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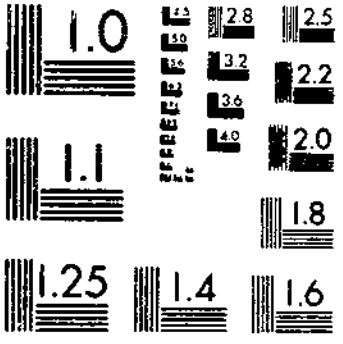

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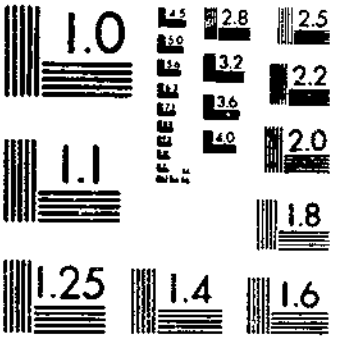

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Relative Resistance of Parent and Progeny Varieties of Saccharum, Erianthus, and Sorghum to Inversion of Sucrose in the Southern United States[1]

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CONTENTS

The relative resistance to inversion of sucrose of species of *Saccharum*, of *Erianthus arundinaceus*, of interspecific hybrids of *Saccharum*, and of intergeneric hybrids of *Saccharum* with *Erianthus* and *Sorghum* was determined. The work was done at the United States Sugar Plant Field Stations, Houma, La., and Canal Point, Fla., and the findings are here summarized.

SUMMARY

The noble canes (*Saccharum officinarum*) studied are, as a group, resistant to inversion of sucrose. Progenies from intercrossing or selfing of these varieties are also resistant. B. H.[4] 10/12, E. K. 28, P. 1135, and Fiji show slightly greater susceptibility to inversion than the other noble canes.

The one variety of *S. robustum* studied, 28 N. G. 219–A (Imp. 976), was found to be fairly susceptible to inversion of sucrose.

The varieties of *S. spontaneum*, *S. barberi*, *S. sinense*, and *Erianthus arundinaceus* studied are highly susceptible to inversion of sucrose.

[1] Submitted for publication September 19, 1949.
[2] Retired August 31, 1949.
[3] Died November 19, 1949.
[4] See footnote 1, table 1 (p. 5), for explanation of abbreviations used for sugarcane varieties.

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In varieties of these six species the initial amount of sucrose in the juice at maturity varied widely, but this proved not to be a factor in the subsequent amount (rate) of sucrose inversion.

The F_1 hybrids studied, *S. officinarum* × *S. spontaneum* and *S. officinarum* × *S. barberi*, are highly susceptible to inversion. The hybrids of varying degrees of nobilization are predominantly susceptible to inversion. Some crosses produce more resistant varieties than others.

The F_1 hybrids of *S. officinarum* (Crystalina and Louisiana Purple) and of P. O. J. 2725 × *S. robustum* (28 N. G. 251) were found to be fairly resistant to inversion. Nothing is known of the resistance of the particular variety of *S. robustum* used in these crosses, but the other parents are highly resistant.

Five varieties from Co. 281 × *S. robustum* (28 N. G. 251) were found to vary from being almost as resistant as Co. 281 to fairly susceptible.

The results of these experiments have been useful in the breeding program at Canal Point, Fla.

REVIEW OF LITERATURE

Loss of sucrose in harvested sugarcane through inversion has been a problem ever since sugar was manufactured from sugarcane. Its importance was indicated early in the literature (Bonamc, 1888; Winter, 1890; Went and Prinsen Geerligs, 1894; Stubbs, 1895) (*2, pp. 160–162; 18, pp. 23–25; 17; 16*).[5] It is quite likely that losses were noted long before they were discussed in print, because under normal weather conditions heavy losses must have occurred whenever there was much delay between cutting and milling.

Deterioration of sucrose (inversion) was noted in the literature as occurring in the windrow in Louisiana as early as 1895 (*16*), especially when the ground was dry. On the whole satisfactory results were obtained from windrowing the noble canes (Louisiana Purple, Louisiana Striped, D. 74, and D. 95), indicating that these varieties were relatively resistant to inversion of sucrose. With the introduction of the P. O. J. varieties (P. O. J. 213, P. O. J. 234, and P. O. J. 36–M) into Louisiana, the losses became aggravated in and out of the windrow, and because they showed fairly consistent susceptibility to inversion of sucrose in contrast to the rather consistent resistance of the noble canes formerly grown in Louisiana it seemed suggestive that their greater susceptibility might be associated with a different genetic make-up. Pellet (*15*) had pointed out in 1897 that varieties varied in their susceptibility to deterioration. Hall (7) presented data that demonstrated a difference in varietal behavior with reference to inversion of sucrose.

The P. O. J. varieties that displaced the noble canes in Louisiana during the period 1924–29 were found (*1, 3, 11*) to be fairly susceptible to inversion of sucrose and unsatisfactory for windrowing. Therefore, an immediate search (*1, 3, 8*) was initiated for a variety or varieties that would keep well in the windrow. Because of the losses encountered in mill cane during the interval between cutting and milling, an effort was made to evaluate the resistance of varieties under cultivation and to find more resistant varieties for commercial culture (*8, 14*). Rapid progress was made.

[5] Italic numbers in parentheses refer to Literature Cited, p. 24.

Co. 281 was found rather promptly to be a good windrowing cane (*3*). It was grown primarily for that purpose for many years (*3*, *9*). It was finally discarded because of low production when a higher yielding variety, C. P. 34/120 (*9*), was found that was fairly resistant to inversion. A highly resistant variety (C. P. 36/13), fairly well adapted to windrowing, was recently distributed to cane growers (*10*). Other moderately resistant commercial varieties are Co. 290, C. P. 29/116, and C. P. 29/120. These varieties may be windrowed in case of threatened severe freezing temperatures, provided the sucrose content is sufficiently high and the soil is moist. Greater losses from windrowing, however, can be expected with these varieties than with Co. 281. This increased resistance among commercial varieties has reduced the losses between cutting and milling.

SCOPE OF THE INVESTIGATION

These studies arose out of the necessity of finding a cane that would windrow satisfactorily. At first they were limited to commercial canes, then extended to all varieties that showed commercial promise as a result of testing by pathologists and agronomists, and finally to parent varieties. It had been hoped to include all varieties involved in the ancestry of our commercial canes (*4*). This hope has not been entirely realized because certain varieties were not available. The studies have been broadened to include a large number of noble canes and varieties of other species of *Saccharum* not involved in the ancestry of commercial canes, as well as one variety of *Erianthus*. Certain hybrid varieties have been studied because of the light they might shed on the degree of inheritance of resistance or susceptibility to inversion.

This investigation relative to the resistance of parent varieties to inversion of sucrose included varieties of *Saccharum officinarum* L., *S. barberi* Jesw., *S. sinense* Roxb., *S. spontaneum* L., and *S. robustum* Brandes and Jesw. ex Grassl; *Erianthus arundinaceus* (Retz.) Jesw.; and hybrids of *S. officinarum* × *S. barberi*, *S. officinarum* × *S. spontaneum*, *S. officinarum* × *S. barberi* × *S. spontaneum*, *S. officinarum* × *S. robustum*, *S. officinarum* × *E. arundinaceus*, and *S. officinarum* × *S. spontaneum* × *Sorghum vulgare* Pers. (Honey sorghum) (tables 1, 2, 3, and 4).

The studies were limited primarily to agronomic varieties and promising selections from progenies that had been tested for disease resistance. These varieties are listed in table 4, which gives the average ratings of most of the varieties thus far tested. The varieties thus studied, of course, do not represent a cross section of the progenies and may not give an accurate picture of the inheritance of resistance. It is believed, however, that when the number of varieties tested of a given cross is large enough, the data do give some idea of what to expect in the way of resistance among the varieties of that cross. Because of the amount of work involved in testing, it has been impracticable to extend the investigation to a large number of varieties of each of a large number of progenies. Whenever a given cross becomes a common source of commercial varieties, the progeny studied should be large enough to serve as a basis of prediction relative to resistance to inversion of sucrose in the offspring.

