

Forage Yield and Protein Content of Millo Blanco (*Sorghum bicolor*) and Two F₁ Hybrids¹

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ABSTRACT

Millo blanco (MB), *Sorghum bicolor* (L.) Moench, and two F₁ hybrids (Redlan × MB and CK-60 × MB) were compared for yields of green forage (GF), dry forage (DF), crude protein (CP) content, CP yield, and height at Isabela, Puerto Rico. Six cuttings were made, the first, 58 days after planting and the remaining five, approximately every 30 days. The first harvest produced the highest forage yields. Dry forage yields (DFY) of 7,700 kg/ha produced by CK-60 × MB were 27.3% more than those of the male parent. The CP content of the three genotypes 58 days after planting was about 16% and crude protein yield (CPY) of 1,362 kg/ha was observed on CK-60 × MB, 33% more than that of MB. Although forage yields of the three genotypes were reduced at 30-day harvest intervals, the CP remained high and mean values of 18% were obtained.

The GFY of Redlan × MB (118,519 kg/ha) during the 211-day growing period was 16.6% higher ($P < .05$) than that of the male parent MB.

CK-60 × MB had 18.7% more DFY and 21.2% CPY than MB ($P < .05$). No significant differences in height and CP content were observed among the three genotypes. The forage yields and high CP content obtained on MB and the two F₁ hybrids were excellent. The results indicate that these genotypes, especially the MB F₁ hybrids, are potentially good forage crops for Puerto Rico.

INTRODUCTION

Millo blanco (*Sorghum bicolor* (L.) Moench) has been used for silage and soilage (green-chop) in the southern part of Puerto Rico for many years.³ Records are not available as to its introduction into Puerto Rico nor is it known how long this plant has been under cultivation on the island. Millo blanco (MB) is a well adapted variety, highly resistant to drought, and produces excellent yields comparable to the best forage species in Puerto Rico. Under high moisture conditions and with nitrogen applications of approximately 134 kg/ha, Vázquez et al.³ reported dry forage yields (DFY) of over 39,000 kg/ha in the Lajas Valley.

MB is a short-day plant. If planted in September in Puerto Rico, it will bloom early in November; if planted after the second week of January, it will also bloom in November. Its forage yields are reduced during the flowering period. This short-day plant characteristic of MB or any other

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³ Vázquez, R., Eschenwald-Hess, A., and Martínez-Luciano, M. J., Response of native white sorghum to irrigation under different nitrogen-fertility levels and seeding rates in Lajas Valley, P.R., J. Agric. Univ. P.R. 50: 73-112, 1966.

good forage could be of advantage to farmers if managed properly. A maximum utilization of the plant must be made during the nonflowering period when the plant produces its highest yields.

Although MB produces excellent yields and is highly resistant to the major diseases affecting forage sorghums in Puerto Rico, no attempt has been made to evaluate this species alone or in hybrid combinations as to its nutritive value and dry forage potential.

This study compares the forage dry matter and protein content of MB with those of two of its F_1 hybrids when growing under long days in Puerto Rico before beginning of its flowering period.

MATERIALS AND METHODS

The experiment was conducted at the Isabela Experiment Farm of the Mayagüez Institute of Tropical Agriculture (MITA), ARS-USDA, located about 128 m above sea level with temperatures ranging from 18° to 31° C. The soil is a Coto clay (Oxisol) with a pH of approximately 5.8. All plots were fertilized with a complete fertilizer (15-5-10) at the rate of 446 kg/ha prior to planting.

MB, as male parent, was crossed to two well-known cytoplasmic male sterile A-lines of grain sorghum, CK-60 (A-3197) and Redlan (A-378). Field plots of the two F_1 hybrids (CK-60 × MB and Redlan × MB) and MB were established with a Farmall⁴ tractor on April 14, 1975. Seeding rate was approximately 15-20 seeds/m. and after emergence the plants were thinned to about 10 cm between plants.

The experiment design was a complete block with five replications. Plots consisted of two rows spaced 101 cm apart and 6 m in length. Sampling area was 4.08 m². The first cutting was made 58 days after planting, on June 10, 1975; subsequent harvests were made approximately every 30 days thereafter. The experiment was discontinued after the 6th harvest when the plants began to flower. After each cutting and throughout the duration of the experiment, N at the rate of about 56 kg/ha in a 15-5-10 analysis was applied to all plots. Overhead irrigation was applied whenever necessary.

Before each cutting, average height from the ground to the tip of the longest leaf of 2 plants/row chosen at random from each plot was measured on all treatments. Green forage yields/plot were calculated for each harvest. Samples were analyzed for dry forage and protein content at the MITA laboratories.

