Performance of New Sugarcane Varieties in the Cabo Rojo-Hormigueros Area of Puerto Rico[1]

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ABSTRACT

The performance of 34 new sugarcane varieties was evaluated in a plant crop and two ratoons at two sites in southwestern Puerto Rico.

At Bonilla farm in Cabo Rojo the five leading varieties were PR 65-413, PR 65-339, PR 62-739, UCW 53-69, and PR 980. PR 980, which is the leading commercial variety of the Cabo Rojo area, ranked fifth in total sugar production per acre. PR 65-413 and PR 65-339 have the greatest potential as commercial varieties for the Cabo Rojo area, since they are high sugar yielders and suited to mechanization.

In the humid valley of Central Eureka in Hormigueros, the most outstanding varieties were PR 1152, PR 61-902, PR 1140, CP 52-43, and NCo 310. PR 1152 is high in sugar content and cane tonnage production, and is suitable for mechanized harvesting. PR 1140 and PR 61-902 also had a good sucrose content, but their performance in subsequent crops was poor. NCo 310 and UCW 53-69 are not suitable for mechanized harvesting.

INTRODUCTION

Sugarcane production in the Eureka area during the 1974 milling season was 191,452 tons of cane with rendements of 8.44%.[3] A total of 10,022 acres were planted. About 53% of the cane was machine loaded while only 14.2% was machine harvested.[3] There are in the area 421 sugarcane farmers, of which 337 produce less than 500 tons of cane each.

Although irrigation is feasible, no supplementary irrigation is used in the Hormigueros Valley. The sugarcane crop is entirely dependent on rainfall. During the rainy season, July through November, most of the soils present drainage problems, but they are high yielding when properly drained.

The Cabo Rojo area also depends entirely on rainfall, which is not uniformly distributed throughout the year. Most Cabo Rojo soils are acid, occurring in undulating or rolling areas.[4]

The leading commercial sugarcane varieties grown in the Cabo Rojo-Hormigueros areas are PR 980 and PR 1028. PR 980 is late maturing, while PR 1028 is an early-maturing, high-sucrose variety. The Cabo Rojo area needs early-maturing, high-sucrose, and drought-tolerant

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[3] Junta Azucarera de P.R., Informe Anual 1973-74, Río Piedras, P.R.

[4] Roberts, R. C., 1942. Soil Survey of Puerto Rico, USDA Series 1936, No. 8, in cooperation with Univ. of P.R. Agric. Stn.

varieties, while the Hormigueros area needs late-maturing, high-sucrose, and high-tonnage varieties.

The purpose of this paper is to present the results obtained in two variety trials conducted from 1971 to 1974 to evaluate new and higher sugar-producing varieties for the Cabo Rojo-Hormigueros area.

MATERIALS AND METHODS

Two sugarcane experiments were planted: one at Bonilla farm, west of Cabo Rojo, and the other at Central Eureka, southeast of Hormigueros.

The prevailing soil at Bonilla farm is a Voladora silty clay, 5–12% slope, eroded, clayey, oxidic, isohyperthermic. This soil is dark, reddish brown, or dark red, extremely acid, with a fine-textured, weathered conglomerate of varying colors.[5]

Twenty-five sugarcane varieties were tested at this site using a 5 × 5 balanced lattice experimental design replicated six times. The experiment was planted in April 1971 and cane was harvested when 12 months old. The first and second ratoon crops were harvested in April 1973 and March 1974, respectively.

The second experiment was conducted in the humid valley of Hormigueros. The prevailing soil is a Coloso clay, a fine mixed, nonacid, isohyperthermic, aeric, Tropic Fluvaquents.[5]

Thirty sugarcane varieties were tested in a 5 × 6 rectangular lattice experimental design replicated six times. The experiment was planted in April 1971 and cane was harvested in May 1972. The first and second ratoon crops were harvested in May 1973 and May 1974, respectively.