TABLE 1.—*Parent varieties* [1] *of species and hybrids of Saccharum, Erianthus, and Sorghum tested for resistance to inversion of sucrose*

Variety	Importation No.
Saccharum officinarum:	
Ashy Mauritius	952
Badila	228
Batjan	771
Black Fiji	697
Bandjarmasin Hitam	1049
Cana Blanca	------
Crystalina	10
Fiji	70
Green Ribbon	31
Louisiana Purple	------
Louisiana Striped	------
Otaheite	466
Yellow Caledonia	------
Atypical *S. officinarum:*	
Loethers	723
Seedlings obtained from *S. officinarum* by open pollination or crossing of clones:	
B. H. 10/12	97
D. 74	------
D. 95	251
D. 1135	11
D. I. 52	68
Diamond 10	720
E. K. 2	576
E. K. 28	69
P. O. J. 100	35
S. C. 12/4	19
S. W. 3	79
S. W. 111	570
Saccharum barberi:	
Chunnee (Saretha group)	233
Dhaulu (Sunnabile group)	1022
Hatooni (Nagori group)	213
Hemja [2] (Mungo group)	234
Kewali (Nagori group)	1023
Saccharum sinense:	
Cayana	126
Uba	------
Saccharum spontaneum:	
Burma	848
Pasoeroean	555
Rellagadi	617
Tabongo	578
Saccharum robustum:	
28 N. G. 219–A	976
Erianthus arundinaceus:	
28 N. G. 7	631
Probable natural hybrids of *S. officinarum* and *S. spontaneum:*	
Hind's Special	169
Kassoer	33
Toledo	56
S. officinarum×*S. barberi:*	
Co. 213	144
P. O. J. 213 [3]	37
S. officinarum×*S. spontaneum:*	
Co. 285	812
C. P. 32/2 [3]	------
P. 33/29	------
P. 33/30	------
P. 33/32	------
P. 33/37	------
P. O. J. 2364	76
P. O. J. 2714	110
P. O. J. 2722	708
P. O. J. 2725	111
P. O. J. 2878	208
P. O. J. 2883	209
P. O. J. 2940	566
P. O. J. 2961	853
S. officinarum×*S. barberi*×*S. spontaneum:*	
Co. 281	------
Co. 290	219
C. P. 807 [3]	------
C. P. 1161	------
C. P. 1165	------
C. P. 27/34	------
C. P. 27/38	------
C. P. 27/48	------
C. P. 27/108	------
C. P. 28/11 [3]	------
C. P. 29/99 [3]	------
C. P. 29/103 [3]	------
C. P. 29/116 [3]	------
C. P. 29/117 [3]	------
C. P. 29/127 [3]	------
C. P. 29/137 [3]	------
C. P. 29/142 [3]	------
C. P. 29/282 [3]	------
C. P. 29/320 [3]	------
C. P. 30/24	------
C. P. 31/288	------
C. P. 31/289	------
C. P. 31/296 [3]	------
C. P. 32/170 [3]	------
C. P. 32/324 [3]	------
C. P. 33/53 [3]	------
C. P. 33/224	------
C. P. 33/229	------
C. P. 33/243 [3]	------
C. P. 33/253 [3]	------
C. P. 33/310 [3]	------
C. P. 33/372 [3]	------
C. P. 34/79 [3]	------
C. P. 34/115 [3]	------
C. P. 34/118 [3]	------
C. P. 34/120	------

See footnotes at end of table.

TABLE 1.—*Parent varieties* [1] *of species and hybrids of Saccharum, Erianthus, and Sorghum tested for resistance to inversion of sucrose*—Continued

Variety	Importation No.	Variety	Importation No.
S. officinarum × *S. barberi* × *S. spontaneum*—Con.		*S. officinarum* × *E. arundinaceus:*	
[C. P.] 38–1322–A [4]		C. P. 36/113	
C. P. 38/41		*S. officinarum* × *S. spontaneum* × *Sorghum vulgare:* [5]	
U. S. 1694		Co. 350	931
S. officinarum × *S. robustum:*		C. P. 36/13 [5]	
C. P. 36/138		C. P. 36/211	
C. P. 36/140			
C. P. 36/151			
C. P. 36/156			

[1] Letters or abbreviations are often used as part of the names of sugarcane varieties and usually indicate the places or institutions at which they were bred or from which they originated. The meanings of such letters and abbreviations used in this bulletin are as follows: B. H.=Barbados Hybrids; Co.=Coimbatore (India); C. P.=Canal Point (Fla.); D.=Demerara; D. I. =Demak Idjo; E. K.=Edward Karthaus; F.=Florida; I.=Java Series; N. G.=New Guinea; P.=seedlings from Philippine seed; P. O. J.=Proefstation Oost Java; S. C.=Saint Croix; S. W.=Sempal Wadak; and U. S. =United States.

[2] Haldane (6) tested Hemza (*S. barberi*), Baruk (*S. barberi*), and Pansahi (*S. sinense*) and found them rather susceptible to inversion of sucrose. Hemza is more often transliterated as Hemja.

[3] Variety tested in connection with experiments relating to evaluation of varieties for commercial culture (tables 3 and 4).

[4] This variety was bred at Canal Point, Fla., but was not given a C. P. number.

[5] The varieties listed under this heading are not regarded as *Sorghum* crosses.

TABLE 2.—*Parents of varieties obtained from open pollination or crossing of noble clones*

Variety	Parents
B. H. 10/12	Seedling of B. 6835.[1]
D. 74	Seedling of White Transparent (Crystalina).
D. 95	Do.
D. 1135	Unknown.
D. I. 52	Louisiana Purple × Batjan.
Diamond 10	Unknown.
E. K. 2	Lahaina × Fiji.
E. K. 28	E. K. 2 × P. O. J. 100.
P. O. J. 100	Loethers × Black Borneo.
S. C. 12/4	Seedling of B. 6835.
S. W. 3	Louisiana Purple × Batjan.
S. W. 111	Do.

[1] B. 6835=seedling of B. 1379 (origin unknown).

TABLE 3.—*Ratings relative to inversion of sucrose of cane of certain hybrid varieties used in the breeding program at Canal Point, Fla.*

Variety	Parents	Experiments conducted	Rating average [1]
		Number	
Co. 281	P. O. J. 213 × Co. 206		1.0
C. P. 807	U. S. 1643 × unknown	6	4.9
C. P. 28/11	Co. 281 × U. S. 1694	7	4.7
C. P. 29/99	P. O. J. 2725 × C. P. 1165	10	.2
C. P. 29/103	do	8	4.1
C. P. 29/116	do	11	1.7
C. P. 29/117	do	5	1.7
C. P. 29/127	do	4	1.6
C. P. 29/137	do	9	.9
C. P. 29/142	do	2	9.9
C. P. 29/282	Co. 281 × U. S. 1694	2	3.3
C. P. 29/320	Co. 281 × C. P. 27/34	7	4.8
C. P. 31/296	Co. 281 × U. S. 1694	3	.9
C. P. 32/2	P. O. J. 2753 × I. 1081	1	5.8
C. P. 32/170	D. 74 × U. S. 1694	1	3.6
C. P. 32/324	P. O. J. 2725 × C. P. 1161	3	1.4
C. P. 33/53	C. P. 31/289 selfed	2	4.0
C. P. 33/243	Co. 281 × U. S. 1694	8	5.3
C. P. 33/253	do	5	4.0
C. P. 33/310	C. P. 1165 × C. P. 27/108	4	5.9
C. P. 33/372	C. P. 1165 × C. P. 28/44	3	9.1
C. P. 34/79	P. 33/30 × C. P. 1161	3	1.4
C. P. 34/115	P. O. J. 2725 × C. P. 1161	8	1.1
C. P. 34/118	P. O. J. 2725 × C. P. 32/109	0	----
C. P. 36/13	P. O. J. 2725 × Honey sorghum	15	.9
P. O. J. 213	Black Cheribon × Chunnee	2	1.9

[1] Ratings are based on differences in drop in apparent purity at the beginning and after about 2 weeks' dry storage or about 2 weeks in the windrow. Co. 281 was the control variety and the drop in purity of this variety was given the value of 1.0. The average ratings of the other varieties were obtained by dividing the total drop in purity of a given variety by the total drop in apparent purity of Co. 281 in the same experiments in which the given variety was included. Varieties with a rating of less than 1.0 have shown a greater resistance to inversion of sucrose than Co. 281, while varieties with a rating greater than 1.0 have shown a greater susceptibility than Co. 281.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]