⁴ Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other equipment or materials not mentioned.

TABLE 1. —Mean green forage, dry matter, crude protein, crude protein yield, and height in *Millo blanco* and two F_1 hybrids at six different harvest periods¹

	Green forage yield	Dry forage yield	Crude pro- tein	Crude protein yield	Height
	Kg/ha	Kg/ha	%	Kg/ha	Cm
<i>Harvest 1 (58 days)</i>					
Redlan × MB	61,676 a	6,745 b	16.68 ²	1,162.1 b	263 ²
CK-60 × MB	60,885 ab	7,700 a	15.60	1,362.2 a	262
MB	50,720 c	5,568 b	16.42	908.9 b	259
<i>Average of harvests 2 to 6</i>					
Redlan × MB	11,369	2,018	18.05	383.5	142
CK-60 × MB	11,289	1,995	17.99	361.7	143
MB	9,637	1,719	17.98	317.6	137

¹ Means within a column with the same letter or letters in common do not differ significantly at ($P < .05$) by Duncan's multiple range test.

² Nonsignificant.

RESULTS AND DISCUSSION

Table 1 shows the average GF, DF, CP content, CP yield, and height of MB and the two F_1 hybrids CK-60 × MB and Redlan × MB for harvest 1 and the average of harvests 2 to 6. In the first cutting, 58 days after planting, no significant differences were noted between Redlan × MB and CK-60 × MB in GF/ha. The two F_1 hybrids outyielded MB ($P < .05$). The highest DF yielder was CK-60 × MB with 7,700 kg/ha. This F_1 hybrid produced 27.3% more DM than its male parent ($P < .05$). The CP content of the two F_1 hybrids and MB ranged from 15.60 to 16.68. Mean differences were not significant. The CPY of CK-60 × MB were significantly superior to those of Redlan × MB and MB ($P < .05$). CK-60 × MB produced 33% more CPY than MB. The CP content of the three genotypes were higher than those reported for the best grasses in Puerto Rico when harvested at about 60 days.⁵

Figure 1 shows the DFY, and CPY of the three genotypes when cut at 58, 30, 32, 30, 29 and 32 days. Forage and protein yields were drastically reduced compared with those of the first cutting. The CP content of the three genotypes remained high, and mean values of over 18% were obtained.

Table 2 shows the total GFY, DFY, CP, CPY, and height of MB and its two F_1 hybrids during the 211-day growing period. The GFY of the two F_1 hybrids were not significantly different. GFY were 16.6% higher

⁵ Sotomayor-Ríos, A., Juliá, F. J., and Arroyo-Aguilú, J. A., Effects of harvest intervals on the yield and composition of 10 forage grasses, *J. Agric. Univ. P.R.* 58: 448-55, 1974.

