The Effect of Soil Conditions on the Sucrose Content of Sugarcane

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INTRODUCTION

Fundamentally a crop is the combined product of the biological and environmental factors at play during the cropping season. In other papers it was and will be indicated that the ecological factors of weather and elevation exert an important influence upon the sugarcane plant and its final sucrose content at harvesttime (3, 4)[2]. The sucrose-yielding potential of some 20 leading varieties under various climatic and edaphic conditions has also been studied (8). Of the cultural factors, the influence of fertilizers on sucrose yields has been emphasized especially (10).

Recent work by González Ríos and Adsuar (1) has shown the detrimental influence of mosaic disease on the sucrose yields of some varieties. Landrau and Adsuar (2) reported that chlorotic-streak-infected canes produced less cane-tonnage than healthy canes, but their sucrose content remained unaffected. Martorell and Bangdiwala (9) showed that borer infestation can significantly reduce the sucrose content of cane. Attempts have been made to affect the sucrose content of sugarcane through preharvest foliage sprays with plant growth regulators (5, 7).

The influence of many other factors remains to be investigated under Puerto Rican conditions. The effect of time of planting and harvesting, arrowing, liming, irrigation, and a number of other factors offers a promising field for research. The adequate regulation of the controllable factors affecting the sucrose content of sugarcane still remains a challenge in most sugarcane-growing areas.

This paper presents information on the influence of soil conditions on the sucrose content of sugarcane.

METHODS OF STUDY

Data were collected from a rather large number of sugarcane fields comprising five broad geographic areas: East-central, northwest-interior, northeastern, northern, and southern. Four distinct farm areas were studied in the northern region, namely, Toa, Cambalache, Plazuela, and Loíza. Yield records were taken for a number of years (11 years in the east-central, 21 in the southern, 10 in the northwest-interior, 2 in the northeastern, and 1 in the northern region) and information was compiled as to varieties,

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[2] Numbers in parentheses refer to Literature Cited, pp. 145-46.

age of harvest, rainfall, elevation, soil type, and other factors. The soil types were determined by superimposing field-distribution maps over detailed soil-survey maps. Spot-checking of soil types was made by examining some profiles in the field either by observations on road cuts or in pits dug especially for the purpose, and more extensively by examining the soil profiles with an auger at selected sites.

The data were then classified by soil types and crop years; in addition, the data from the northern region were further subdivided by varieties. Analyses-of-variance studies were made of the data from each area.

Some of the available information was classified according to certain properties of the soils which were regarded as indices of their physical, chemical, and mineralogical nature. To study the interaction between soils and varieties data were taken at random for a limited number of soils for which production records were available for at least two varieties. The interaction between climate and soil was determined from yield data obtained in a given soil type occurring extensively in more than one of the areas studied.

DESCRIPTION OF SOIL AREAS STUDIED

The annual rainfall in the northern, east-central, northeastern, and northwest-interior regions ranges from 60 to 75 inches along the immediate coast to over 75 inches near the foothills, the heaviest falls of 90 inches or more occurring to the east and southeast of the Luquillo mountains. The southern region receives the least rainfall on the Island, an average of 30 to 40 inches annually. The annual temperature (below 1,000 feet elevation) averages 76° to 80°F. At elevations between 1,000 and 2,000 feet the annual temperature averages 71° to 75°F.

The soils of the east-central and northeastern regions are mostly derived from quartz-diorite and granite, but in some cases the parent material consists of tuffaceous shales and andesites. There are also some areas of organic soils. In general, the soils of this area are rather acid and of moderate fertility. In the lowlands of the east-central region soils are generally imperfectly and often poorly drained, and occasionally claypans are found underlying the plow layer (6).

In the northwest-interior, soils are derived from two broad groups of parent materials: Limestone towards the extreme northern interior and tuffaceous rocks toward the western interior. They are generally well-drained except for areas of the Chernozemlike soils where drainage is somewhat restricted. Fertility ranges from moderately low to high.

In the southern region the soils are neutral or alkaline, rather deep, and very fertile. They are derived from a variety of materials. As a rule, irrigation is necessary to raise crops profitably.