The varieties tested at each site were, at Cabo Rojo: PR 980, PR 1013, PR 1140, PR 1141, PR 1152, PR 1175, PR 1191, PR 1239, PR 1249, PR 61-53, PR 61-902, PR 62-258, PR 62-739, PR 64-214, PR 64-1791, PR 65-339, PR 65-413, PR 65-1302, PR 65-1305, PR 65-2638, B 42-231, B 49-119, CB 49-260, NCo 310, UCW 53-69; and at Hormigueros: PR 1002, PR 1028, PR 1140, PR 1141, PR 1152, PR 1175, PR 1248, PR 1249, PR 1250, PR 61-53, PR 61-632, PR 61-902, PR 62-214, PR 62-258, PR 62-285, PR 62-626, PR 63-525, PR 63-847, PR 64-15, PR 64-211, PR 64-245, PR 64-288, PR 64-363, PR 64-1791, PR 65-2638, CB 49-260, CP 52-43, Q-68, NCo 310, UCW 53-69.

At both experimental sites, plot size was 22 × 20 ft with furrows 5.5 ft apart. Standard field management operations of commercial cane growers were followed.

In both experiments whole plots were harvested and weighed, and a 10-cane sample was selected from each plot for sucrose and fiber

[5] Soil Survey Interim Report, USDA, Soil Conservation Service. (In press)

determinations using the pol-ratio method. Statistical analyses for sucrose-percent-cane, tons of cane, and tons of sugar per acre were conducted on each crop. Combined analyses for the plant cane and two ratoon crops were also made. Varieties were ranked as to production of tons of sugar per acre (TSA).

RESULTS AND DISCUSSION

CABO ROJO

Table 1 presents the analyses for the plant cane and two ratoons and a combined analysis of the three crops of sucrose-percent-cane, tons of cane, and tons of sugar per acre in the Cabo Rojo experiment. In the plant cane crop, PR 65-413 and B 42-231 produced significantly more sugar per acre than 20 other varieties. PR 65-339, PR 65-1305, and PR 1175 ranked third, fourth, and fifth, respectively, outyielding the commercial variety of the zone, PR 980. No significant difference was observed among the five leading varieties.

In the first ratoon crop, UCM 53-69 produced 4.63 tons of sugar per acre, which was significantly higher than 17 other varieties. PR 62-739, PR 980, and PR 61-53 were among the five superior ones, although no significant difference was observed among them. In the second ratoon crop, four of the leading varieties of the first ratoon, (PR 65-339, PR 980, PR 62-739, and PR 65-413) were at the top. Varieties UCM 53-69 and PR 61-53 performed poorly. PR 980 was the leading variety, although its performance during the plant cane was very poor. Although no significant difference was observed among the previously mentioned varieties, statistical results indicated, when the pooled data of the three crops were analyzed, that the commercial variety of the zone, PR 980, remained fifth in order of merit.

The poor performance of this variety in the plant cane crop is unexplainable, since it has a high cane tonnage and tolerates quite well certain climatic stresses.

In general, variety performance during the plant cane was poorer than that of the first and second ratoon crops. Normally, the best results are obtained during the plant cane crop, after which, a decline in cane and sugar tonnage is expected. This is true when climatic patterns during the different crop cycles are similar. Thus, results obtained during the first crop indicate unfavorable climatic conditions prevailing during the plant cane crop as compared to the succeeding crops.