Variety	Parents	Experiments conducted	Rating [2]
		Number	
Co. 281	P. O. J. 213×Co. 206		1.0
Co. 290	Co. 221×D. 74 or Kansar	52	1.7
C. P. 807	U. S. 1643×unknown	6	4.9
C. P. 28/11	Co. 281×U. S. 1694	7	4.7
C. P. 28/19	do	14	2.9
C. P. 29/1	D. 74 × C. P. 27/108	2	4.7
C. P. 29/15	D. 74 × U. S. 1694	1	2.5
C. P. 29/58	P. O. J. 2878 selfed	1	1.9
C. P. 29/89	P. O. J. 2725 × C. P. 1165	6	1.9
C. P. 29/93	do	1	2.1
C. P. 29/94	do	8	.7
C. P. 29/98	do	3	3.6
C. P. 29/99	do	10	.2
C. P. 29/101	do	1	2.4
C. P. 29/103	do	8	4.1
C. P. 29/108	do	2	3.5
C. P. 29/111	do	1	7.6
C. P. 29/114	do	3	1.4
C. P. 29/115	do	1	5.6
C. P. 29/116	do	11	1.7
C. P. 29/117	do	5	1.7
C. P. 29/120	do	15	2.4
C. P. 29/121	do	1	3.3
C. P. 29/125	do	2	1.8
C. P. 29/127	do	4	1.6
C. P. 29/130	do	2	2.5
C. P. 29/131	do	4	.9
C. P. 29/136	do	4	8.0
C. P. 29/137	do	10	.9
C. P. 29/142	do	2	9.9
C. P. 29/282	Co. 281 × U. S. 1694	2	3.3
C. P. 29/283	do	5	2.6
C. P. 29/285	do	1	5.1
C. P. 29/291	do	2	4.1
C. P. 29/301	Co. 281 × P. O. J. 2878	7	1.9
C. P. 29/320	Co. 281 × C. P. 27/34	7	4.8
C. P. 31/12	C. P. 29/310 × C. P. 28/74	1	3.6
C. P. 31/73	C. P. 29/84 × 21 N. G. 37 (noble cane)	2	5.0
C. P. 31/89	Co. 281 × P. O. J. 2878	2	3.2
C. P. 31/110	do	2	6.6
C. P. 31/114	do	2	4.6
C. P. 31/124	do	1	2.6
C. P. 31/152	Co. 281 × 28 N. G. 251 (*S. robustum*)	1	3.0
C. P. 31/160	do	2	2.6
C. P. 31/161	do	1	2.5
C. P. 31/234	Co. 281 × U. S. 1694	2	3.8
C. P. 31/258	do	2	4.8
C. P. 31/274	do	1	2.1
C. P. 31/276	do	1	6.5
C. P. 31/288	do	1	5.2
C. P. 31/296	do	3	.9
C. P. 31/299	do	1	2.8
C. P. 31/302	do	2	3.6
C. P. 31/509	Co. 281 × C. P. 27/1	2	4.4
C. P. 31/529	Co. 281 × P. O. J. 2878	3	3.6

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 31/551	Co. 281 × U. S. 1694	2	3.2
C. P. 31/561	do	1	1.4
C. P. 32/2	P. O. J. 2753 × I. 1081	1	5.8
C. P. 32/25	P. O. J. 2725 × U. S. 1694	1	2.0
C. P. 32/28	do	1	4.2
C. P. 32/62	U. S. 1643 × C. P. 28/100	1	6.4
C. P. 32/75	do	1	7.8
C. P. 32/87	do	1	5.7
C. P. 32/91	Co. 281 × 28 N. G. 25 (*S. robustum*)	1	5.7
C. P. 32/97	do	3	1.5
C. P. 32/115	P. O. J. 2725 × C. P. 1161	1	3.1
C. P. 32/117	do	1	2.2
C. P. 32/118	do	2	2.9
C. P. 32/120	do	1	2.3
C. P. 32/123	do	1	2.2
C. P. 32/124	do	2	2.1
C. P. 32/131	do	1	3.4
C. P. 32/133	do	1	1.4
C. P. 32/134	do	5	1.0
C. P. 32/135	do	1	1.4
C. P. 32/138	do	1	2.5
C. P. 32/146	do	3	3.2
C. P. 32/168	Co. 281 × U. S. 1694	1	2.2
C. P. 32/170	D. 74 × U. S. 1694	1	3.6
C. P. 32/179	C. P. 28/9 × 28 N. G. 288 (noble cane)	1	3.2
C. P. 32/182	C. P. 29/290 selfed	1	1.7
C. P. 32/195	C. P. 28/44 selfed	1	1.5
C. P. 32/196	do	1	2.5
C. P. 32/202	Co. 281 × C. P. 30/23	4	.8
C. P. 32/206	do	9	1.3
C. P. 32/207	do	1	2.4
C. P. 32/209	do	1	2.0
C. P. 32/212	do	1	2.0
C. P. 32/214	do	1	2.1
C. P. 32/233	C. P. 807 × C. P. 28/36	1	3.2
C. P. 32/307	Co. 281 × C. P. 30/23	2	2.0
C. P. 32/324	P. O. J. 2725 × C. P. 1161	1	1.4
C. P. 32/329	do	1	1.6
C. P. 32/334	do	2	1.2
C. P. 32/335	do	1	1.4
C. P. 32/336	do	2	1.7
C. P. 32/337	do	4	1.2
C. P. 32/339	do	1	5.8
C. P. 32/342	do	1	3.6
C. P. 32/345	do	4	2.1
C. P. 32/348	do	1	3.9
C. P. 32/352	Co. 281 × U. S. 1694	1	6.3
C. P. 33/51	C. P. 31/289 selfed	1	1.5
C. P. 33/53	do	2	4.0
C. P. 33/99	C. P. 31/117 × C. P. 28/100	1	3.7
C. P. 33/121	C. P. 29/307 × C. P. 27/48	4	.9
C. P. 33/125	do	1	1.3
C. P. 33/142	C. P. 31/303 × C. P. 27/108	1	1.6
C. P. 33/148	C. P. 31/493 × C. P. 31/521	1	4.7

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 33/165	C. P. 1165×C. P. 31/518	4	3.5
C. P. 33/173	C. P. 1165×C. P. 28/44	3	2.5
C. P. 33/174	do	1	7.5
C. P. 33/185	do	1	21.5
C. P. 33/216	C. P. 28/9×C. P. 31/288	2	1.8
C. P. 33/224	C. P. 27/139×C. P. 31/432	6	1.2
C. P. 33/228	do	3	1.4
C. P. 33/229	do	1	.9
C. P. 33/232	do	3	.5
C. P. 33/238	C. P. 31/199 selfed	1	.3
C. P. 33/243	Co. 281 × U. S. 1694	8	5.3
C. P. 33/246	do	1	9.8
C. P. 33/249	do	1	9.2
C. P. 33/253	do	5	4.0
C. P. 33/255	do	2	11.7
C. P. 33/257	do	3	2.4
C. P. 33/258	do	1	8.9
C. P. 33/261	do	2	9.7
C. P. 33/262	do	1	9.6
C. P. 33/273	C. P. 29/142 × C. P. 27/108	1	1.6
C. P. 33/278	do	3	4.3
C. P. 33/285	do	1	3.9
C. P. 33/297	C. P. 31/289 selfed	1	1.6
C. P. 33/298	do	1	2.7
C. P. 33/299	do	1	3.4
C. P. 33/301	do	1	5.2
C. P. 33/302	do	1	.7
C. P. 33/307	C. P. 1165 × C. P. 27/108	1	3.3
C. P. 33/309	do	1	2.4
C. P. 33/310	do	4	5.9
C. P. 33/320	do	4	1.6
C. P. 33/323	do	1	3.8
C. P. 33/334	C. P. 31/117 × C. P. 28/100	1	4.8
C. P. 33/335	do	1	4.1
C. P. 33/337	do	1	2.9
C. P. 33/342	C. P. 29/307 × C. P. 27/48	1	1.1
C. P. 33/351	C. P. 28/9 × C. P. 28/100	1	3.9
C. P. 33/364	C. P. 1165 × C. P. 28/44	1	7.1
C. P. 33/365	do	1	2.9
C. P. 33/366	do	3	5.0
C. P. 33/370	do	1	3.7
C. P. 33/372	do	3	9.1
C. P. 33/374	do	1	4.2
C. P. 33/375	do	1	2.8
C. P. 33/389	C. P. 28/9 × C. P. 31/288	1	2.1
C. P. 33/393	Co. 281 × U. S. 1694	1	4.0
C. P. 33/394	do	1	3.3
C. P. 33/397	do	1	2.4
C. P. 33/398	do	1	3.5
C. P. 33/400	do	1	3.8
C. P. 33/401	do	1	3.2
C. P. 33/406	do	3	3.5
C. P. 33/409	do	5	3.2
C. P. 33/411	do	1	2.9

