Holstein) between 10 and 12 months old were used. Three heifers, properly identified, one of which was the "tester", were assigned per acre, and the groups were made as uniform as possible as to weight.

All animals were weighed and treated for stomach parasites at the start of the experiment and weighed monthly from then until the end of the grazing season. Water and mineralized salt were provided constantly. Each group was kept in the pastures for about 1 year, hence a different group was started each year.

The put-and-take system of grazing was followed to insure a complete utilization of the roughage produced and avoiding overgrazing at the same time. The heifers were rotated in the pastures weekly.

[3] Soil classification was made by Mr. Juan Juárez, Soils Department, Agricultural Experiment Station, and tested by the Central Chemistry Laboratory.

Three weeks before the end of the first grazing year the second group of heifers was brought to a pasture near the experimental field to get them acquainted with the location. This was done because they were to enter the trial the same day the first group finished and came out.

Calculations of TDN yield per acre, standard dairy and beef cow-days, and carrying capacity were made according to the recommendations of Joint Pasture Committee of the A.S.A., A.D.S.A., A.S.A.P., and A.S.-R.M., (*1*). Statistical analyses were made using the variance and covariance methods. This trial lasted 613 consecutive days.

TABLE 2.—*Average calculated TDN yield per acre, and differences between these averages, for trials at Corozal Substation, P.R., using 3 grasses*

Grass	Pounds and kilograms of TDN	Differences between averages in pounds and kilograms
Common Pangola	12,643.75 lb. (5,747.16 kg.)	Common Pangola—Giant Pangola...3,329.75 lb. (1,695.12 kg.)
		Common Pangola—Signal grass.....288.25 N.S. lb.[1] (131.02 kg.)
Giant Pangola	8,914.50 lb. (4,052.04 kg.)	
Signal grass	12,355.50 lb. (5,616.13 kg.)	Signal grass—Giant Pangola.....3,441.00 lb. (1,564.09 kg.)

[1] Not significant.

RESULTS

Table 2 presents the average calculated total digestible nutrients per acre for the three grasses under trial, and the differences between these averages.

No significant difference was found between Common Pangola and Signal grass; both were significantly superior to Giant Pangola at the 1-percent level.

Standard dairy (average TDN yield per acre divided by 16) and beef cow-days (average TDN yield per acre divided by 12) are presented in table 3, which also includes the carrying capacity for the three grasses: TDN yield per day divided by 16 and by 12, respectively.

Common Pangola and Signal grass were almost equal in carrying capacity, while Giant Pangola was much lower, as expected.

All three grasses were equal in nutritive value, as shown by the average gains in weight per acre of the test heifers. There were 4 heifers per grass, a total of 16; (table 4).

No significant differences were found between the grasses. It is important to notice, however, the average gain for the testers on Signal grass as

compared with Common Pangola. These two grasses had about the same number of extra heifers grazing on them, besides the test animals. Giant Pangola had only the test heifer grazing on it most of the time.

The results of this trial, together with other experiments, are very important. We have now another grass that can be used by our farmers advantageously. It also can substitute for Common Pangola and Guinea grasses if this becomes necessary.

We can recommend Signal grass because it equals Common Pangola in yield per acre, carrying capacity, and nutritive value, as well as Guinea

TABLE 3.—*Standard dairy and beef cow-days, and carrying capacity, for the 3 grasses under test at Corozal Substation, P.R.*

Grass	Standard dairy cow-days	Standard beef cow-days	Carrying capacity	
			Dairy	Beef
Common Pangola	790.25	1,053.67	1.29	1.72
Giant Pangola	557.15	742.90	.81	1.08
Signal grass	722.21	1,029.63	1.26	1.68

TABLE 4.—*Average gain in weight per acre for the test heifers for the duration of the trial with 3 grasses at the Corozal Substation, P.R.*

Grass	Average weight gain per acre	
	Pounds	*Kilograms*
Common Pangola	571.25	259.65
Giant Pangola	612.50	278.41
Signal grass	636.25	289.20

grass (see Review of Literature, p. 194). It is better than Common Pangola in that it is not attacked by the yellow aphis (*Sipha flava*), which constitutes its most important insect pest, or by any known grass disease, including Pangola virus disease. Signal grass maintains itself clean of any visible symptoms of disease.

It is very resistant to trampling, forming a very thick mat, and recovering relatively fast from grazing.

It is probably better than Guinea grass as a soil-erosion preventive because it covers the ground completely.

DISCUSSION

Information from Ceylon describes Signal grass as very drought-resistant. This was reconfirmed satisfactorily at the Corozal Substation where this

grass was planted on slopes ranging from 20 to 50 percent. For 5 to 6 months before the experiment started we were undergoing a very dry spell in all the Island. Then, during the first experimental year we had only 48.4 inches of rainfall (121 cm.) as compared with the normal average of 75 inches (187.5 cm.) at the Substation. It always appeared to be the best grass of the three under test. Maybe that amount of rainfall was more than enough for it. The second year was normal with 77.35 inches (193.35 cm.).

It is important to note that the fertilizer must be very well distributed when used on Signal grass, especially if it is not raining. This grass has the tendency, even more than other grasses, to get burned if too much fertilizer is deposited on the leaves. The leaves are very hairy, apparently not permitting the excess fertilizer to slide down to the ground easily.

We do not recommend Giant Pangola for the following reasons:

1. Under animal stress the yield per acre is very low as compared with Common Pangola and Signal grass.
2. It is easily uprooted by the animals grazing on it, reducing the stands considerably. Apparently it has a very weak root system. It does not cover the ground completely.
3. Weeds compete favorably with it. Hence it requires very careful management, which is uneconomical.
4. It is attacked by the yellow aphis.
5. It is also severely attacked occasionally by an unidentified blightlike disease.

