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Influence of Time of Planting on the Growth of Sugarcane Variety P.R. 980 at Río Piedras

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INTRODUCTION

In the Temperate Zone, almost everyone is familiar with the influence of the season on plant growth. In the spring, plant growth begins anew after the cold winter; the summer with its high temperatures and bright sun brings rapid growth; and in the autumn plant growth slows down and maturity of many plants occurs just before the rigors of the winter weather set in. Despite the absence of snow or freezing temperatures, subtropical climates such as that of Puerto Rico, also experience seasonal changes in growth rate. From visual observations the sugarcane grower in Puerto Rico is aware of the very slow growth of sugarcane in the winter months of December, January, and February, and of its rapid growth during the summer months of June, July, and August.

Stender (*3*)[2] has shown that, in Hawaii, cane growth, as measured by both cane elongation and increased volume, was highly related to air temperature, increased growth being associated with increases in the mean daily temperature. Clements and Kubota (*2*) found a positive correlation between the moisture content of the elongating cane and meristem, and the rate of elongation. A high positive correlation between rate of stalk elongation and rainfall has been reported from Formosa by Sun and Chow (*4*).

For Puerto Rico there appears to be no published information available on growth measurements for sugarcane except for the work of Brandes (*1*) who compared the growth of many of the *Saccharum* species at six selected stations at different latitudes, including Puerto Rico. Aside from random field observations, no specific study has been made in Puerto Rico on rates of growth for sugarcane for various planting dates. It is the purpose of

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[2] Italic numbers in parentheses refer to Literature Cited, p. 52.

this paper to report data on the influence that the time of the year sugarcane variety P.R. 980 is planted exerts on its growth.

PROCEDURE

The data for this study were taken from a time-of-planting and harvesting experiment established at Río Piedras by the Agronomy and Horticulture Department of the Agricultural Experiment Station, University of Puerto Rico. Sugarcane variety P.R. 980 was planted at 28-day intervals for 14 plantings, beginning on May 31, 1955. Each planting consisted of 28 rows of cane 4½ feet apart and 24 feet long, giving a plot size of 0.70 acre. The plantings were replicated four times in a randomized block design.

Measurements of growth were made every 28 days beginning 1 month after planting. Eight measurements were made for each planting until the cane had reached an age of 7 months. Measurements were then discontinued because of the difficulty in movement within the experiment to make them. The measurements of the cane were made 1 inch from the soil surface to the top of the upmost visible ligule of the cane sheath. To minimize error due to changes in the height of the soil surface by erosion or cultivation, a wooden reference stake was driven into the soil at the base of the plant with the top of the stake 1 inch from the soil surface. This stake served as a reference point for all measurements. Twelve canes were measured in each plot. All measurements were made to the nearest ⅛ inch. For the sake of brevity all measurements given in this paper are averaged for all replications.

RESULTS

The accumulated growth measurements and rate of growth for P.R. 980 at various planting dates are given in tables 1 and 2, respectively.

The best growth of cane as measured by height was made with sugarcane planted in May and June (table 1) and the poorest growth was attained by the October and November plantings. The planting made on May 31, 1955 reached 91.56 inches in 7 months as compared with only 42.73 inches for the November planting.

The highest average growth rate for the entire 7-month period occurred in May and June plantings with the poorest rates in the October and November plantings (table 2). The average growth rate for the entire growth period measured was 11.1 inches per month for cane planted on May 31, 1955, and 5.0 inches per month for the November 15, 1955 planting.

A comparison of the heights of cane reached at 4 and 7 months is given in table 3. At an age of 4 months, sugarcane in Puerto Rico is normally considered to have grown sufficiently to close-in a field. The closing-in of a field is considered beneficial in that the dense growth of cane prevents or

TABLE 1.—*The height, in inches, of sugarcane planted at various dates throughout the year and measured for a period of 7 months at 28-day intervals, plant crop of P.R. 980 at Solís Farm, Río Piedras*