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 33/413	Co. 281 × U. S. 1694	1	3.6
C. P. 33/414	do	1	6.2
C. P. 33/415	do	4	5.3
C. P. 33/416	do	1	2.0
C. P. 33/420	do	1	4.8
C. P. 33/421	do	1	1.6
C. P. 33/425	do	6	3.3
C. P. 33/427	do	1	4.4
C. P. 33/430	do	1	2.7
C. P. 33/435	do	1	4.6
C. P. 33/437	do	2	2.6
C. P. 33/438	do	1	3.4
C. P. 33/441	do	1	2.2
C. P. 33/445	do	1	3.8
C. P. 33/446	do	1	1.7
C. P. 33/449	do	2	4.4
C. P. 33/450	do	1	3.1
C. P. 33/451	do	1	5.8
C. P. 33/453	do	1	6.1
C. P. 33/455	do	1	3.6
C. P. 33/459	do	1	3.2
C. P. 33/461	do	1	2.0
C. P. 33/464	do	1	3.0
C. P. 33/467	do	1	3.0
C. P. 33/471	do	3	2.5
C. P. 33/472	do	2	4.1
C. P. 33/476	do	1	1.8
C. P. 33/485	C. P. 1165 × C. P. 27/108	5	1.9
C. P. 33/494	C. P. 1165 × C. P. 28/44	2	1.4
C. P. 33/500	Co. 281 × U. S. 1694	4	4.0
C. P. 33/509	do	1	2.2
C. P. 34/1	do	3	4.6
C. P. 34/9	P. O. J. 2725 × C. P. 1165	2	11.8
C. P. 34/10	do	3	7.1
C. P. 34/16	U. S. 1643 × C. P. 29/284	2	5.2
C. P. 34/20	do	3	3.3
C. P. 34/21	do	3	3.7
C. P. 34/25	C. P. 28/11 × C. P. 27/38	3	4.4
C. P. 34/27	do	2	8.0
C. P. 34/52	Co. 281 × P. O. J. 2878	1	.2
C. P. 34/53	do	3	8.1
C. P. 34/54	Co. 281 × C. P. 1165	2	1.8
C. P. 34/57	do	1	3.2
C. P. 34/59	do	4	4.7
C. P. 34/64	Co. 281 × C. P. 29/290	1	1.3
C. P. 34/67	Co. 281 × C. P. 32/197	1	3.2
C. P. 34/70	C. P. 28/10 × C. P. 29/290	1	3.2
C. P. 34/73	C. P. 29/307 × C. P. 29/252	1	3.1
C. P. 34/75	P. 33/30 × C. P. 1161	3	2.0
C. P. 34/77	do	3	2.0
C. P. 34/79	do	3	1.4
C. P. 34/80	do	6	2.1
C. P. 34/83	Co. 281 × U. S. 1694	2	2.2
C. P. 34/84	do	3	2.7
C. P. 34/86	do	2	2.7

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1938 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 34/90	Co. 281 × P. O. J. 2878	1	2.5
C. P. 34/92	Co. 281 × C. P. 1165	6	3.7
C. P. 34/95	do	2	2.6
C. P. 34/96	do	2	2.5
C. P. 34/102	P. O. J. 2725 × C. P. 1165	2	2.3
C. P. 34/105	C. P. 28/11 × C. P. 27/38	2	3.5
C. P. 34/112	P. O. J. 2725 × C. P. 1161	1	1.9
C. P. 34/115	do	8	1.1
C. P. 34/120	Co. 281 × P. O. J. 2878	25	1.7
C. P. 34/138	C. P. 28/11 × C. P. 27/38	2	2.8
C. P. 34/139	P. O. J. 2725 × C. P. 1165	14	1.8
C. P. 34/141	P. O. J. 2725 × C. P. 1161	4	2.1
C. P. 34/143	do	4	2.4
C. P. 34/144	do	1	2.3
C. P. 34/149	Co. 281 × U. S. 1694	1	2.8
C. P. 34/151	do	2	4.5
C. P. 34/152	do	1	3.1
C. P. 34/153	do	1	2.9
C. P. 34/155	Co. 281 × P. O. J. 2878	3	2.9
C. P. 34/156	Co. 281 × C. P. 1165	1	2.3
C. P. 34/158	Co. 281 × P. O. J. 2822	1	2.7
C. P. 34/164	P. 33/30 × C. P. 1161	3	1.4
C. P. 34/165	P. O. J. 2725 × C. P. 1161	4	1.1
C. P. 34/167	P. O. J. 2725 × C. P. 32/109	1	11.9
C. P. 35/1	Co. 281 × C. P. 27/38	2	2.6
C. P. 35/14	C. P. 31/78 selfed	4	2.1
C. P. 36/1	P. O. J. 2725 × C. P. 1165	10	1.4
C. P. 36/7	do	4	2.6
C. P. 36/13	P. O. J. 2725 × Honey sorghum	15	.9
C. P. 36/17	Co. 281 × C. P. 1165	3	3.8
C. P. 36/18	do	2	5.4
C. P. 36/19	do	8	4.2
C. P. 36/22	do	2	3.2
C. P. 36/23	do	4	1.4
C. P. 36/27	Co. 281 × U. S. 1694	1	1.3
C. P. 36/50	do	2	2.8
C. P. 36/54	do	2	3.4
C. P. 36/55	do	7	11.2
C. P. 36/56	P. O. J. 2725 × C. P. 1165	1	2.1
C. P. 36/62	do	3	1.9
C. P. 36/63	do	3	4.0
C. P. 36/64	do	2	1.5
C. P. 36/66	do	1	3.5
C. P. 36/67	do	1	2.7
C. P. 36/69	do	1	6.5
C. P. 36/70	do	2	18.0
C. P. 36/72	do	3	.9
C. P. 36/73	do	3	2.4
C. P. 36/75	do	4	7.2
C. P. 36/78	do	3	6.1
C. P. 36/80	do	4	1.9
C. P. 36/81	do	2	7.4
C. P. 36/83	P. O. J. 2822 × U. S. 1694	2	3.3

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 36/85	P. O. J. 2725 × C. P. 1165	8	1.3
C. P. 36/89	do	3	2.7
C. P. 36/94	do	10	1.8
C. P. 36/96	do	3	4.3
C. P. 36/100	P. O. J. 2725 × C. P. 28/11	1	2.2
C. P. 36/105	Co. 281 × C. P. 1165	7	3.4
C. P. 36/106	Co. 281 × C. P. 30/24	2	2.3
C. P. 36/111	P. O. J. 2725 × C. P. 1165	3	7.1
C. P. 36/160	Co. 281 × U. S. 1694	3	2.7
C. P. 36/161	do	1	3.3
C. P. 36/162	P. O. J. 2725 × C. P. 1165	2	2.5
C. P. 36/164	do	1	2.6
C. P. 36/165	do	2	11.2
C. P. 36/167	do	1	1.7
C. P. 36/169	do	1	7.5
C. P. 36/170	do	1	7.2
C. P. 36/173	do	1	5.4
C. P. 36/174	do	1	3.0
C. P. 36/175	do	2	1.4
C. P. 36/178	do	4	5.2
C. P. 36/179	do	6	2.4
C. P. 36/180	do	1	3.2
C. P. 36/181	do	1	2.9
C. P. 36/183	do	8	4.3
C. P. 36/184	do	2	2.1
C. P. 36/185	do	1	1.8
C. P. 36/187	do	2	3.3
C. P. 36/189	do	2	.9
C. P. 36/190	do	1	2.1
C. P. 36/191	do	4	2.7
C. P. 36/192	do	3	3.4
C. P. 36/193	Co. 281 × U. S. 1694	1	3.4
C. P. 36/194	P. O. J. 2725 × C. P. 1165	2	8.2
C. P. 36/195	do	2	4.2
C. P. 36/197	do	5	4.3
C. P. 36/198	do	1	3.3
C. P. 36/199	do	1	23.8
C. P. 36/201	do	1	5.2
C. P. 36/202	do	1	2.6
C. P. 36/203	P. O. J. 2878 × C. P. 28/11	4	4.6
C. P. 36/205	P. O. J. 2725 × C. P. 1165	1	2.4
C. P. 36/206	do	1	7.9
C. P. 36/207	P. O. J. 2878 × C. P. 28/11	2	2.4
C. P. 36/208	Co. 281 × U. S. 1694	1	1.8
C. P. 36/209	P. O. J. 2725 × C. P. 1165	4	5.9
C. P. 37/3	Co. 281 × C. P. 27/108	4	1.7
C. P. 37/5	do	8	1.4
C. P. 37/9	C. P. 33/224 × C. P. 33/152	12	.8
C. P. 37/14	P. O. J. 2725 × Co. 356	1	4.3
C. P. 37/17	C. P. 29/366 × C. P. 28/100	1	14.8
C. P. 38/1	P. O. J. 2725 × C. P. 1165	3	2.1
C. P. 38/2	do	2	3.4
C. P. 38/3	do	1	6.2

