

# Yield Comparison of Four Forage Grasses at Two Cutting Heights and Three Harvest Intervals<sup>1</sup>

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## INTRODUCTION

Congo (*Brachiaria ruziziensis*), Napier (*Pennisetum purpureum* Schum), Para (*Brachiaria mutica* (Forsk.) Stapf), Pangola (*Digitaria decumbens* Stent), Star (*Cynodon nlemfuensis* var. *nlemfuensis*), and Guinea (*Panicum maximum* Jacq.) are grasses that have been subjected to various experimental procedures such as cutting height, frequency of cutting and stage of maturity under humid tropical conditions in Puerto Rico by Caro-Costas et al. (1,2) and Vicente-Chandler et al. (5,6,7,8,9).

These authors reported higher yields of grasses such as Congo, Napier, Para, Star and Guinea are obtained by cutting them low, 0 to 3 inches from the ground, than by cutting them high, 7 to 10 inches. They also found yields produced by all these grasses increase with length of cutting interval from 30 up to 90 days.

A series of species belonging to the genera *Brachiaria*, *Cynodon* and *Digitaria* were evaluated in Puerto Rico under various cutting systems by Sotomayor-Ríos et al. (3,4). Outstanding species, superior to Pangola in total yield and crude protein content, have been selected on the basis of these studies for further experimentation.

This experiment was designed to evaluate three of these forage grass introductions (i.e. Tanner (*Brachiaria mutica* (Forsk.) Stapf, P.I. 299299), Bermuda (*Cynodon dactylon* var. *coursii* P.I. 288218), and Hexapangola, obtained from Hawaii) found very promising in preliminary evaluations conducted under humid tropical conditions by the Plant Breeding Department of this Station when compared with Pangola (*D. decumbens* Stent, P.I. 111110) at two cutting heights and three harvest intervals.

## MATERIALS AND METHODS

The experiments were conducted over 2 consecutive years at the Corozal Substation located in the humid mountainous region of Puerto Rico at about 700 feet above sea level where temperatures range from 64° to 89° F.

The soil is a deep, red Corozal clay, an Ultisol. Lime was applied at the start of the experiment to adjust the pH to about 5.5.

The three grasses, with Pangola as check, were evaluated using a ran-

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domized split-plot design with four replications with grasses as the main plots, harvest intervals of 30-, 45- and 60-days as the sub-plots, and cutting heights of 2 or 6 inches above the ground as sub-sub-plots. Individual plots were 10 feet by 13.5 feet. A 15-5-10 fertilizer was applied at the rate of 2 tons per acre per year apportioned according to the harvest interval used.

The grasses were cut at the prescribed heights and intervals, the forage weighed, sampled, and removed from the plots. All samples were analyzed for total dry forage and crude protein content.

### RESULTS AND DISCUSSION

Analyses of variance showed significant differences for varieties, cutting intervals and cutting heights in terms of total green forage (TGF), total dry forage (TDF), dry matter content (DMC), crude protein content (CPC), and crude protein yield (CPY). There was no interaction between varieties  $\times$  cutting interval, varieties  $\times$  cutting height, cutting interval  $\times$  cutting height and varieties  $\times$  cutting interval  $\times$  cutting height for TGF, DMC, CPC, and CPY. A significant interaction for variety  $\times$  cutting interval was observed for TDF.

Bermuda (*Cynodon dactylon* var. *coursii*) was the highest yielder in terms of TDF per acre yearly at the 45- and 60-day harvest interval at both low and high cutting (table 1, fig. 1). No significant yield differences were observed among the four grasses when cut 6 inches above the ground every 30 days.

Hexapangola, *Digitaria decumbens* Stent, was the best producer in terms of CPY per acre yearly at the 30- and 45-day intervals at both low and high cutting. At the 60-day interval no significant differences were observed for total CPY per acre yearly when the grasses were cut high, although Hexapangola was the best yielder with low cutting.