TABLE 1.—*Mean sucrose yields of sugarcane grown in different soil types within the east-central region of Puerto Rico, including differences between means*[1]

Soil type	Soil identification No.	Mean sucrose yields	Differences between means of soil types Nos.—								
			1	2	3	4	5	6	7	8	9
		Percent									
Yabucoa silty clay loam	1	12.1120									
Las Piedras silty clay loam	2	11.9497	0.1623								
Río Arriba clay	3	11.8400	.2720	0.1097							
Mabí clay	4	11.8300	.2820	.1197	0.0100						
Josefa clay loam	5	11.8170	.2950	.1327	.0230	0.0130					
Candelero loam	6	11.8135	.2985	.1362	.0265	.0165	0.0035				
Juncos silt loam	7	11.7937	.3183	.1560	.0463	.0363	.0233	0.0198			
Cayaguá silt loam	8	11.6698	.4422	.2799	.1702	.1602	.1472	.1437	0.1239		
Irurena clay	9	11.6420	.4700	.3077	.1980	.1880	.1750	.1715	.1517	0.0278	
Sabana clay	10	11.6378	.4742	.3119	.2022	.1922	.1792	.1757	.1559	.0320	0.0042
Vía silty clay	11	11.5071	.6049	.4426*	.3329	.3229	.3099	.3064	.2866	.1627	.1349
Múcara silty clay loam	12	11.4236	.6884	.5261	.4164	.4064	.3934	.3899	.3701	.2462	.2184
Toa loam	13	11.3653	.7467	.5844**	.4747	.4647**	.4517	.4482	.4284*	.3045	.2767
Coloso clay loam	14	11.2873	.8247	.6624**	.5527	.5427**	.5297	.5262	.5064**	.3825	.3547
Torres clay	15	11.0506	1.0614*	.8991**	.7894	.7794**	.7664	.7620*	.7431**	.6192*	.5914
Palmas Altas loam	16	10.7967	1.3153*	1.1530**	1.0433**	1.0333**	1.0203**	1.0168**	.9970**	.8731**	.8453**
Reparada clay	17	10.4585	1.6535**	1.4912**	1.3815**	1.3715**	1.3585**	1.3550**	1.3352**	1.2113**	1.1835**
Caguas clay	18	10.4400	1.6720*	1.5097**	1.4000*	1.3900*	1.3770*	1.3735*	1.3537*	1.2298*	1.2020*
Aguadilla loamy sand	19	9.3654	2.7466**	2.5843**	2.4746**	2.4646**	2.4516**	2.4481**	2.4283**	2.3044**	2.2766**

Soil type [1]	Soil identification No.	Mean sucrose yields	Differences between means of soil types Nos.—								
			10	11	12	13	14	15	16	17	18
		Percent									
Yabucoa silty clay loam	1	12.1120									
Las Piedras silty clay loam	2	11.9497									
Río Arriba clay	3	11.8400									
Mabí clay	4	11.8300									
Josefa clay loam	5	11.8170									
Candelero loam	6	11.8135									
Juncos silt loam	7	11.7937									
Cayaguá silt loam	8	11.6698									
Irurena clay	9	11.6420									
Sabana clay	10	11.6378									
Vía silty clay	11	11.5071	0.1307								
Múcara silty clay loam	12	11.4236	.2142	0.0835							
Toa loam	13	11.3653	.2725	.1418	0.0583						
Coloso clay loam	14	11.2873	.3505	.2198	.1363	0.0780					
Torres clay	15	11.0506	.5872	.4565	.3730	.3147	0.2367				
Palmas Altas loam	16	10.7967	.8411*	.7104**	.6269	.5686**	.4906**	0.2539			
Reparada clay	17	10.4585	1.1793**	.0486**	.9651**	.9068**	.8288**	.5921*	0.3382		
Caguas clay	18	10.4400	1.1978*	1.0671	.9836	.9253	.8473	.6106	.3567	0.0185	
Aguadilla loamy sand	19	9.3654	2.2724**	2.1417**	2.0582**	1.9999**	1.9219**	1.6852**	1.4313**	1.0931**	1.0746

[1] * Significant; ** highly significant.

In the northern region the soils range from well-drained to poorly drained and from moderate to high in fertility. They are acid, and derived from limestone, tuffaceous rocks, and a variety of other materials.

RESULTS AND DISCUSSION

SUCROSE-YIELDING POTENTIAL OF VARIOUS SOILS

Tables 1, 2, and 3, give the mean yields, including differences between means of available 96° sugar-percent-cane of sugarcane grown in various soil types for a number of years in three broad geographic areas. Wide differences are apparent in the sucrose content of cane from different soils.