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 38/4	do	1	1.9
C. P. 38/5	do	1	7.7
C. P. 38/6	do	2	5.2
C. P. 38/7	do	1	4.4
C. P. 38/8	do	1	3.5
C. P. 38/9	do	4	3.6
C. P. 38/10	do	1	2.7
C. P. 38/12	do	1	14.0
C. P. 38/13	do	1	2.7
C. P. 38/14	do	3	3.2
C. P. 38/15	P. O. J. 2725 × Co. 356	4	3.8
C. P. 38/16	do	3	3.3
C. P. 38/17	Co. 281 × U. S. 1694	2	9.3
C. P. 38/18	do	5	2.5
C. P. 38/19	C. P. 29/116 × C. P. 1165	2	1.7
C. P. 38/21	P. O. J. 2725 × C. P. 1165	1	5.0
C. P. 38/23	do	3	2.3
C. P. 38/25	P. 33/29 × C. P. 1161	5	1.0
C. P. 38/26	P. O. J. 2725 × C. P. 36/156	8	2.0
C. P. 38/27	Co. 281 × C. P. 1165	3	2.3
C. P. 38/28	do	3	13.4
C. P. 38/30	do	1	4.4
C. P. 38/31	Co. 281 × C. P. 27/108	1	.6
C. P. 38/33	Co. 421 × C. P. 27/156	2	1.0
C. P. 38/34	do	3	1.5
C. P. 38/35	C. P. 35/7 × Co. 356	1	1.7
C. P. 38/36	do	1	2.2
C. P. 38/37	P. O. J. 2725 × C. P. 1161	4	.9
C. P. 38/38	do	3	1.8
C. P. 38/39	P. 33/29 × C. P. 1161	4	.8
C. P. 38/40	30 series 1310–A selfed	1	3.1
C. P. 42/1	P. O. J. 2725 × C. P. 1161	1	3.6
C. P. 42/2	C. P. 29/117 × C. P. 1165	1	12.5
C. P. 42/3	Co. 281 × C. P. 1165	1	10.2
C. P. 42/4	do	1	9.8
C. P. 42/6	Co. 281 × C. P. 27/108	2	1.6
C. P. 42/13	P. O. J. 2878 × C. P. 28/11	2	2.0
C. P. 42/15	P. O. J. 2725 × C. P. 31/289	2	2.0
C. P. 42/16	P. O. J. 2725 × C. P. 1165	1	1.7
C. P. 42/17	do	3	1.1
C. P. 42/18	P. O. J. 2725 × C. P. 1161	2	6.1
C. P. 42/19	P. O. J. 2725 × C. P. 1165	2	3.8
C. P. 42/20	do	1	4.5
C. P. 42/21	Co. 281 × (P. O. J. 2725 × Amu Darya 60, *S. spontaneum*, Turkestan).	2	3.2
C. P. 42/22	P. O. J. 2725 × C. P. 1165	2	2.2
C. P. 42/23	C. P. 33/224 × C. P. 33/152	3	.5
C. P. 42/24	P. 33/29 × C. P. 1161	1	3.3
C. P. 42/25	Co. 421 × C. P. 27/156	2	2.5
C. P. 42/26	C. P. 29/116 selfed	2	10.8
C. P. 43/3	C. P. 29/99 × C. P. 36/156	4	4.7
C. P. 43/4	P. 33/29 × C. P. 1161	1	2.4
C. P. 43/5	do	1	1.0

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 43/9	C. P. 29/320 × P. 33/32	3	2.5
C. P. 43/10	C. P. 29/320 × P. O. J. 2878	1	.9
C. P. 43/12	Co. 281 × C. P. 27/34	2	1.9
C. P. 43/13	do	4	3.5
C. P. 43/14	do	1	2.4
C. P. 43/15	do	1	2.5
C. P. 43/17	do	1	2.2
C. P. 43/20	do	1	2.8
C. P. 43/21	Co. 281 × C. P. 27/108	1	3.2
C. P. 43/22	do	1	2.4
C. P. 43/24	do	2	1.8
C. P. 43/26	do	1	1.9
C. P. 43/28	Co. 281 × C. P. 1161	2	4.2
C. P. 43/30	do	1	2.5
C. P. 43/31	do	1	3.4
C. P. 43/32	do	5	2.0
C. P. 43/33	Co. 281 × C. P. 1165	5	3.6
C. P. 43/34	do	2	3.1
C. P. 43/35	do	1	4.2
C. P. 43/36	do	2	3.6
C. P. 43/37	do	2	3.6
C. P. 43/38	do	2	3.2
C. P. 43/39	do	2	2.8
C. P. 43/41	do	1	2.2
C. P. 43/43	do	5	1.3
C. P. 43/44	do	1	6.2
C. P. 43/45	do	1	4.1
C. P. 43/47	do	7	2.2
C. P. 43/48	do	2	3.1
C. P. 43/49	Co. 281 × U. S. 1694	4	2.6
C. P. 43/50	do	1	3.7
C. P. 43/52	do	3	3.9
C. P. 43/53	do	4	4.7
C. P. 43/56	C. P. 28/9 × C. P. 36/212	1	3.9
C. P. 43/67	C. P. 36/138 × C. P. 27/108	2	8.6
C. P. 44/26	Co. 281 × C. P. 1165	1	3.5
C. P. 44/37	C. P. 28/9 × C. P. 27/108	1	.5
C. P. 44/45	Co. 281 × C. P. 27/34	1	.2
C. P. 44/49	do	2	4.7
C. P. 44/50	do	1	3.2
C. P. 14/51	do	2	.9
C. P. 44/52	do	1	.9
C. P. 44/53	do	1	1.0
C. P. 44/69	Co. 281 × C. P. 27/108	2	3.6
C. P. 44/72	Co. 281 × C. P. 1161	2	3.8
C. P. 44/78	Co. 281 × C. P. 1165	2	4.0
C. P. 44/92	do	2	1.0
C. P. 44/101	do	2	.9
C. P. 44/116	39-863-C × C. P. 33/229	2	3.5
C. P. 44/119	Co. 281 × U. S. 1694	1	2.9
C. P. 44/121	C. P. 29/103 × C. P. 27/48	1	3.3
C. P. 44/132	Co. 281 × C. P. 1161	2	1.0

See footnotes at end of table.

TABLE 4.—*Ratings relative to inversion of sucrose in sugarcane varieties tested for high resistance during the period from 1933 to 1947, inclusive* [1]—Continued

Variety	Parents	Experiments conducted	Rating [2]
		Number	
C. P. 44/153	Co. 281 × C. P. 1165	2	2. 1
C. P. 44/155	C. P. 33/229 × C. P. 33/224	1	.1
C. P. 44/156	Co. 281 × C. P. 27/108	1	1. 1
F. 31/762	do	5	1. 7
F. 31/962	do	1	1. 1
F. 36/819	F. 31/962 × P. O. J. 2878	5	.3
P. 33/11	P. O. J. 2878 × Badila	1	2. 2

[1] Only varieties that showed some indication of commercial promise were tested. As soon as a variety ceased to be considered for commercial release, testing was discontinued.

[2] Ratings are based on differences in drop in purity during about 2 weeks of storage under dry conditions or 2 weeks in the windrow. Co. 281 was the control variety, and the drop in purity of this variety in each experiment was given the value of 1. 0. The ratings of the other varieties were obtained by dividing the drop in purity of these varieties by that of Co. 281. The average ratings were obtained by dividing the total drop in purity of a given variety by the total drop in purity of Co. 281 in the same experiments in which the given variety was included. Varieties with a rating less than 1. 0 showed greater resistance to inversion of sucrose than Co. 281, whereas varieties with ratings greater than 1. 0 showed greater susceptibility to inversion than Co. 281.

SELECTION OF SAMPLES AND STORAGE OF CANE

Three methods of selecting samples were employed. (1) A number of stalks of about the same thickness and length, corresponding to the number of samples to be selected, were taken and distributed. This process was repeated until the desired number of stalks for each sample was selected. Each sample consisted of one stalk from each successive selection. This method of selection was employed when the supply of cane was small and only 10-stalk samples were used. (2) Stalks were taken at random from a pile, and one placed at successive locations representing the number of samples to be selected. This procedure was repeated until there was the desired number of stalks for a sample at each location. (3) Stalks were taken at random from a pile, and the selection of a sample completed before the selection of another sample was started.

In drawing stalks from a pile of cane, the person who did the selecting was prone to draw the larger stalks. This procedure sometimes resulted in a gradation in size of stalks among samples when the samples were selected successively, as by the third method. Great care was observed to keep such biased selection to a minimum. By use of the first and second methods, particularly the first, this difficulty was overcome. The use of method 1 was limited to small lots of cane. Method 2 was employed more often than the other two, and now is used exclusively, except in case of small lots of cane.

Samples were taken at random from the entire lot of samples of each variety of cane for controls and for storage. From one to five,

usually five, samples of each variety were used as controls for each period of storage.[6]

The samples were stored in racks in an open shed, which permitted free circulation of air, or in open racks in a room where temperature and relative humidity were controlled and in which forced air circulation was provided, or in the windrow. Studies dealing with parent varieties stored under controlled temperature and humidity were limited to three experiments in one season, 1941 (see fig. 3). These environmental conditions usually favored heavy loss of moisture, an essential condition for clearly differentiating varietal susceptibility, especially in mature cane of highly resistant varieties. In less mature cane, conditions of drying need not be so severe in order to obtain contrasting results between varieties of dissimilar resistance.

METHOD OF ANALYSIS

The samples were weighed, crushed, and analyzed for Brix and apparent sucrose at the beginning of the experiments and after periods of storage under the conditions previously described (*11*).