### VARIETIES

The average DMC and CPC yields of the four grasses for the three harvest intervals and the two cutting heights are shown in table 2. Hexapangola, Tanner and Pangola grasses were the highest green forage yielders with 83,806, 83,770 and 81,327 pounds per acre yearly, respectively, while Bermuda *coursii* produced but 66,899 pounds. Bermuda *coursii* was the best dry forage producer, however, with an average of 21,515 pounds per acre yearly, being significantly superior to Tanner, Pangola and Hexapangola. Hexapangola and Pangola grasses had the highest CPC, with 10.8 and 10.5 percent, respectively, while Bermuda *coursii* had the lowest, 8.8 percent. The highest CPY per acre yearly, on the average, were from

TABLE 1.—Effect of frequency and height of cutting on the yield and crude protein of four tropical grasses over 2-year period

Grass	Grasses cut 2 inches from ground					Grasses cut 6 inches from ground				
	Yield of green forage per acre yearly	Yield of dry forage per acre yearly	Dry matter content	Crude protein content	Yield of crude protein per acre yearly	Yield of green forage per acre yearly	Yield of dry forage per acre yearly	Dry matter content	Crude protein content	Yield of crude protein per acre yearly
	Pounds	Pounds	Percent	Percent	Pounds	Pounds	Pounds	Percent	Percent	Pounds
	<i>Grasses cut every 30 days</i>									
Hexapangola	80,095 a <sup>1</sup>	16,403 a	21.0 b	13.0 a	1,969 a	74,200 a	15,032 a	21.0 b c	12.7 a	1,815 a
Pangola	77,545 a	16,420 a	21.9 b	13.0 a	1,920 a b	73,268 a	15,698 a	21.8 b	12.4 a	1,797 a
Tanner	75,944 a	15,620 a	20.9 b	11.7 b	1,691 b c	66,147 a	14,077 a	20.6 c	11.6 b	1,552 b
Bermuda var. <i>coursii</i>	53,688 b	15,899 a	29.4 a	11.1 b	1,589 c	53,143 b	15,563 a	30.0 a	10.4 c	1,516 b
	<i>Grasses cut every 45 days</i>									
Hexapangola	89,396 a	19,737 a	22.7 b	10.8 a	2,001 a	83,135 a	19,242 b	23.6 b	10.6 a	1,921 a
Tanner	89,047 a	19,857 a	22.4 b	8.9 b	1,667 b	79,700 a	18,170 b	22.9 b	8.8 b	1,433 b
Pangola	85,121 a	19,013 a	22.8 b	10.4 a	1,805 a b	77,526 a b	18,314 b	24.0 b	10.1 a	1,678 a
Bermuda var. <i>coursii</i>	68,975 b	21,316 a	31.2 a	8.9 b	1,727 b	68,702 b	22,113 a	32.2 a	8.4 b	1,692 a
	<i>Grasses cut every 60 days</i>									
Tanner	96,567 a	23,762 b	24.2 c	7.1 b	1,501 b	95,216 a	23,192 b	24.0 c	7.4 b	1,550 a
Hexapangola	92,182 a	22,050 b	24.4 b c	9.0 a	1,796 a	83,649 a	20,857 c	24.8 b c	8.4 a	1,568 a
Pangola	90,602 a b	23,183 b	25.3 b	8.4 a	1,665 a b	83,899 b	21,150 b c	25.3 b	8.5 a	1,574 a
Bermuda var. <i>coursii</i>	81,703 b	28,247 a	33.6 a	6.8 b	1,694 a b	75,182 b	25,954 a	33.1 a	6.9 b1	1,533 a

<sup>1</sup> Means followed by same letter are not significantly different at 0.05 level of probability.