SUMMARY AND CONCLUSIONS

Signal grass (*Brachiaria brizantha*) and Giant Pangola (*Digitaria valida*) were submitted to a grazing trial to evaluate them as grazing grasses, as compared with Common Pangola (*Digitaria decumbens*). The test was carried on for 613 consecutive days in the Mountainous Region of Puerto Rico. A randomized block design was used with four replications of each treatment.

Two groups of heifers of the Holstein breed from 10 to 12 months old were used. The first group was used from March to December 1964, and the second from December 1964 to December 1965.

No significant difference was found between Signal grass and Common Pangola in TDN yield per acre and carrying capacity; both were significantly superior to Giant Pangola.

Signal grass is recommended favorably as a grass that can be substituted for Common Pangola in Puerto Rico, and also for Guinea grass.

Giant Pangola is not recommended, although it equals the other two in nutritive value. The reasons for this are discussed in the text.

RESUMEN Y CONCLUSIONES

Las yerbas Signal (*Brachiaria brizantha*) y Pangola Gigante (*Digitaria valida*) se sometieron a una prueba para evaluarlas como yerbas para el pastoreo, en comparación con la yerba Pangola común (*Digitaria decumbens*), durante 613 días consecutivos en la Region Montañosa de Puerto Rico.

Se usó un diseño de bloques al azar con cuatro repeticiones de cada tratamiento.

Se usaron dos grupos de novillas de la raza Holstein cuyas edades fluctuaban entre los 10 y 12 meses. El primer grupo empezó en marzo de 1964 y permaneció en el experimento hasta diciembre de 1964 y el segundo empezó en diciembre de 1964 y estuvo hasta diciembre de 1965.

No hubo diferencias significativas entre la Signal y la Pangola común en la producción de TDN por acre y capacidad para el sostenimiento de los animales; no obstante, ambas fueron significativamente superiores a la Pangola Gigante.

Se recomienda la yerba Signal para sustituir la Pangola común en Puerto Rico e igualmente a la yerba de Guinea.

Aunque la yerba Pangola Gigante tiene un valor nutritivo igual al de las otras yerbas, no se recomienda que se siembre en Puerto Rico. Las razones se discuten en el texto del artículo.

LITERATURE CITED

1. Anonymous, Pasture and Range Research Techniques: A report by the Joint Committee of the A.S.A., the A.D.S.A., the A.S.A.P. and A.S.R.M., *Agron. J.* *44*(1): 39–50, 1952.
2. Arroyo, J. A., and Rivera-Brenes, L., Digestibility studies on Napier (Merker) grass (*Pennisetum purpureum*), Giant Pangola (*Digitaria valida*, Stent) and Signalgrass (*Brachiaria brizantha*), *J. Agr. Univ. P.R.* *45*(3): 148–50, 1961.
3. Caro-Costas, R., Vicente-Chandler, J., and Burleigh, C., Beef production and carrying capacity of heavily fertilized, irrigated, Guinea, Napier, and Pangola grass pastures on the semiarid South Coast of Puerto Rico, *J. Agr. Univ. P.R.* *45*(1): 32–6, 1961.
4. Caro-Costas, R., Vicente-Chandler, J. and Figarella, J., Productivity of intensively managed pastures of five grasses on the steep slopes in the Humid Mountains in Puerto Rico *J. Agr. Univ. P.R.* *49*(1): 99–111, 1965.
5. Rivera-Brenes, L., Marchán, F. J., and Cabrera, J. I., Comparison of fertilized Guinea grass, Pará grass-Tropical kudzú and Tropical kudzú alone as pasture crops, *J. Agr. Univ. P.R.* *33*(3): 85–97, 1949.
6. Rivera-Brenes, L., Cabrera, J. I., and Colón, L. F., Comparison of Guinea grass-Tropical kudzu, Pará grass, Pangola grass, and St. Augustine grass as pasture crops in the Yabucoa valley in Eastern Puerto Rico, *J. Agr. Univ. P.R.*, *38*(2): 96–104, 1954.
7. Rivera-Brenes, L., Colón-Torres, E. N., Gelpí, F., and Torres-Más, J., Influence of nitrogenous fertilizer on Guinea grass yield and carrying capacity in the Lajas Valley, *J. Agr. Univ. P.R.* *42*(4): 239–47, 1958.

8. Rivera-Brenes, L., Arroyo, J. A., Cestero, H., and Sierra, A., Palatability tests on Giant Pangola grass (*Digitaria valida* Stent), and Signal grass (*Brachiaria brizantha*, Stapf.) as compared with Napier (Merker) grass (*Pennisetum purpureum*), *J. Agr. Univ. P.R.* *45*(3): 47–50, 1961.
9. Sotomayor-Ríos, A., Vélez-Fortuño, J., Woodbury, R., Schirtz, K. F., and Sierra-Bracero, A., Description and cytology of a form of Signal grass (*Brachiaria brizantha*, Stapf.) and its agronomic behavior compared to Guinea grass (*Panicum maximum* Jach), *J. Agr. Univ. P.R.* *44*(4): 208–20, 1960.
10. Sotomayor-Ríos, A., Schirtz, K. F., Woodbury, R., and Vélez-Fortuño, J., Taxonomic description and reproductive behavior of Giant Pangola (*Digitaria valida* Stent), *J. Agr. Univ. P.R.* *44*(2): 53–9, 1960.