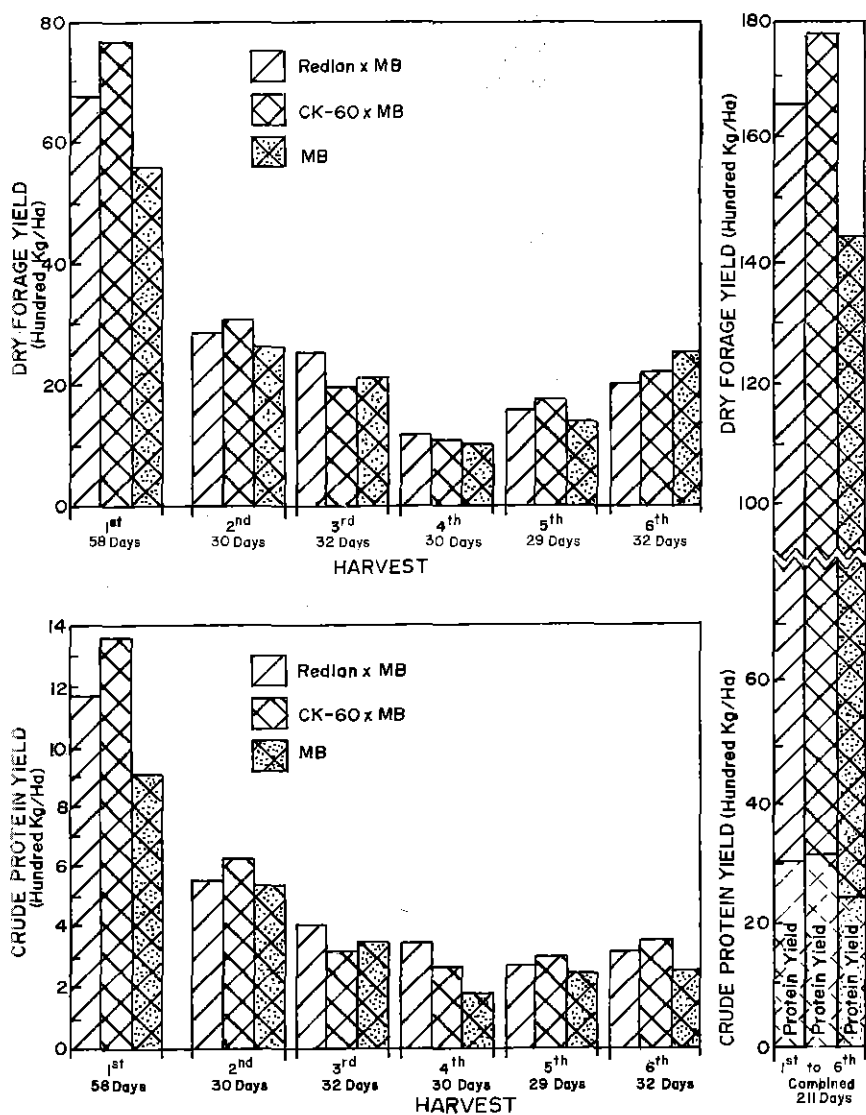


FIG. 1. — Dry matter and crude protein yields of Millo blanco (MB), Redlan x MB and CK-60 x MB cut every 58, 30, 32, 30, 29, and 32 days, respectively, at Isabela, Puerto Rico.

($P < .05$) in Redlan x MB as compared to the corresponding male parent.

The difference in DFY of the two F_1 hybrids was not statistically significant. The highest producer was CK-60 x MB and had 18.7% more

TABLE 2.—Yield, protein content, and height in Millo blanco and two F_1 hybrids during a 211 day period¹

	Green forage yield	Dry forage yield	Crude protein	Crude protein yield	Height
	Kg/ha	Kg/ha	%	Kg/ha	Cm
Redlan × MB	118,519 a	16,639 a	17.82	3,079.7 a	186 ²
CK-60 × MB	117,329 a	17,674 a	17.60	3,170.7 a	163
MB	98,904 b	14,362 b	17.71	2,497.1 b	157

¹ Means within a column with the same letter or letters in common do not differ significantly at ($P < .05$) by Duncan's multiple range test.

² Nonsignificant.

DFY than the corresponding male parent. The CP content of the three genotypes was approximately 18%. There were no significant differences among those means. The CPY of the two F_1 hybrids were not significantly different. The best CPY producer was CK-60 × MB with 3,170 kg/ha. Those yields were 21.2% higher ($P < .05$) than yields of the male parent.

The high forage yields produced by Millo blanco, CK-60 × MB and Redlan × MB, especially in the first cutting, 58 days after planting, could be an important factor to consider as to the selection of this species. Even the most aggressive forage grasses in the tropics, such as those in the genera *Cynodon*, *Brachiaria*, *Digitaria*, and others, require about 2 to 5 months of growth before light grazing or cutting is initiated. The results of this experiment show that forage sorghums such as Millo blanco or its F_1 hybrids may offer great potential for rapid utilization after planting due to their high yields and excellent CP content.

RESUMEN

Millo Blanco (MB), *Sorghum bicolor* (L.) Moench, y dos híbridos F_1 (Redlan × MB y CK-60 × MB) se evaluaron en términos de forraje verde (GF), materia seca (DF), proteína bruta (CP), y altura durante 211 días en Isabela, Puerto Rico. Se llevaron a cabo seis cortes, el primero a los 58 días y los subsiguientes cada 30 días, aproximadamente.

La producción de forraje verde (GFY) del primer corte fluctuó entre 61,676 y 50,720 kg./ha. La producción de materia seca (DFY) del híbrido CK-60 × MB de 7,700 kg./hg. fue 27.3% mayor que la de MB ($P < .05$). La CP de los tres genotipos fue de aproximadamente 16% y no se observaron diferencias significativas entre ellos. La producción de proteína bruta (CPY) de CK-60 × MB fue de 1, 1,362 kg./ha., 33× mayor que la de MB ($P < .05$).

La GFY del híbrido Redlan × MB durante el período total de 211 días fue de 118,519 kg./ha., aproximadamente 16.6% mayor ($P < .05$) que la de MB. El híbrido CK-60 × MB produjo 17,674 kg./ha., aproximadamente 18% más materia seca que MB ($P < .05$). El contenido de CP de los tres genotipos durante el período de 211 días fue excelente (aproximadamente 18%).