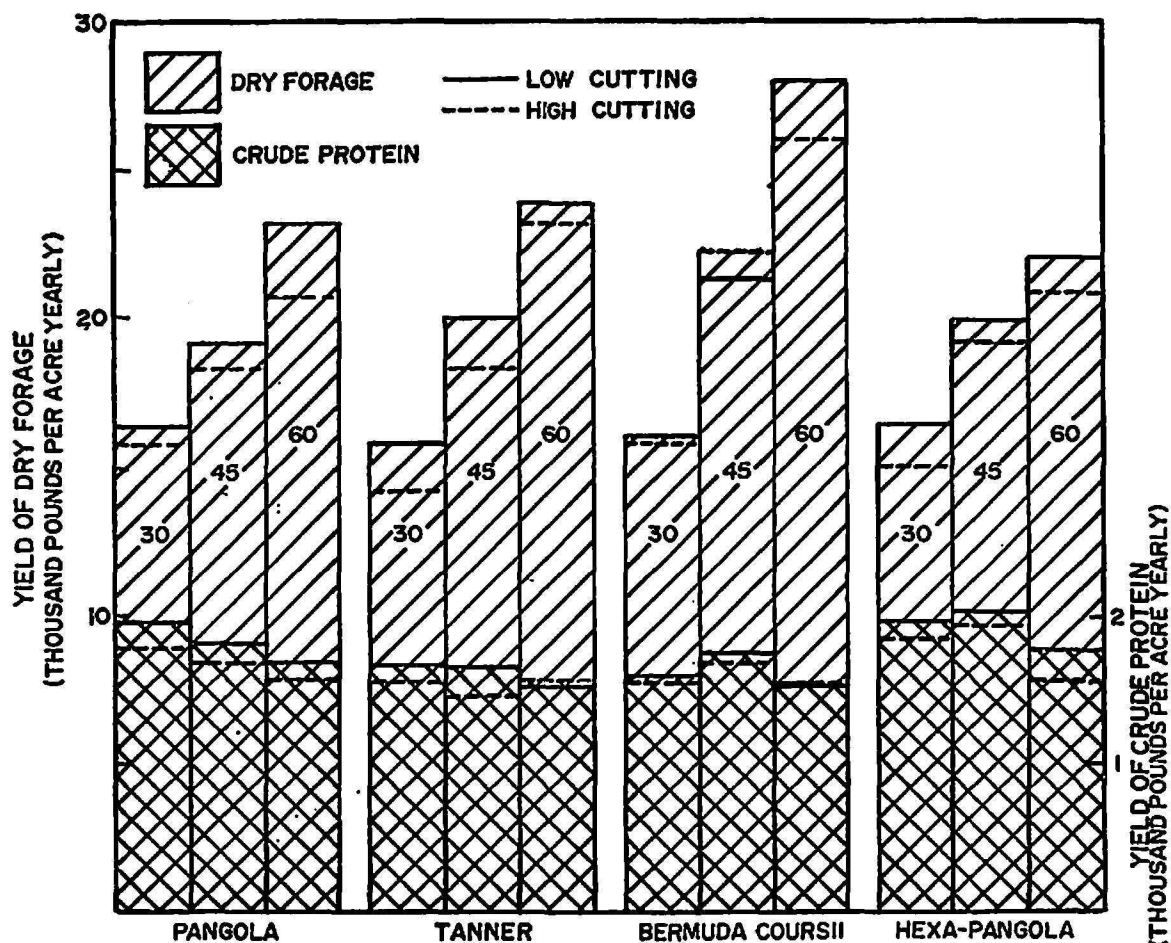


FIG. 1.—Effect of frequency and height of cutting on dry matter and crude protein yields of four forage grasses over a 2-year period at Coroza.