EXPERIMENTAL DATA

Twenty-one experiments dealing directly with parents and involving 82 varieties were conducted during the period 1938–48. In addition, 26 varieties used as parents at Canal Point, Fla., were tested in experiments dealing with progeny selections during the years 1931–48 (table 3). The weight losses and changes in purity of the 82 varieties are graphically represented in figures 1 to 5.[7] The initial Brix, apparent sucrose, and apparent purity are also given for each variety and experiment. The ratings relative to resistance to inversion of sucrose of the 26 hybrid parent varieties are given in table 3, and the selections from their progenies in table 4.

The Brix, sucrose, and purity values of a given variety varied from experiment to experiment, depending upon the maturity of the cane, the season, and the conditions under which the cane was grown. The values of the changes occurring during storage, such as the loss of moisture and inversion of sucrose in a given variety, differed with the above variables and with the conditions under which the cane was stored. It is not possible to control any of these variables except the conditions of storage. It has been impracticable, thus far, to standardize storage conditions except in a given experiment. Controlled conditions of storage were not available for the extensive experiments involved, and the conditions in the shed varied from experiment to experiment, depending upon usual changes of weather. The variation in environment should be kept in mind when comparing the results of different experiments. Notwithstanding the differences in season,

[6] The only cases in which only 1 sample was stored and 1 used as a control were those of Burma (*S. spontaneum* from Burma) and Pasoerocan (*S. spontaneum* from Java). The samples of Burma contained 86 stalks each and those of Pasoerocan 87. Five 100-stalk samples of each of Rellagadi (*S. spontaneum* from British India) and Tabongo (*S. spontaneum* from North Celebes, Dutch East Indies) were stored and 5 were used as controls. With the exception of *S. spontaneum* the size of the samples ranged from 10 to 30 stalks. Most of the samples contained 20 stalks.

[7] Weighings were not made in one experiment (fig. 4, *C*).

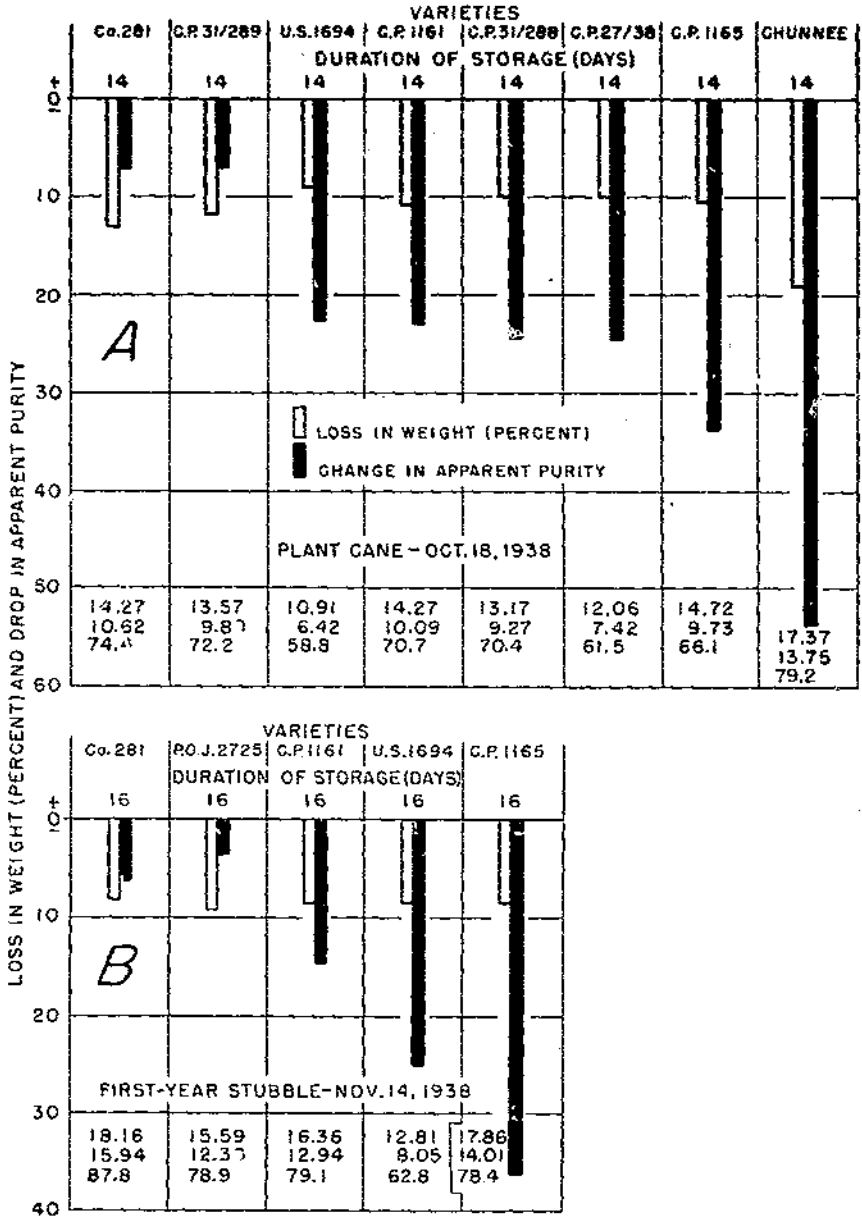

FIGURE 1.—Initial Brix, apparent sucrose, and apparent purity (figures in each block reading from top to bottom), loss in weight (percent), and drop in apparent purity in cane of parent varieties stored in an open shed in two experiments at Houma, La., in 1938.

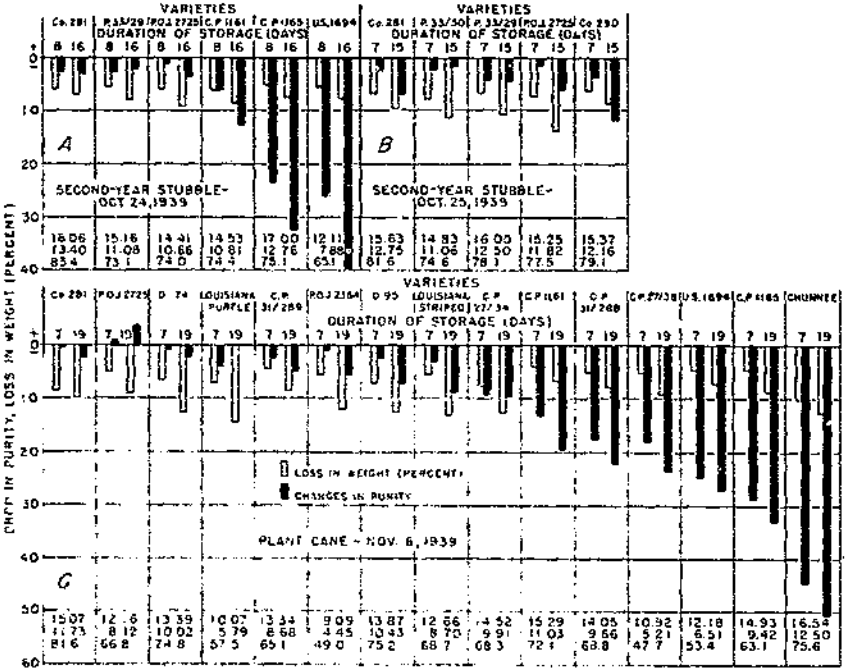

FIGURE 2.—Initial Brix, apparent sucrose, and apparent purity (figures in each block reading from top to bottom), loss in weight (percent), and change in apparent purity in cane of parent varieties stored in an open shed in three experiments at Houma, La., in 1939.

maturity of cane, and the weather conditions associated with the different experiments, the behavior of each variety was remarkably characteristic. Only minor varietal shifts were observed.

The relation of moisture loss to variety was not always consistent between experiments, nor was the relation of moisture loss to inversion of sucrose consistent. This conclusion must be drawn notwithstanding the marked influence of the loss of moisture on inversion within a variety. A condition sometimes develops within a variety that restricts inversion despite marked loss of moisture (*12*).