Table 1 reveals that the lowest sucrose yields are obtained in such low-lands soils as those of the Reparada, Palmas Altas, Caguas, and Aguadilla series, where the water table is generally at a high level throughout the year. In the alluvial soils of the Coloso and Toa series, considered the best sugarcane soils of the humid section of the Island, yields of approximately 11.3 percent are common. In other soils of rather hilly and undulating relief, such as the Las Piedras and Juncos soils, not rated as good cane soils as the level alluvial lands, yields of 11.95 and 11.80, respectively, have been consistently obtained over a period of years.

In southern Puerto Rico (table 2) the San Antón, Paso Seco, and Descalabrado soils yield canes of significantly lower sucrose concentrations than the rest of the soils comprised in the study. However, the sucrose yields obtained in this region were higher in every single soil than in the highest sucrose-yielding soils of the east-central region. This fact can be explained on basis of the climatic differences pointed out in a previous paper (3). Weather and climate are the predominant factors in determining cane and sucrose yields in an area, but within a given area of more or less uniform climatic conditions the differences in soil properties may bring about significant differences in sucrose concentrations.

Table 3 shows the mean sucrose yields obtained over a number of years on 12 different soil types and soil complexes in the northwest-interior region surrounding Central Plata. This is another area where sucrose yields are generally high, presumably because reduced rainfall and low night temperatures, both conducive to high sucrose accumulations, are predominant during the period just prior to the harvest (3). However, there were significant differences in the sucrose-yielding potential of the various soils. Except in the Toa, Soller, and the Soller-Santa Clara-Camagüey complex, sucrose yields were over 12.5 percent and compared very favorably with yields from southern Puerto Rico.

The analyses of the total sum of squared deviations of the sucrose data obtained from the three sugarcane-producing regions already discussed are presented in table 4. The results further indicate the dominant influence of

TABLE 2.—*Mean sucrose yields of sugarcane grown in different soil types within the southern region of Puerto Rico, including differences between means*[1]

Soil type	Soil identification No.	Mean sucrose yields	Differences between means of soil types Nos.—							
			1	2	3	4	5	6	7	8
		Percent								
Santa Isabel silty clay	1	13.1626								
Aguirre clay	2	13.1190	0.0436							
Coamo clay	3	13.0018	.1608	0.1172						
Vives clay loam	4	12.9134	.2492*	.2056**	0.0884					
Paso Seco silty clay loam	5	12.8969	.2657*	.2221*	.1049	0.0165				
Machete clay	6	12.8965	.2661*	.2225*	.1053	.0169	0.0004			
Descalabrado silty clay	7	12.6648	.4978**	.4542**	.3370**	.2486*	.2321*	0.2317*		
Paso Seco silty clay	8	12.5762	.5864**	.5428**	.4256**	.3372**	.3207**	.3203**	0.0886	
San Antón silt loam	9	12.4875	.6751**	.6315**	.5143**	.4259**	.4094**	.4090**	.1773	0.0887

[1] * Significant; ** highly significant.

TABLE 3.—*Mean sucrose yields of sugarcane grown in different soils within the northwest-interior region of Puerto Rico, including differences between means*[1]

Soil types or complex	Soil identification No.	Mean sucrose yields	Differences between means of soil types Nos.—										
			1	2	3	4	5	6	7	8	9	10	11
		Percent											
Cialitos clay	1	13.2169											
Lares clay	2	13.1991	0.0178										
Tanamá clay	3	13.1107	.1062	0.0884									
Camagüey—Moca	4	13.0860	.1309	.1131	0.0247								
Catalina clay	5	13.0263	.1906	.1728	.0844	0.0597							
Santa Clara clay	6	12.9756	.2413*	.2235	.1351	.1104	0.0507						
Colinas clay	7	12.8682	.3487**	.3309**	.2425	.2178	.1581	0.1074					
Moca clay	8	12.7379	.4790**	.4612**	.3728	.3481**	.2884**	.2377*	0.1303				
Camagüey clay	9	12.5093	.7076**	.6898**	.6014*	.5767**	.5170**	.4663**	.3589**	0.2286*			
Toa clay	10	12.3086	.9083**	.8905**	.8021**	.7774**	.7177**	.6670**	.5596**	.4293**	0.2007		
Soller—Santa Clara—Camagüey	11	12.1543	1.0626**	1.0448**	.9564**	.9317**	.8720**	.8213**	.7139**	.5836**	.3550**	0.1543	
Soller clay	12	12.1063	1.1106**	1.0928**	1.0044**	.9797**	.9200**	.8693**	.7619**	.6316	.4030**	.2023*	0.0480

[1] * Significant; ** highly significant.