TABLE 2.—Average yields of crude protein and dry matter content of four grasses during a 2-year period<sup>1</sup>

Grass	Yield of green forage per acre yearly	Yield of dry forage per acre yearly	Dry matter content	Crude protein content	Yield of crude protein per acre yearly
	Pounds	Pounds	Percent	Percent	Pounds
Hexapangola	83,806 a <sup>2</sup>	18,887 b	22.9 b c	10.8 a	1,845 a
Tanner	83,770 a	19,113 b	22.5 c	9.2 b	1,566 c
Pangola	81,327 a	18,963 b	23.5 b	10.5 a	1,740 a b
Bermuda var. <i>coursii</i>	66,899 b	21,515 a	31.6 a	8.8 b	1,625 b c

<sup>1</sup> Includes averages of three cutting intervals and two cutting heights.

<sup>2</sup> Means followed by same letter are not significantly different at 0.05 level of probability.

the grasses *Hexapangola* and *Pangola* with 1,845 and 1,740 pounds, respectively.

#### CUTTING HEIGHT

The four grasses produced more forage and CPY with low than with high cutting (table 3). Low cutting produced averages of 81,739 pounds of green forage and 20,126 pounds of dry forage per acre yearly. With high

TABLE 3.—Average yields of crude protein and dry matter content of four grasses at two cutting heights during a 2-year period<sup>1</sup>

Cutting height	Yield of green forage per acre yearly	Yield of dry forage per acre yearly	Dry matter content	Crude protein content	Yield of crude protein per acre yearly
	<i>Pounds</i>	<i>Pounds</i>	<i>Percent</i>	<i>Percent</i>	<i>Pounds</i>
Low	81,739 a <sup>2</sup>	20,126 a	25.0	9.9	1,752 a
High	76,162 b	19,114 b	25.3	9.7	1,636 b

<sup>1</sup> Includes averages of four grasses and three harvest intervals.

<sup>2</sup> Means followed by letter a significantly higher than means followed by letter b.

TABLE 4.—Average yields of crude protein and dry matter content of four grasses at three harvest intervals during a 2-year period<sup>1</sup>

Cutting interval	Yields of green forage per acre yearly	Yields of dry forage per acre yearly	Dry matter content	Crude protein	Yields of crude protein per acre yearly
<i>Days</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Percent</i>	<i>Percent</i>	<i>Pounds</i>
60	87,375 a <sup>2</sup>	23,549 a	26.8 a	7.8 c	1,610 b
45	80,223 b	19,720 b	25.2 b	9.6 b	1,741 a
30	69,254 c	15,589 c	23.3 c	12.0 a	1,731 a

<sup>1</sup> Includes averages of four grasses and two cutting heights.

<sup>2</sup> Means followed by same letter are not significantly different at 0.05 level of probability.

cutting, the respective figures were 76,162 and 19,114 pounds. The average CPY were 1,752 and 1,636 pounds per acre yearly with low and high cutting, respectively. Neither CPC percentage nor TDF were affected by cutting heights.

#### HARVEST INTERVAL

The four grasses produced more TGF and TDF on the average at the 60-day harvest interval. Average green and dry forage yields for the four grasses were 87,375 and 23,549 pounds at 60-day interval, 80,223 and 19,720 at 45-day interval and 69,254 and 15,589 at 30-day interval (table 4).

DMC content of the four grasses increased significantly with length of

harvest interval from 23.3 to 26.8 percent. CPY at the 30- and 45-day intervals were similar, and superior (5 percent level) to those obtained with a 60-day interval. CPC percent of the four grasses decreased as the harvest interval increased. At the 30-, 45- and 60-day intervals the grasses averaged 12.0, 9.6, and 7.8 CPC percent, respectively (table 4).

#### EFFECT OF CUTTING INTERVALS AND SEASON OF THE YEAR

The significant (P. 0.01) variety  $\times$  cutting interval interaction for dry forage yield indicates that the grasses did not respond similarly to these treatments. Dry forage yields increased with the harvest intervals (tables 1 and 4). Similar results have been obtained with grasses such as Congo, Star, Napier, Pangola and others in Puerto Rico (1,2,6,7,8,9).