Date of measurement	Measurement of the height of the cane, in inches, for the planting dates indicated													
	May 31, 1955, I	June 28, 1955, II	July 26, 1955, III	Aug. 23, 1955, IV	Sept. 20, 1955, V	Oct. 18, 1955, VI	Nov. 15, 1955, VII	Dec. 13, 1955, VIII	Jan. 10, 1956, IX	Feb. 7, 1956, X	Mar. 6, 1956, XI	Apr. 3, 1956, XII	May 1, 1956, XIII	May 29, 1956, XIV
June 30, 1955	2.96	—	—	—	—	—	—	—	—	—	—	—	—	—
July 28, 1955	7.20	3.64	—	—	—	—	—	—	—	—	—	—	—	—
Aug. 25, 1955	15.56	7.02	3.09	—	—	—	—	—	—	—	—	—	—	—
Sept. 22, 1955	38.04	19.97	7.97	3.76	—	—	—	—	—	—	—	—	—	—
Oct. 20, 1955	58.47	43.11	18.62	8.80	3.87	—	—	—	—	—	—	—	—	—
Nov. 17, 1955	74.48	61.33	33.83	18.98	8.95	2.87	—	—	—	—	—	—	—	—
Dec. 15, 1955	83.58	71.01	45.52	32.54	11.49	5.06	2.77	—	—	—	—	—	—	—
Jan. 12, 1956	91.56	80.89	56.39	45.82	19.93	7.45	4.13	2.97	—	—	—	—	—	—
Feb. 9, 1956	—	86.15	61.07	53.21	26.71	10.34	5.91	4.66	4.64	—	—	—	—	—
Mar. 8, 1956	—	—	68.96	60.60	32.81	14.05	7.40	6.09	7.75	2.52	—	—	—	—
Apr. 5, 1959	—	—	—	71.10	42.37	22.59	11.97	10.94	14.39	4.71	3.58	—	—	—
May 3, 1956	—	—	—	—	57.78	36.30	24.25	25.16	23.63	11.50	7.83	4.67	—	—
May 31, 1956	—	—	—	—	—	44.93	32.11	39.31	37.07	23.65	17.58	8.11	4.29	—
June 28, 1956	—	—	—	—	—	—	42.73	51.29	50.00	36.96	32.05	16.40	7.38	4.36
July 26, 1956	—	—	—	—	—	—	—	69.70	60.99	57.52	54.04	34.90	24.11	12.06
Aug. 23, 1956	—	—	—	—	—	—	—	—	75.86	63.42	58.85	41.65	33.17	19.27
Sept. 20, 1956	—	—	—	—	—	—	—	—	—	75.76	71.27	57.13	48.44	37.22
Oct. 18, 1956	—	—	—	—	—	—	—	—	—	—	83.38	72.85	64.76	55.09
Nov. 15, 1956	—	—	—	—	—	—	—	—	—	—	—	81.62	76.37	66.31
Dec. 13, 1956	—	—	—	—	—	—	—	—	—	—	—	—	85.68	77.10
Jan. 10, 1957	—	—	—	—	—	—	—	—	—	—	—	—	—	85.46

TABLE 2.—*Average rate of growth per month, in inches, of sugarcane planted at various dates throughout the year, plant crop of P.R. 980 at Solís Farm, Río Piedras*