TABLE 4.—*Analysis of the total sum of squared deviations for the sucrose yield data obtained from 3 broad sugarcane-producing regions in Puerto Rico*

Source	Degrees of freedom	Sum of squares	Mean square	F value[1]
East-central region				
Total	743	1,171.69		
Soils	18	191.72	10.65	8.91**
Years	10	125.45	12.54	10.50**
Error	715	854.52	1.09	
Southern region				
Total	1,777	2,556.63		
Soils	8	75.04	9.38	8.07**
Years	20	447.58	22.38	19.24**
Error	1,749	2,034.01	1.16	
Northwest-interior region				
Total	2,210	2,999.75		
Soils	11	302.64	27.51	34.96**
Years	9	973.63	108.18	137.46**
Error	2,190	1,723.47	.78	

[1] ** Highly significant.

weather, as exemplified by the high significance of the variations due to years. Moreover, the differences in the sucrose-yielding potential of the soils within each region are also highly significant.

Table 5 gives mean sucrose yields for two crop years and three varieties in various soils of the northeastern region. The study of the data corresponding to the 1951 crop and variety P.O.J. 2878, revealed significant differences in the sucrose-yielding potential of various soils. No significant differences were measured either in the three soils where yield records of P.R. 902 were available, or in those of B.H. 10(12) for the 1952 crop.

Data on the sucrose yields of sugarcane in four broad farm areas in northern Puerto Rico are given in table 6. In Cambalache for 1951, significant differences in the sucrose-yielding potential of soils were measured in fields growing both M. 275 and P.O.J. 2878. Some areas of the Toa and Coloso soils, considered among the top-ranking sugarcane soils of the area, produced cane with low sucrose contents, dropping to extremes of about 8.5 percent. Other types within the Toa soil series produced better yields, indicative of the large variability among and within soils. In the Loíza area the Toa soils produced yields inferior to those of the Colosos, at least for

TABLE 5.—*Mean sucrose yields of sugarcane grown in various soils of the northeastern region of Puerto Rico for the crop years 1951 and 1952*

Soil type	Variety	Mean sucrose yields
1951 crop year		
		Percent
Fortuna clay loam, stony phase	P.O.J. 2878	11.50
Catalina clay	do.	10.93
Estación silt loam	do.	10.33
Múcara silty clay	do.	10.08
Múcara silty clay loam	do.	9.98
Juncos silty clay loam	do.	9.95
Cialitos clay	do.	9.93
Palmas Altas clay, poorly drained phase	do.	9.91
Mabí clay	do.	9.84
Sábana silty clay loam	do.	9.68
Juncos clay	do.	9.63
Sabana silty clay	do.	9.05
Cataño loamy sand	P.R. 902	12.91
Fajardo clay	do.	11.89
Estación loam	do.	10.26
1952 crop year		
Cataño loamy sand	B.H. 10(12)	11.62
Coloso silty clay loam	do.	11.51
Vega Baja silty clay	do.	10.83
Estación silt loam	do.	10.69
Cialitos clay	do.	10.48
Fajardo clay	do.	10.21
Fortuna clay loam	do.	10.12
Estación loam	do.	9.86
Fortuna clay	do.	9.62
Múcara silty clay loam	do.	9.45
Mabí clay	do.	9.15

the 1952 crop. Consideration must be given to the fact that the Toa fine sandy loam included in this study occurs in low positions and is usually subject to frequent overflows. Unless deep drainage ditches are dug at intervals to maintain the water table low, the excess moisture is likely to promote a rank growth of foliage, and the cane juices are lower in sucrose content.

No significant differences were measured in yields of variety P.O.J. 2878 in the Plazuela area. However, both M. 336 and M. 275 yielded juices of significantly lower sucrose contents in the Toa than in the Coloso soils. In the Toa area, no significant differences were measured for the 1951 crop in the Toa, Coloso, and Sabana Seca soils from which M. 275 was harvested.