The most promising variety for this area was PR 65-413. It is a high-sucrose, high-cane-tonnage, erect-growth, and intermediate-maturing variety. Cost of sugar production with this variety is lower than that of

TABLE 1.—*Mean yield of 25 sugarcane varieties at Bonilla farm in Cabo Rojo*

Rank	Variety	Sucrose content	Cane	Sugar	Fiber
		%	*Tons*	*Tons*	%
			Plant cane crop, 1972		
1	PR 65-413	11.87	31.8	3.77 a	15.35
2	B 42-231	11.57	29.9	3.45 a	16.76
3	PR 65-339	12.18	27.6	3.40 ab	15.83
4	PR 65-1305	12.99	22.9	2.93 ab	13.57
5	PR 1175	13.79	20.8	2.92 abc	13.85
6	PR 61-53	11.28	25.2	2.86 bc	16.95
7	UCW 53-69	10.64	27.0	2.85 bc	17.84
8	PR 62-258	11.65	24.2	2.81 bc	16.99
9	PR 62-739	10.50	26.5	2.77 bc	15.19
10	PR 1141	11.15	24.6	2.74 bc	14.18
19	PR 980 (CK)	10.72	21.5	2.26	14.65
			First ratoon crop, 1973		
1	UC 53-69	13.11	35.12	4.63 a	17.30
2	PR 62-739	12.34	34.52	4.24 ab	14.26
3	PR 980 (CK)	12.94	32.64	4.21 ab	14.92
4	PR 65-413	13.14	30.61	4.03 ab	14.11
5	PR 61-53	13.33	29.97	3.99 ab	15.18
6	PR 65-339	12.80	30.94	3.97 ab	14.45
7	PR 1239	13.11	29.94	3.89 ab	13.57
8	B 42-231	12.39	31.04	3.87 ab	16.29
9	PR 1140	12.78	28.92	3.71 b	14.48
10	NCo 310	13.38	27.66	3.71	15.88
			Second ratoon crop, 1974		
1	PR 65-339	13.21	40.45	5.25	15.46
2	PR 980 (CK)	11.11	46.91	5.23	15.50
3	PR 62-739	11.70	44.17	5.19	15.53
4	PR 65-413	12.12	42.90	5.16	15.53
5	PR 1152	12.92	38.75	5.02	14.66
6	PR 62-258	12.53	38.23	4.76	16.65
7	PR 1013	12.54	39.27	4.70	15.07
8	PR 1249	12.75	36.13	4.61	15.00
9	PR 64-1791	10.63	42.16	4.61	15.00
10	PR 1141	12.28	35.48	4.38	14.83
			Combined analysis		
1	PR 65-413	12.37	35.12	4.32 a	14.98
2	PR 65-339	12.73	32.98	4.20 ab	15.23
3	PR 62-739	11.51	35.06	4.07 ab	14.92
4	UCW 53-69	11.84	32.94	3.94 ab	17.97
5	PR 980 (CK)	11.58	33.68	3.90 ab	15.02
6	B 42-231	12.00	31.80	3.80 ab	16.37
7	PR 62-258	11.51	31.99	3.69 b	15.40
8	PR 1152	12.31	29.54	3.66 b	14.18
9	PR 1013	12.13	29.71	3.63 b	14.90
10	PR 1141	12.24	29.36	3.61 c	14.12

PR 980, which is a low-sugar-producing variety and is unsuitable for mechanized harvesting.

PR 65-339, which has a high-sucrose content, intermediate cane tonnage, and is an erect-growth variety, should also be given consideration as a commercial variety for the zone. It ranked third, sixth, and first in total sugar during the plant cane and the first and second ratoon crops, respectively.

PR 62-739 is of rather low rendements, high tonnage and semi-erect growth, ranking third in the combined analysis and ninth, second, and third in the plant cane and the first and second ratoon crops, respectively. The agronomic performance of this variety is very similar to that of PR 980, and it seems to adapt well to poor agricultural soils.

UCW 63-69 ranked fourth in the combined analysis but performed irregularly, ranking seventh in the plant cane, first in the first ratoon, and eleventh in the second ratoon.

PR 980, the standard commercial variety of the zone, was among the top five. However, farmers are replacing it by new sweet, erect-growth varieties adapted to mechanized harvesting.