Period of growth	Average rate of growth, in inches, for the planting dates indicated													
	May 31, 1955, I	June 28, 1955, II	July 26, 1955, III	Aug. 23, 1955, IV	Sept. 20, 1955, V	Oct. 18 1955, VI	Nov. 15, 1955, VII	Dec. 13, 1955, VIII	Jan. 10, 1956, IX	Feb. 7, 1956, X	Mar. 6, 1956, XI	Apr. 3, 1956, XII	May 1, 1956, XIII	May 29, 1956, XIV
June 30–July 28	4.24	—	—	—	—	—	—	—	—	—	—	—	—	—
July 28–Aug. 25	8.36	3.38	—	—	—	—	—	—	—	—	—	—	—	—
Aug. 25–Sept. 22	22.48	12.95	4.88	—	—	—	—	—	—	—	—	—	—	—
Sept. 22–Oct. 20	20.43	23.14	10.65	5.04	—	—	—	—	—	—	—	—	—	—
Oct. 20–Nov. 17	16.01	18.22	15.21	10.18	5.08	—	—	—	—	—	—	—	—	—
Nov. 17–Dec. 15	9.10	9.68	11.69	13.56	2.54	2.19	—	—	—	—	—	—	—	—
Dec. 15–Jan. 12	7.98	9.88	10.87	13.28	8.44	2.39	1.36	—	—	—	—	—	—	—
Jan. 12–Feb. 9	—	5.26	4.68	7.39	6.78	2.89	1.78	1.69	—	—	—	—	—	—
Feb. 9–Mar. 8	—	—	7.89	7.39	6.10	3.71	1.49	1.43	3.11	—	—	—	—	—
Mar. 8–Apr. 5	—	—	—	10.50	9.56	8.54	4.57	4.85	6.64	2.19	—	—	—	—
Apr. 5–May 3	—	—	—	—	15.41	13.71	12.28	14.22	9.24	6.79	4.25	—	—	—
May 3–May 31	—	—	—	—	—	8.63	7.86	14.15	13.44	12.15	9.75	3.44	—	—
May 31–June 28	—	—	—	—	—	—	10.62	11.98	12.93	13.31	14.47	8.29	3.09	—
June 28–July 26	—	—	—	—	—	—	—	18.41	10.99	20.56	21.99	18.50	16.73	7.70
July 26–Aug. 23	—	—	—	—	—	—	—	—	14.87	5.90	4.81	6.75	9.06	7.21
Aug. 23–Sept. 20	—	—	—	—	—	—	—	—	—	12.34	12.42	15.48	15.27	17.95
Sept. 20–Oct. 18	—	—	—	—	—	—	—	—	—	—	12.11	15.72	16.32	17.87
Oct. 18–Nov. 15	—	—	—	—	—	—	—	—	—	—	—	8.77	11.61	11.22
Nov. 15–Dec. 13	—	—	—	—	—	—	—	—	—	—	—	—	9.31	10.79
Dec. 13–Jan. 10	—	—	—	—	—	—	—	—	—	—	—	—	—	8.36

TABLE 3.—*Height of sugarcane and yields of cane per acre as influenced by the time of planting, plant crop of P.R. 980 at Solís farm, Río Piedras*

Planting No.	Date of planting	Height of cane at—		Average rate of growth per month	Yield of cane per acre when harvested at—		Dates covered by the 8-month period of growth in which measurements were taken
		4 months	7 months		12 months	18 months	
		Inches	*Inches*	*Inches*	*Tons*	*Tons*	
1	May 31, 1955	38	92	11.1	81	132	June 20, 1955 to Jan. 12, 1956
2	June 28, 1955	43	86	10.7	99	136	July 28, 1955 to Feb. 9, 1956
3	July 26, 1955	34	69	8.2	88	127	Aug. 25, 1955 to Mar. 8, 1956
4	Aug. 23, 1955	33	71	8.4	92	107	Sept. 22, 1955 to Apr. 5, 1956
5	Sept. 20, 1955	20	58	6.7	75	95	Oct. 20, 1955 to May 3, 1956
6	Oct. 18, 1955	10	45	5.3	70	86	Nov. 17, 1955 to May 31, 1956
7	Nov. 15, 1955	7	43	5.0	59	73	Dec. 15, 1955 to June 28, 1956
8	Dec. 13, 1955	11	70	8.8	84	92	Jan. 12, 1956 to July 26, 1956
9	Jan. 10, 1956	24	76	8.9	67	80	Feb. 9, 1956 to Aug. 23, 1956
10	Feb. 7, 1956	24	76	9.2	64	79	Mar. 8, 1956 to Sept. 20, 1956
11	Mar. 6, 1956	32	83	10.0	71	105	Apr. 5, 1956 to Oct. 18, 1956
12	Apr. 3, 1956	35	82	9.6	73	109	May 3, 1956 to Nov. 15, 1956
13	May 1, 1956	33	86	10.2	64	102	May 31, 1956 to Dec. 13, 1956
14	May 29, 1956	37	86	10.1	72	94	June 28, 1956 to Jan. 10, 1957

limits weed growth, thus reducing weeding costs. Table 3 shows that canes planted from September to February were 2 feet or less in height at 4 months, and not tall enough to prevent weed growth. Cane planted from April to August reached heights of 3 feet or more at 4 months and required less weeding.

Sugarcane at 7 months attained heights of about 7 feet and over when planted from March to June, and heights of only about 4 feet for October and November plantings. In fact, cane planted on June 28, 1955, had the same height, 43 inches at 4 months of age, as cane planted on November 15, 1955, at 7 months of age.