At the 30-, 45- and 60-day intervals, dry forage yields of the four grasses were apparently affected by seasonal rainfall. In general, grasses were more productive during the first year of experimentation (figs. 2, 3, and 4). The lowest dry forage yields were during the cool dry months of December to April, especially during the second year.

#### SUMMARY

Four forage grasses, i.e., Pangola, *Digitaria decumbens* Stent; Tanner, *Brachiaria mutica*; a Bermuda selection, *Cynodon dactylon* var. *coursii* and Hexapangola, *Digitaria decumbens* Stent, were evaluated under cutting management at the Corozal Substation located in the humid mountainous region of Puerto Rico. The effects of cutting heights of 2 and 6 inches above the ground, and of 30-, 45- and 60-day harvesting intervals were determined over a 2-year period. All grasses received 2 tons of 15-5-10 fertilizer per acre per year.

At all cutting heights and harvest intervals, Bermuda (*Cynodon dactylon* var. *coursii*) had the highest dry forage yields while Pangola and Hexapangola had the highest crude protein contents.

At all harvest intervals the grasses produced more total yields and crude protein per acre yearly when cut to a height of 2 inches than when cut to 6 inches above the ground.

Green and dry forage yields produced by the grasses increased and on the average, crude protein content of the grasses decreased with the length of the harvest interval.

A significant variety  $\times$  cutting interval interaction was observed for total dry forage yields. Lower yields were obtained during the dry winter months at all cutting intervals.

When cut 2 inches above the ground and every 60 days, Bermuda (*Cynodon dactylon* var. *coursii*) produced 28,247 pounds of dry forage per acre yearly containing about 9.0 percent crude protein.