The variation in soluble solids and sucrose content between varieties was great, as indicated by the difference in Brix and sucrose content of the juice. In some instances the variation was due to differences in maturity, in others to environmental response, and in some to inherent characteristics. Many varieties, such as those of *S. spontaneum*, have a low sucrose content at maturity, while many of the commercial varieties reach a high sucrose content at maturity. However, there seems to be little relation between sucrose content and resistance to inversion of sucrose within the limits of these experiments. For instance, P. 33/30 and P. O. J. 2725 with about equal sucrose content (fig. 4, *B*) showed about the same drop in purity; Black Fiji and S. W. 111, with dissimilar sucrose content, showed the same drop in purity (fig. 4, *E*); Caña Blanca, with a high sucrose content (17.78 percent), showed much less inversion than Fiji with a sucrose content of 9.75

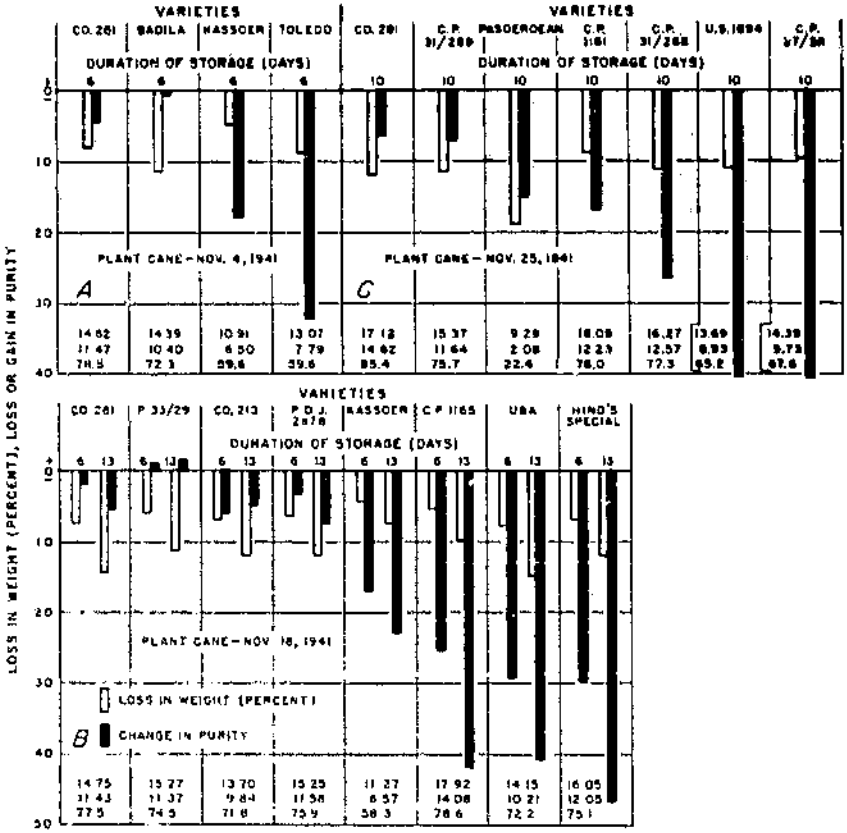

FIGURE 3.—Initial Brix, apparent sucrose, and apparent purity (figures in each block reading from top to bottom), loss in weight (percent), and change in apparent purity in cane of parent varieties stored at a temperature of 65° F. and a relative humidity of 54 percent with constant air movement in three experiments at Houma, La., in 1941.

percent (fig. 4, *E*); and Black Fiji with a sucrose content of 5.26 percent showed a much smaller drop in purity than E. K. 28 with a sucrose content of 12.23 percent (fig. 4, *E*). These examples are not exceptions. There are many similar cases.

The duration of storage may become a factor influencing the differences obtained with different varieties. For instance, a comparison of varieties with contrasting sucrose content and the same rate of inversion would be meaningless if the storage period were long enough to allow inversion to continue to completion in the variety with the higher sucrose content.

The length of the storage period used, while arbitrarily selected, is within practical limits, and the behavior under dry storage relative to inversion is in harmony with results obtained in the windrow under similar environmental conditions.

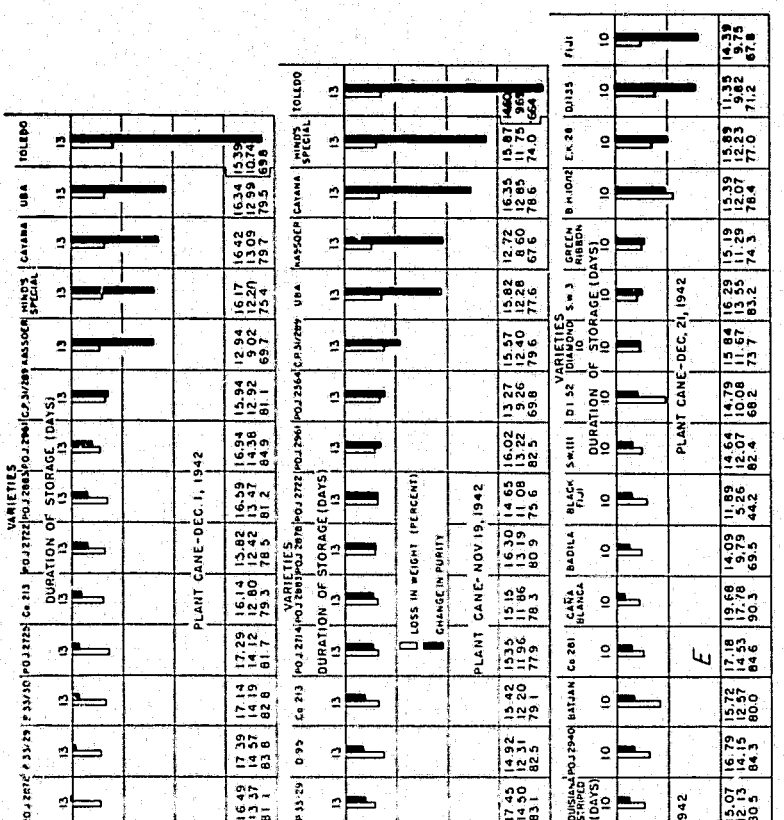

FIGURE 4.—Initial Brix, apparent sucrose, and apparent purity (figures in each block reading from top to bottom), loss in weight (percent), and change in apparent purity in cane of parent varieties stored in an open shed in four experiments (*A*, *B*, *C*, and *D*) at Houma, La., and one experiment (*E*) at Canal Point, Fla., in 1942.

The rate of inversion of sucrose may or may not change materially with the continuation of storage. If the conditions of storage were such as to more or less maintain a constant loss of moisture, the rate of inversion of sucrose in varieties Co. 281 and Co. 290 was generally only slightly retarded with the lapse of time (as long as 35 days) (*13*). In case of varieties C. P. 807 and C. P. 28/19 inversion tended to reach an equilibrium at various air-moisture and temperature levels after certain periods of time, although the moisture loss continued at about the same rate (*13*). Yet these two varieties usually lost more

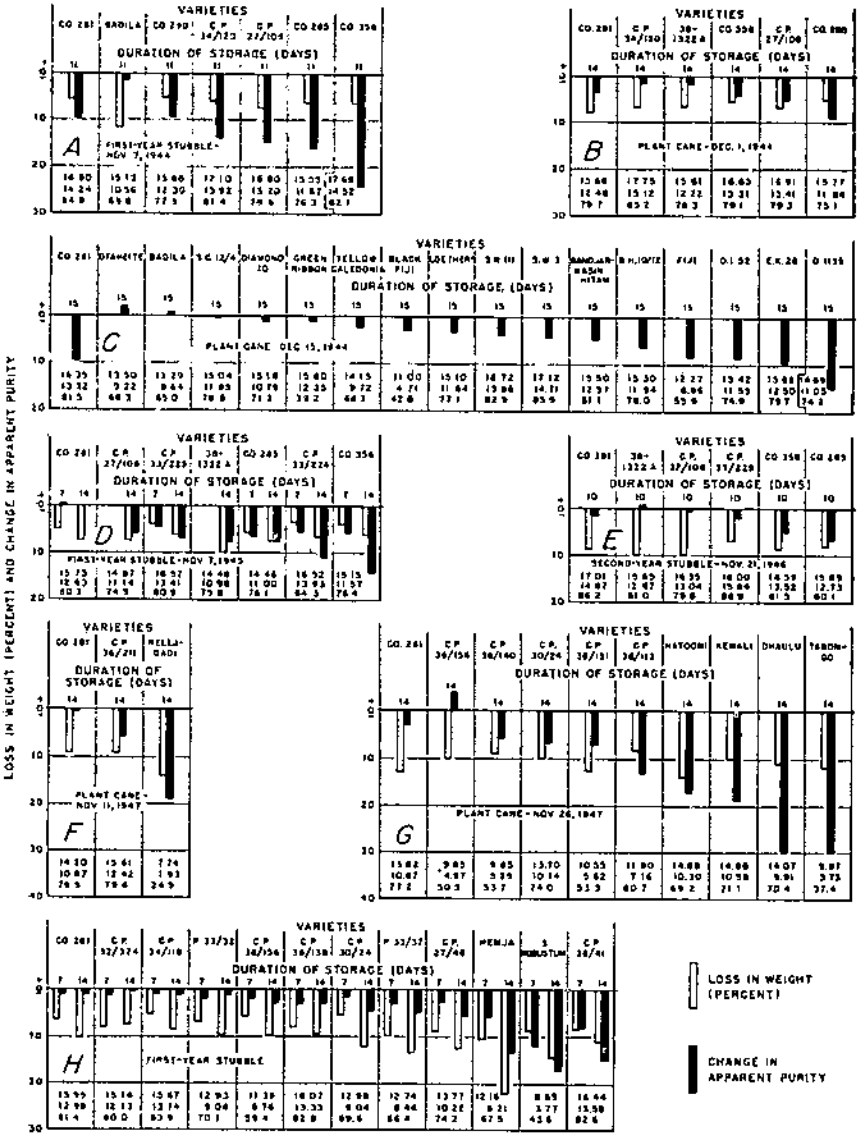

FIGURE 5.—Initial Brix, apparent sucrose, and apparent purity (figures in blocks reading from top to bottom), loss in weight (percent), and change in apparent purity in cane of parent varieties stored in an open shed in eight experiments, seven of which (*A*, *B*, *D*, *E*, *F*, *G*, and *H*) were conducted at Houma, La., and one (*C*) at Canal Point, Fla. *A*, *B*, and *C* were conducted in 1944, *D* in 1945, *E* in 1946, *F* and *G* in 1947, and *H* in 1948.