Based on the general variety performance, PR 65-413 and PR 65-339 are the most promising varieties for the Cabo Rojo area, but PR 980 and PR 62-739 can be grown commercially in marginal areas because of their ability to withstand climatic stress and low fertility.

With few exceptions, fiber content was over 16%. PR 65-413, PR 65-339, and PR 62-739 had a fiber content of 14.9, 15.2, and 14.9%, respectively. Of higher fiber content were UCW 53-69 (17.9%), PR 65-1302 (18.1%), and PR 61-53 (16.7%). High fiber content seems to be associated with undesirable milling qualities.

HORMIGUEROS

Table 2 presents the analyses for the plant cane and two ratoons and the combined analysis of the three crops of sucrose-percent-cane, tons of cane, and tons of sugar per acre in the Hormigueros area.

PR 1152 was the leading variety, producing 4.68 tons of sugar in the plant cane crop, although its production was not significantly higher except over the last 10 varieties in the rank of merit. It also ranked second in the first and second ratoon crops and in the combined analysis for the three crops, producing significantly more sugar than 21 of the 30 varieties studied, which included the main commercial variety of the zone, PR 1028, which produced only 3.56 tons of sugar. PR 1152 is a high sugar yielder, early maturing, and suited to mechanized harvesting. PR 61-902 ranked second in the order of merit by the combined analysis. It produced high rendements and sugar per acre, ranking sixth, second, and thirteenth in the plant cane and the two

TABLE 2.—*Mean yields of 30 sugarcane varieties planted at Central Eureka–Hormigueros*

Rank	Variety	Sucrose content	Cane	Sugar	Fiber
		%	*Tons*	*Tons*	%
			Plant cane crop, 1972		
1	PR 1152	10.73	44.7	4.68	15.04
2	Q 68	10.73	40.6	4.35	16.36
3	PR 64-245	9.54	44.3	4.33	12.30
4	CP 52-43	9.87	42.6	4.26	15.77
5	PR 1140	10.95	38.8	4.18	15.70
6	PR 61-902	10.13	38.9	4.01	14.24
7	PR 64-15	9.33	43.6	3.97	15.12
8	PR 1028 (CK)	9.90	37.2	3.63	16.03
9	PR 1141	10.02	36.2	3.63	13.29
10	PR 62-258	8.99	39.2	3.60	17.10
			First ratoon crop, 1973		
1	PR 1250	11.69	48.57	5.58 a	16.00
2	PR 1152	11.38	47.42	5.34 ab	15.93
3	PR 61-902	12.11	42.16	5.09 ab	16.44
4	PR 62-258	11.64	42.94	5.05 ab	17.00
5	NCo 310	10.51	46.46	4.84 ab	18.01
6	PR 63-525	10.98	42.37	4.61 ab	14.19
7	PR 1140	12.14	36.76	4.52 ab	16.66
8	PR 62-626	11.55	38.86	4.50 ab	17.30
9	PR 62-285	10.25	44.30	4.48 b	17.02
10	PR 1175	11.94	36.57	4.39 b	14.41
17	PR 1028 (CK)	9.79	40.17	3.91 b	17.51
			Second ratoon crop, 1974		
1	NCo 310	9.68	44.04	4.25	22.26
2	PR 1152	10.33	41.22	4.19	18.35
3	PR 1250	10.76	38.55	4.12	14.53
4	CB 49-260	9.09	45.33	4.11	22.21
5	PR 61-632	10.32	39.43	4.02	20.44
6	PR 1249	10.41	38.55	3.99	17.47
7	CP 52-43	9.53	42.28	3.95	18.56
8	PR 65-2638	10.42	36.85	3.87	17.64
9	PR 64-288	9.57	37.65	3.61	17.29
10	PR 62-258	9.80	36.72	3.55	19.81
20	PR 1028 (CK)	9.93	31.80	3.21	20.01
			Combined analysis		
1	PR 1152	10.79	44.43	4.72 a	16.43
2	PR 61-902	10.63	38.81	4.18 ab	16.88
3	PR 1140	11.43	35.99	4.17 ab	16.08
4	CP 52-43	9.73	42.93	4.16 ab	16.81
5	NCo 310	9.30	44.57	4.14 ab	18.65
6	PR 1250	9.86	40.98	4.08 ab	14.66
7	PR 62-258	10.05	40.07	4.06 ab	18.45
8	PR 62-2638	10.42	37.57	4.01 ab	15.66
9	PR 1249	10.04	38.83	3.89 ab	15.38
10	PR 62-626	10.03	37.50	3.83 b	18.77
17	PR 1028	9.83	36.39	3.56 b	17.84