TABLE 6.—*Mean sucrose yields of sugarcane grown in 4 broad farm areas of the north coast of Puerto Rico for the years 1951 and 1952*

Farm area	Year	Soil type	Variety	Mean sucrose yields
				Percent
Cambalache	1951	Coloso silty clay loam	M. 336	12.05
		Toa silt loam	M. 275	11.81
		Toa silty clay loam	do.	10.81
		Toa fine sandy loam	do.	10.58
		Piñones clay loam, poorly drained phase	do.	10.28
		Coloso silt loam	do.	10.24
		Coloso silty clay loam	do.	9.40
		Coloso clay loam	do.	9.13
		Toa loam	do.	8.60
		Coloso loam	do.	8.49
		Tanamá clay, stony phase	P.O.J. 2878	11.80
		Sábana Seca silty clay loam	do.	10.18
		Toa silty clay loam	do.	9.35
		Coloso loam	do.	8.61
		Sábana Seca clay	do.	8.43
Loíza	1952	Toa clay loam	do.	11.22
		Coloso silty clay loam	do.	10.85
		do.	M. 336	11.96
		Coloso clay	do.	11.53
		Toa fine sandy loam	do.	11.02
		Sábana Seca clay	do.	10.81
		Coloso silty clay	do.	10.16
		Coloso silty clay loam	P.O.J. 2878	10.60
		Coloso silty clay	do.	10.54
		Coloso clay	do.	10.53
		Toa fine sandy loam	do.	9.54
Plazuela		Coloso silty clay loam	M. 275	10.60
		Coloso clay, poorly drained phase	do.	10.59
		Toa loam	do.	9.52
		Coloso silty clay	M. 336	11.09
		Toa loam	do.	9.71
		Piñones silty clay	P.O.J. 2878	10.48
		Coto sandy clay	do.	10.26
		Vega Alta sandy clay	do.	10.25
		Bayamón sandy loam	do.	10.21
		Coloso clay, poorly drained phase	do.	10.03
		Bayamón sandy clay	do.	9.29
		Coloso silty clay loam	do.	9.18

TABLE 6—*Continued*

Farm area	Year	Soil type	Variety	Mean sucrose yields
				Percent
Toa	1951	Sábana Seca clay	M. 275	11.93
		Toa clay	do.	11.81
		Coloso silty clay	do.	11.54
		Coloso clay	do.	11.40
		Coloso silty clay loam	do.	11.27
		Toa silt loam	do.	11.14
		Coloso clay	do.	11.13
		Coloso silt loam	do.	11.00
		Moca clay loam	P.O.J. 2878	12.41
		Toa silt loam	do.	12.02
		Vega Alta clay	do.	11.68
		Colinas clay loam	do.	11.64
		Moca clay	do.	11.39
		Coloso clay	do.	11.27
		Colinas clay loam, stony phase	do.	10.57

In the same crop year and area cane grown on the Moca soils outyielded all others with a mean sucrose percentage of 12.41, the highest measured for the whole northern area, all four farm areas included. The Moca soils of the northwest-interior (table 3) also had a good sucrose-producing potential, although they were not the best in that area.

SPECIFIC SOIL PROPERTIES AND THEIR EFFECT ON SUCROSE YIELDS

The variation in the sucrose-yielding potential of the different soils within a given geographic region has been emphasized. This variation must be attributable to the variation in intensity of some factor closely associated with the soil. An attempt was made to relate the sucrose-yielding potential to some soil properties and allied factors on which specific information was available for the areas considered in this study. Soil drainage was taken as an index of the physical condition of the soils. Soil reaction was regarded as an index of the chemical properties. Advantage was taken also of available information relative to parent material and physiographic position. Table 7 summarizes the results of this approach to the problem.

In general, lower sucrose yields were obtained from sugarcane growing in poorly drained soils rather than in their better drained equivalents within the same geographic district. Furthermore, better sucrose yields were obtained in soils which were neutral to alkaline in reaction than in acid soils. Table 7 further shows that better sucrose yields were obtained in areas of

TABLE 7.—*The influence of soil drainage, reaction, and other factors on the sucrose content of sugarcane*

Soil characteristic	Number of crops	Mean sucrose yields
Drainage		
		Percent
Well-drained	543	11.8
Poorly drained	245	10.1
Reaction		
Neutral to alkaline	1,778	12.9
Acid	744	11.5
Parent material		
Limestone	2,191	12.7
Granitic and tuffaceous materials	788	11.4
Physiografic position		
Hills	97	11.9
Alluvial plains	147	11.3

soils derived from limestone than in adjoining soil areas where tuffaceous and granitic materials constituted the parent material of the soils. Richer canes were usually harvested from hilly soils than from nearby alluvial-plain soils.