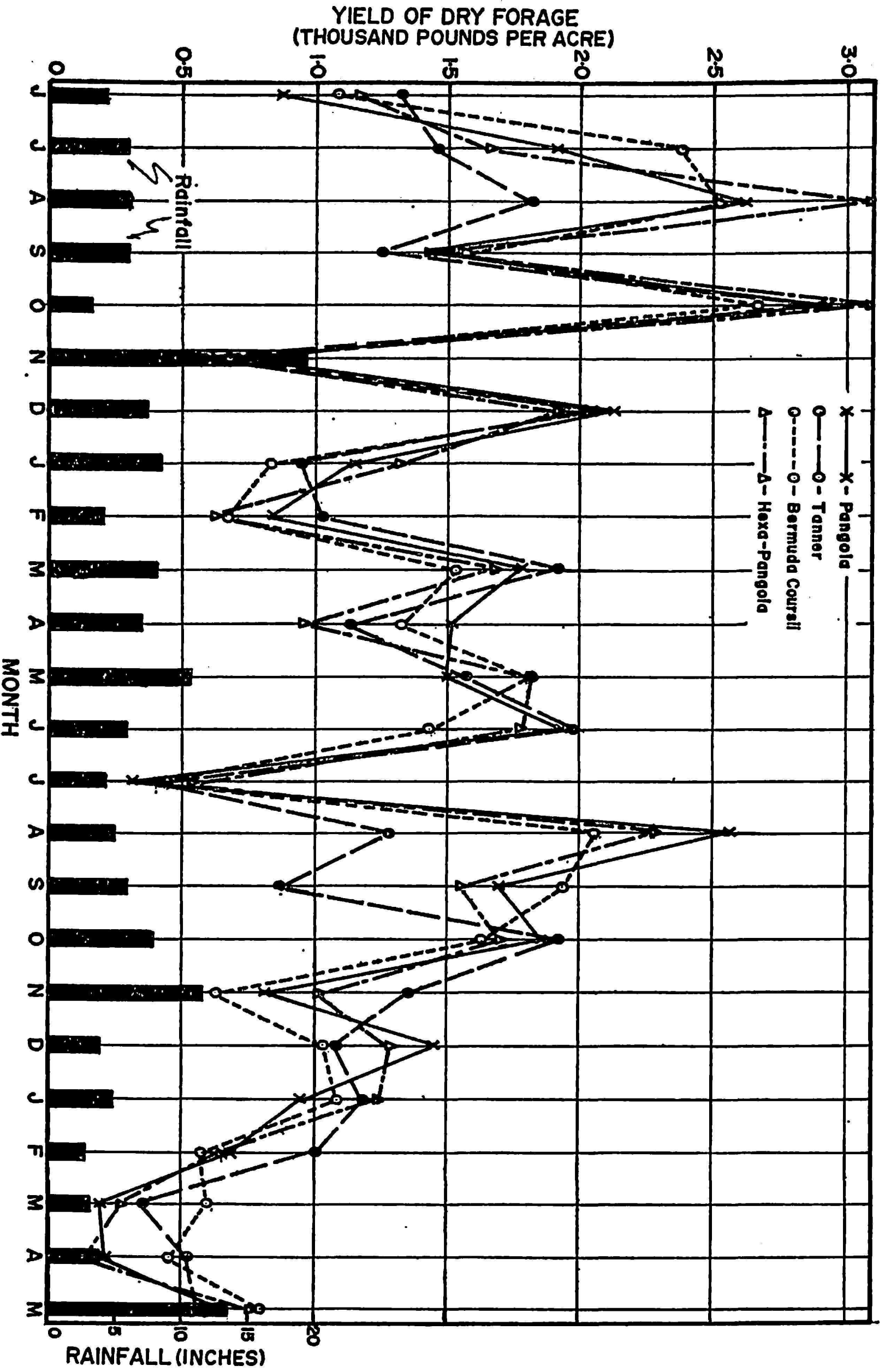


Fig. 2.—Seasonal yields of dry forage per acre produced by four grasses cut 2 inches above ground every 30 days over a 2-year period at Corozal.