Good cane growth normally means good cane tonnage. The yields of cane per acre for the various planting dates are given in table 3 as 12-month and 18-month cane. The lowest cane yields per acre were associated with the lowest average rate of growth per month and also cane height at 4 and 7 months. Highest cane tonnages were not necessarily associated with highest average growth rates nor heights of cane at 4 or 7 months.

The poor growth of sugarcane obtained in the winter reflects lower temperatures, fewer hours of sunlight, and lower rainfall occurring in Puerto Rico during the winter months.

In table 4, the average rainfall, hours of sunlight, and temperatures per month for Río Piedras are shown together with the height of cane per month. Sugarcane planted in November must make its initial months of growth in a time of poor rainfall and low temperatures. Cane planted on May 30 has the summer with its abundant rainfall and high temperatures to grow in. The May-planted cane enters the winter period at 7 months of age and almost 5 feet in height, with an abundant leaf surface to make a better use of the lower photoperiod in the winter. This more developed cane also has a larger root system which can penetrate deeper into the soil to obtain moisture. November-planted cane has but a few thin leaves to use for its photosynthetic activity and a small shallow root system which suffers from lack of rain in the winter.

SUMMARY

Sugarcane variety P.R. 980 was planted at 28-day intervals throughout the year in Río Piedras, P. R. Measurements of growth were made on these plantings each month. The influence of the time of planting on growth was found to be as follows:

1. The best growth, as measured by heights of cane at 7 months, was made by sugarcane planted in May and June and the poorest growth by October and November plantings.

2. The highest average rate of growth for the 7-month period was made

by cane planted in May and June and the lowest for October and November plantings.

3. A comparison of the heights of cane reached at 4 months revealed that cane planted from April to August attained 3 feet or more and required

TABLE 4.—*Monthly rainfall, mean temperature, total hours of sunlight, and accumulated height of cane P.R. 980, planted May 30 and November 15*

Month	Rainfall	Mean daily temperature	Possible sunshine as total per day	Height of cane
		May 30 planting		
	Inches	*°F*	*Minutes*	*Inches*
June	6.4	78.1	396	3.0
July	8.0	79.4	406	7.2
August	8.4	80.2	394	15.6
September	8.0	79.8	367	38.0
October	6.6	79.4	364	58.5
November	7.2	77.7	339	74.5
December	6.2	75.3	343	83.6
Average	7.3	78.6	373	83.6
		November 15 planting		
November	7.2	77.7	339	2.8
December	6.2	75.3	343	4.1
January	4.9	73.0	346	5.9
February	3.5	72.9	324	7.4
March	3.3	74.4	374	12.0
April	4.5	76.1	377	24.3
May	7.4	77.7	402	32.1
Average	5.3	75.3	358	32.1

less weeding than cane planted from September to February, which measured 2 feet and under.

4. The lowest cane tonnage at 12 and 18 months was associated with the lowest average rate of growth per month, but the highest cane tonnages were not necessarily associated with highest average growth rates nor heights of cane at 4 or 7 months.

RESUMEN

En Río Piedras, distintas parcelas de la variedad de caña de azúcar P. R. 980 se sembraron a intervalos de 28 días durante doce meses. Se midió su

crecimiento cada mes. Los efectos del tiempo en que cada parcela fué sembrada sobre los índices de crecimiento de la caña fueron como sigue:

1. El mayor crecimiento de la caña, medido 7 meses después de sembrada, se registró en las parcelas sembradas en mayo y junio. El menor crecimiento, igualmente medido en cañas de 7 meses, se registró en las parcelas sembradas en octubre y noviembre.

2. El promedio de crecimiento mayor en cañas de 7 meses fué el correspondiente a las cañas sembradas en mayo y junio, mientras que el más bajo correspondió a las sembradas en octubre y noviembre.

3. Cuando se comparó la altura de las cañas a los 4 meses de sembradas se comprobó que las sembradas de abril a agosto alcanzaron alturas de 3 pies o más, y las que se sembraron de septiembre a febrero sólo alcanzaron 2 pies o menos de altura. Es obvio que las primeras no necesitaron tantos desyerbos como las segundas.

4. El tonelaje mayor de caña, según este estudio, no fué necesario asociarlo a los indices más altos de crecimiento ni a los promedios de altura alcanzados en cañas de 4 a 7 meses, sin embargo, el tonelaje menor obtenido de cañas de 12 a 18 meses de sembradas hubo que asociarlo a su índice de crecimiento, el cual fué el más bajo por mes.

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