ratoon crops, respectively. The poor performance of this variety in its second ratoon, its undesirable growth habit, and poor tillering and ratooning capacity disqualifies it for commercial release for the Hormigueros area.

PR 1140 produced the best sucrose content among all the varieties tested, (11.43% for the combined analysis). It has a low-cane tonnage but is suited to mechanization. It was third on the basis of total sugar per acre. The tendency to lower cane tonnage with successive crops, reduces its probability for release as a commercial variety for this area.

CP 52-43 ranked fourth in the combined analysis, but the total sugar produced was significantly higher than that of the last five varieties. It is an early-maturing variety and suitable for mechanized harvesting.

NCo 310 ranked fifth; it has recumbent growth, is early maturing, intermediate in sugar yield, and produces a high cane tonnage. Juice quality is rather poor (9.3%). Fourteen varieties had over 17% fiber.

Summarizing, the ecological conditions prevailing in the two experimental sites were quite different. Although they are not geographically far apart, the area of Cabo Rojo is mainly characterized by rolling hills, medium fertility, and acid soils. Rainfall is scarce and not uniformly distributed throughout the year.

Under these conditions, the best performing varieties were those that were tolerant to water stress and to soil problems. PR 980, PR 65-339, PR 65-413, and PR 62-739 performed very well under these conditions.

Meanwhile, the area of Hormigueros is different from that of Cabo Rojo in that its soils are flat, heavy, and poorly drained during the rainy season. Proper water management can improve the soils, but the varietal adaptability plays an important role. There are some varieties that tolerate poorly-drained conditions. Proper placement of varieties is a determining factor in sugarcane production. New varieties PR 1152, PR 1140, PR 61-902, and CP 52-43 have consistently shown superior agronomic characteristics when compared with the standard commercial variety of the zone, PR 1028. However, varieties that are not suited to mechanized harvest, such as NCo 310 and PR 61-902, have low probabilities of becoming commercial varieties in this zone.

RESUMEN

El comportamiento de 34 nuevas variedades de caña de azúcar se evaluó en dos sitios de la zona suroeste de Puerto Rico. Un experimento se ubicó en Cabo Rojo en un suelo Voladora y el otro en Hormigueros en uno de la serie Coloso. En cada experimento se recopilaron datos sobre rendimiento, toneladas de caña y toneladas de azúcar en una cosecha de plantilla y dos de retoño, los que fueron analizados estadísticamente.

En Cabo Rojo se destacó la variedad PR 65-413, seguida de las variedades PR 65-339, PR 62-739 y UCW 53-69. Las variedades PR 65-413 y PR 65-339 tienen grandes probabilidades para convertirse en variedades comerciales en esta región.

En Hormigueros la variedad PR 1152 ocupó la primera posición en el orden de mérito, seguida de las variedades PR 61-902, PR 1140, CP 52-43 y NCo 310. Las variedades PR 1140 y PR 61-902 producen buenos rendimientos, aunque su producción se debilita en las cosechas sucesivas. La UCW 53-69 y NCo 310 se comportaron relativamente bien, pero su hábito de crecimiento dificulta la mecanización del corte, reduciendo así sus posibilidades como variedades comerciales para esta zona.