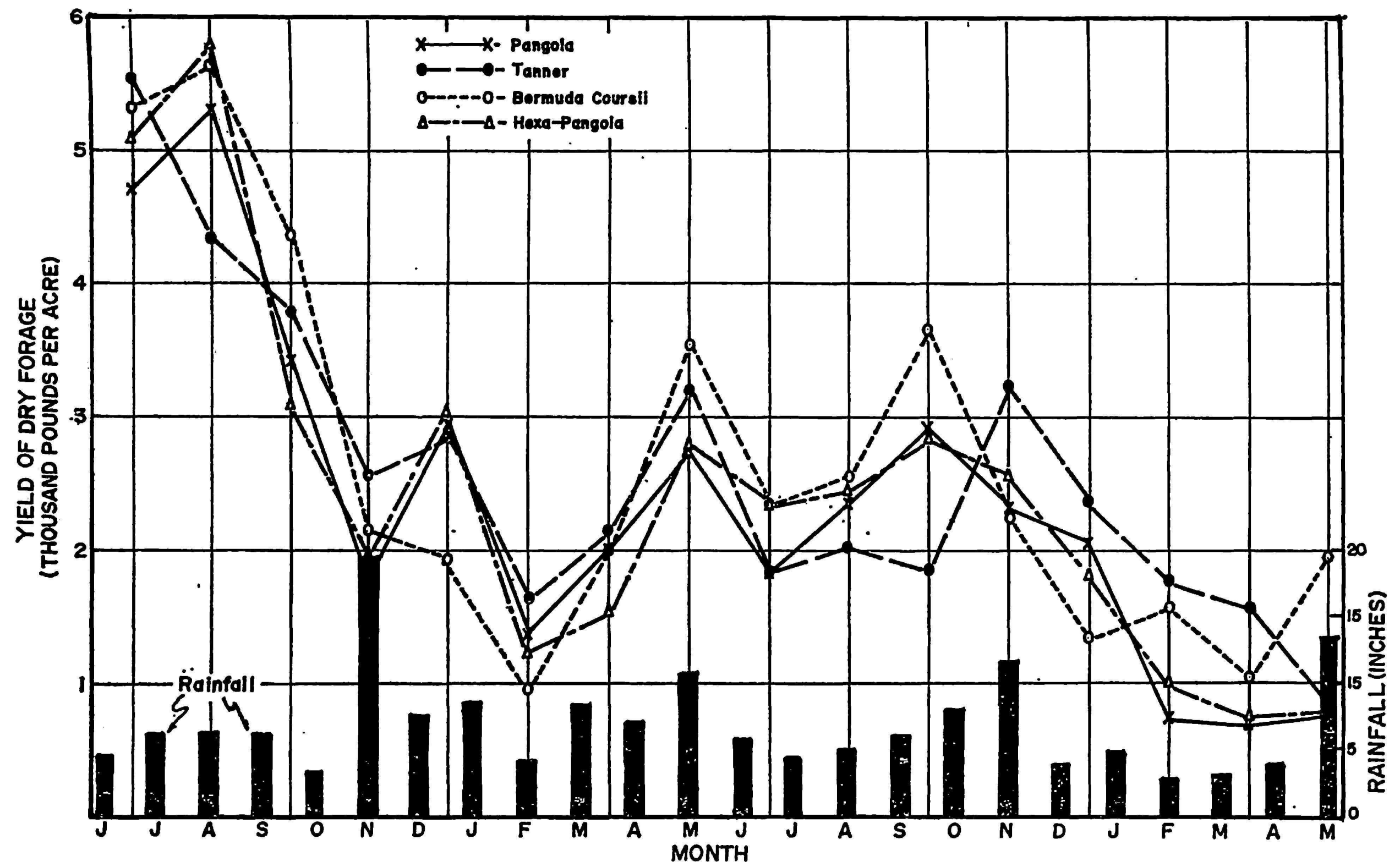


FIG. 3.—Seasonal yields of dry forage per acre produced by four grasses cut 2 inches above ground every 45 days over a 2-year period at Corozal.