sucrose through inversion than Co. 281 and Co. 290 (table 4).[8] It is believed that despite the many variables involved in these experiments, the method followed clearly shows large inherent differences in

[8] The results in table 4 are based on storage in an open cane shed and in the windrow.

resistance to inversion of sucrose. It will be noted that Co. 281 (the control variety) maintained a fairly constant position relative to the other varieties. It was relatively highly resistant despite great differences in sucrose content, maturity, and conditions of storage. Some other varieties, as Badila and P. O. J. 2725, appeared to be more highly resistant than Co. 281.

The results show that the noble canes studied are more resistant as a group to inversion of sucrose than the varieties of *S. barberi*, *S. sinense*, *S. spontaneum*, and *E. arundinaceus* tested. This difference in resistance is further shown by the difference in resistance between varieties of *S. officinarum* obtained from open pollination and from crossing clones of noble canes and for the most part those obtained from interspecific crossing between *S. officinarum* and *S. barberi*, *S. spontaneum*, and *E. arundinaceus*. In the experiments, the natural hybrids of *S. officinarum* and *S. spontaneum* (Hind's Special, Kassoer, and Toledo) were highly susceptible (fig. 3, *B*, and fig. 4, *B*, *C*). P. O. J. 36 and 36–M, offspring of Gestreept Preanger (Louisiana Striped) × Chunnee, were very susceptible (*3*, *7*). P. O. J. 213 and P. O. J. 234, obtained from Black Cheribon (Louisiana Purple) × Chunnee (*4*), showed moderate and high susceptibility, respectively (*3*, *7*). Co. 213, which resulted from an outcross of P. O. J. 213 with a variety of *S. barberi* (Kansar), was fairly resistant (fig. 3, *B*, and fig. 4, *C*). Unfortunately, Kansar has not been tested. It would seem from the results obtained with Co. 213 that it is more resistant than the varieties of *S. barberi* tested.

Only one variety of *S. robustum* (Imp. 976) has been tested for resistance to inversion of sucrose. It was found susceptible (fig. 5, *H*), but not so susceptible as the varieties of *S. barberi*, *S. sinense*, *S. spontaneum*, and *E. arundinaceus*. None of its progenies have been tested. C. P. 36/140 was from the progeny of Crystalina × *S. robustum* (Imp. 496), and C. P. 36/151 from Louisiana Purple × *S. robustum* (Imp. 496). These two varieties apparently were less resistant than Co. 281 (fig. 5, *G*), but were moderately resistant. C. P. 36/156, from a cross between P. O. J. 2725 and *S. robustum*, appeared to be highly resistant (fig. 5, *G*, *H*). P. O. J. 2725 was one of the most resistant varieties tested. C. P. 31/152, C. P. 31/160, C. P. 31/161, C. P. 32/91, and C. P. 32/97 resulted from a cross between Co. 281 and *S. robustum* (Imp. 496). Their range of resistance and susceptibility extended from resistance slightly less than that of Co. 281 to considerable susceptibility (ratings: 3.0, 2.6, 2.5, 5.7, 1.5, respectively) (table 4).

C. P. 36/113, an F_1 from Louisiana Purple × *E. arundinaceus*, was moderately susceptible (fig. 5, *G*). *E. arundinaceus* apparently was very susceptible to inversion (fig. 4, *A*).

The foregoing data indicate strongly that susceptibility to inversion of sucrose in most of the varieties studied is derived from *S. spontaneum* and *S. barberi* and that it is dominant to resistance. The data relative to *S. robustum* are insufficient from which to draw definite conclusions. It is possible that *S. robustum* is more resistant than the other wild canes. More data, likewise, are needed in connection with *Erianthus* sp. The study should have included more F_1 hybrids of the noble and wild canes, but thus far they have not been available.

Two varieties, C. P. 36/13 and C. P. 36/211, obtained from the cross P. O. J. 2725 × Honey sorghum, and one variety, Co. 356, from P. O. J. 2725 × *Sorghum durra* Stapf., were tested for resistance to inversion (table 3 and fig. 5). However, they are not sorghum hybrids. They may have arisen in one of three ways: Selfing, parthenogenesis (induced development by sorghum pollen), or pollination by stray sugarcane pollen. Because of the resemblance of these varieties to the female parent, it is believed that they resulted from development of the unfertilized mother cell. C. P. 36/13 was slightly more resistant than Co. 281 (table 3), while C. P. 36/211 and Co. 356 were more susceptible than Co. 281 (fig. 5, *A, B, D, E, F*).

Considerable data were accumulated relative to progenies before studies relating to parent varieties were initiated. These and later data are summarized in table 4. The progenies are mostly interspecific hybrids of sugarcane of varying degrees of nobilization and are predominantly susceptible to inversion of sucrose. This fact is further evidence that susceptibility is dominant. Only in a few instances were the progenies large enough to show definite trends of inheritance. The results of certain progenies are summarized in table 5. The number of varieties from two of the crosses (Co. 281 × C. P. 1161 and Co. 281 × P. O. J. 2878) is probably too small from which to draw conclusions. It is quite evident that the first three crosses are a better source of high resistance than Co. 281 × U. S. 1694. Although the data in table 5 are limited to one segment of the population, the population as a whole shows a similar difference in resistance.

TABLE 5.—*Percentage of progenies showing high resistance to inversion of sucrose*

Parents	Progenies		
	Tested	Showing a rating of 1.0 or less [1]	Showing a rating of 1.1 to 1.5
	Number	*Percent*	*Percent*
P. O. J. 2725 × C. P. 1165	98	6. 1	6. 1
P. O. J. 2725 × C. P. 1161	32	6. 3	25. 0
Co. 281 × C. P. 1165	36	5. 6	5. 6
Co. 281 × C. P. 1161	6	16. 7	0
Co. 281 × U. S. 1694	88	1. 1	2. 3
Co. 281 × P. O. J. 2878	11	9. 1	0

[1] Ratings are based on differences in drop in apparent purity at the beginning and after about 2 weeks of dry storage or about 2 weeks in the windrow. Co. 281 was the control variety and the drop in apparent purity of this variety was given the value of 1.0. The average ratings of the other varieties were obtained by dividing the total drop in apparent purity of a given variety by the total drop in apparent purity of Co. 281 in the *same* experiments in which the given variety was included. Varieties with a rating less than 1.0 have shown greater resistance to inversion of sucrose than Co. 281, while varieties with a rating greater than 1.0 have shown greater susceptibility to inversion of sucrose than Co. 281. Some of the varieties were more thoroughly tested than others.

The effect of nobilization in building up resistance is noticeable in a few instances. P. O. J. 2714, 2722, 2725, 2878, and 2883 from a progeny of a third nobilization of *S. spontaneum* (*4*) all showed considerable resistance (fig. 4, *B*, *C*). P. O. J. 2725 was highly resistant. These varieties of that particular progeny were the only ones tested. The data therefore seem highly significant. Further nobilization of P. O. J. 2878 by the highly resistant Badila yielded very high resistance in two varieties, P. 33/29 and P. 33/30 (fig. 4, *B*, *C*), and moderate resistance in one variety, P. 33/11 (table 4).

On the basis of data presented, it would seem that *S. officinarum* (noble canes) had an independent development from that of *S. barberi*, *S. sinense*, and *S. spontaneum*, and that the noble canes have not been modified, or at least not to any extent, by natural intercrossing with varieties of these three species.

On the basis of limited data the behavior of *S. robustum* with respect to resistance to inversion is more like that of *S. officinarum* than of the other species. It is also similar to the noble varieties in its reaction to diseases and in many of its morphological characteristics. The behavior of chromosomes of these two species in hybrid combination indicates that many of their chromosomes may be homologous (*4*). There are marked differences also. The floral parts of the two species can readily be distinguished (*5*). Considering similarities as well as differences it appears that *S. officinarum* and *S. robustum* are related and probably are from the same line of descent.

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