Specific information was not available at the time this survey was conducted to permit the study of the relationship of soil sucrose-yielding potential to other important soil properties. However, the information presented clearly points to the influence of some factor closely connected with the soil and which has a great bearing on the sucrose-yielding potential.

INTERACTION OF SOILS AND VARIETIES

From the data available for this study it was evident that, in general, some soils have a higher sucrose-yielding potential than others. This potential difference, of course, can be explained on a basis of soil-associated factors. However, it was also observed that some varieties performed better than others in a given soil or group of soils. Table 8 presents data taken at random for a limited number of soil types showing this variation within soils attributable to varieties. Variety B.H. 10(12) yielded canes of higher sucrose content in all the soils selected than did P.O.J. 2878. This is in agree-

TABLE 8.—*Comparison of the sucrose yields of 2 sugarcane varieties in 4 different soils of Puerto Rico*

Soil	Sucrose yields of variety—	
	B.H. 10(12)	P.O.J. 2878
	Percent	*Percent*
Candelero	12.65	10.13
Toa	11.88	11.01
Palmas Altas	11.02	9.46
Reparada	10.78	9.34

ment with data previously presented comparing the behavior of 20 selected varieties within three broad climatic areas (8). Variety P.O.J. 2878, however, yielded more sucrose in the Toa than in the Candelero soils, whereas variety B.H. 10(12) yielded more in the Candelero than in the Toa.

INTERACTION OF SOILS AND CLIMATE

Data were obtained relative to the sucrose-yielding potential of some soils occurring in more than one area of those included in this study. The following tabulation shows the sucrose yields of P.O.J. 2878 harvested from fields of Toa clay loam occurring in three of the areas considered.

Climatic area	*Mean sucrose yields*
	Percent
Northwest-interior	12.31
East-central	11.36
Northern	11.22

The highest sucrose yields were obtained in the northwest-interior area. All three areas are characterized by rather heavy rainfall, but there is a more definite dry season corresponding to the harvesting period in the northwest-interior region. Moreover, night temperatures are lower throughout the year. Both of these factors are conducive to higher sucrose production and accumulation. Therefore, within a given area the sucrose-yielding potential of a given soil is limited by the other ecological forces at play.

SUMMARY

Data are presented herein to show the influence of soils and soil conditions on the sucrose yield of sugarcane. Information derived from five broad geographic areas of Puerto Rico, namely: North, south, northeast, east-central, and northwest-interior, was analyzed critically. There were significant differences in the sucrose-yielding potential of several commercial sugarcane varieties among some soils within each area. These differences

are attributable to variations in the properties of the various soil types or complexes, or to some factor closely connected with the soil like drainage, chemical reaction, and so on.

Some varieties produced higher sucrose yields than others even when growing under similar edaphic conditions. Different varieties of sugarcane produced their maximum yields in different soils, thus indicating a certain degree of variability and adaptation to the soil, as far as this factor was concerned. Within a given area the sucrose-yielding potential of a given soil may be modified considerably by the dominant climatic conditions.

RESUMEN

En este trabajo se presentan datos que demuestran cómo influyen el suelo y sus propiedades sobre los rendimientos de sacarosa de la caña de azúcar. Al hacer los análisis estadísticos de los datos obtenidos en las zonas norte, sur, noreste, este-central y noroeste del interior, se encontraron diferencias significativas en cuanto a la producción de sacarosa en los distintos suelos, dentro de una zona específica. Estas diferencias pueden atribuirse a variaciones en las propiedades de los suelos o a las de algún factor estrechamente relacionado con los suelos.

Se observó que algunas variedades tienen mayor contenido de sacarosa que otras, aún desarrollándose en condiciones edáficas más o menos iguales. Variedades distintas pueden producir su máximo rendimiento de sacarosa en distintos suelos, lo cual indica una variabilidad de adaptación en este respecto. Dentro de una zona en particular el efecto de los suelos sobre la producción de sacarosa de la caña de azúcar está sujeto a modificaciones por los factores climáticos predominantes.

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