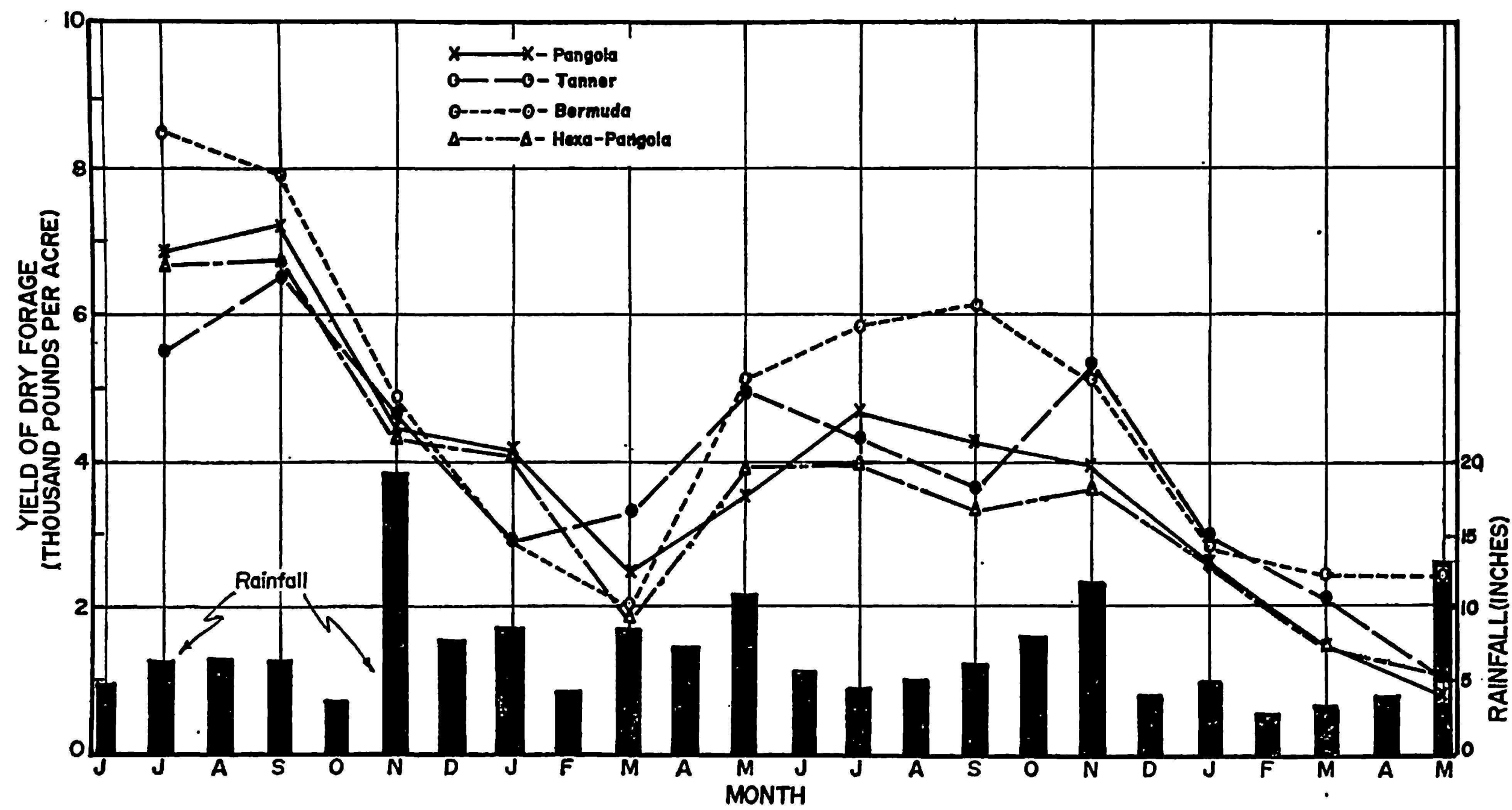


FIG. 4.—Seasonal yields of dry forage per acre produced by four grasses cut 2 inches above ground every 60 days over a 2-year period at Corozal.

## RESUMEN

Cuatro yerbas forrajeras: Pangola, *Digitaria decumbens* Stent; Tanner, *Brachiaria mutica*; una selección de Bermuda, *Cynodon dactylon* var. *coursii* y Hexapangola, *Digitaria decumbens* Stent, fueron evaluadas bajo corte en la Subestación de Corozal, que está localizada en la región húmeda montañosa de Puerto Rico. Se determinó el efecto del corte de las yerbas a 2 y a 6 pulgadas de altura cada 30, 45 y 60 días durante 2 años. Todas las yerbas se abonaron con la fórmula 15-5-10 a razón de 2 toneladas por acre por año.

La mejor productora de forraje seco fue la Bermuda, *Cynodon dactylon* var. *coursii*, mientras que la Pangola y la Hexapangola demostraron tener el contenido más alto de proteína cruda.

Las yerbas produjeron más forraje y proteína cruda por acre por año cuando se cortaron a 2, que a 6 pulgadas del suelo.

La producción de forraje verde y de forraje seco aumentó mientras que el contenido promedio de proteína cruda disminuyó según se alargó el intervalo entre los cortes.

Se observó una interacción significativa entre la variedad y el intervalo de corte en cuanto a la producción de forraje seco. Durante el invierno los rendimientos fueron más bajos independientemente del intervalo entre cortes.

La yerba Bermuda, *Cynodon dactylon* var. *coursii*, cortada a 2 pulgadas del suelo cada 60 días produjo 28,247 libras de forraje seco por acre por año con un contenido de 9.0 por ciento de proteína.

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