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COOPERATIVE SWEET SORGHUM VARIETY TESTS FOR SUGAR PRODUCTION DURING 1972 IN FOUR SOUTHERN STATES

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CONTENTS

	Page
Abstract	1
Introduction	1
Test cultivars and methods	1
Results and discussion	2

TABLES

1. Yield of stripped stalks	3
2. Total soluble solids in extracted juice	4
3. Sucrose content of extracted juice	5
4. Apparent purity of sucrose	6
5. Calculated sugar yield per ton of stalks	7
6. Calculated sugar yield per acre	8
7. Days from planting to harvest	9
8. Leaf diseases of economic importance on 11 sweet sorghum sugar varieties	10

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COOPERATIVE SWEET SORGHUM VARIETY TESTS FOR SUGAR PRODUCTION DURING 1972 IN FOUR SOUTHERN STATES

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ABSTRACT

Ten cultivars of sweet sorghum, *Sorghum bicolor* (L.) Moench, were evaluated for potential sugar production at one or more locations. Average stalk yields of 'Mer. 68-2', 'Mer. 69-13', and 'Mer. 70-15' were equivalent to 'Rio' stalk yield. 'Mer. 65-2' and 'Roma' exceeded 'Rio' stalk yield by 27% and 33%, respectively, at Weslaco, Tex. The Brix of 'Mer. 70-10' and 'Mer. 70-15' was significantly lower than 'Rio' Brix at Weslaco. Average sucrose content of the cultivars tested in Georgia, Louisiana, and Mississippi exceeded that of 'Rio'. Sucrose of cultivars tested at Weslaco was significantly lower than 'Rio'. Sugar production per ton of stalks serves as an excellent index of quality. Average sugar per ton of stalks of 'Mer. 68-2', 'Mer. 69-10', and 'Mer. 69-15' exceeded that of 'Rio' by 16%, 12%, and 12%, respectively. 'Mer. 68-2', 'Mer. 69-13', 'Mer. 69-15', 'Mer. 70-15', 'Mer. 65-2', and 'Roma' compared favorably to 'Rio' in yield of sugar per acre. Various diseases observed on the cultivars had minor effects on yield and juice quality.

INTRODUCTION

Experimental plots designed to evaluate 10 sweet sorghum cultivars, *Sorghum bicolor* (L.) Moench, for sugar production were planted in 4 Southern States—Georgia, Louisiana, Mississippi, and Texas. These experiments were conducted in cooperation with several agencies and the U.S. Sugar Crops Field Station, Agricultural Research Service, Meridian, Miss. (See "Acknowledgments" for a complete list of cooperating stations and personnel.)

TEST CULTIVARS AND METHODS

All tests included cultivars 'Rio' and 'Mer. 70-15', and all except those at Weslaco, Tex., included 'Mer. 67-15', 'Mer. 68-2', 'Mer. 69-10', 'Mer. 69-13', and 'Mer. 69-15'. 'Roma', 'Mer. 65-2', and 'Mer. 70-10' were included only in the test at Weslaco, Tex. 'Rio' was used as the standard for comparing

all other cultivars. 'Honey' was planted on border rows as a susceptible check for disease ratings.

A randomized complete-block design with four replications of each cultivar was used. Each plot included three rows, with an area of 0.02 acre. The seed at most locations was planted with hill-drop planters, and the plants were thinned to three or four per hill spaced 24 inches apart. At the other locations, the seed was drilled with a spout drill and the plants were thinned to 4- to 6-inch spacings. The plots were cultivated with conventional tractor cultivators. All cultivars were harvested when the seed was ripe.

All stalks from the center row of each three-row plot were weighed to determine gross yield of green weight. Ten to thirty randomly selected stalks from the gross sample were weighed, stripped, topped, and reweighed to provide a mill sample and to determine the stripped stalk yield. Stalk samples at Cairo, Ga., and Meridian, Miss., were harvested, milled, and the juice analyzed the same day. Stalk samples at Weslaco, Tex., were milled immediately after harvest, but the juice was quickfrozen and analyzed later.

The stalk samples from Baton Rouge and Bossier City, La., and from Lorman, Poplarville, Mississippi State, and Stoneville, Miss., were milled within 24 hours after harvest.

Part of the extracted juice from each stalk sample

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was used to fill a copper cylinder designed for measuring total soluble solids with a Brix hydrometer. Brix readings were corrected to 20° C. Another part of juice, measured in milliliters equal to the corrected Brix reading, was transferred to a measuring flask and diluted with distilled water to 100 milliliters. About one-fourth teaspoon of technical grade lead subacetate was mixed in the diluted juice to coagulate the solid particles, and the sample was filtered. The filtrate was read for sucrose with a saccharimeter.

Apparent purity of sucrose for each sample was calculated by dividing the sucrose reading by the Brix reading and multiplying the quotient by 100 to convert to percentage.

Sugar yield per ton of stalks was calculated by the Winter and Carp formula. Sugar production per acre was determined by multiplying the sugar yield per ton by tons of stripped stalks per acre.

RESULTS AND DISCUSSION

Table 1 shows yield of stripped stalks as a percentage of 'Rio' in tons of stalks per acre. 'Rio' averaged 14.1 tons of stalks per acre and ranged from 5.9 to 25.1 tons at Cairo, Ga., and Meridian, Miss., respectively. 'Mer. 68-2', 'Mer. 69-13', and 'Mer. 70-15' were equivalent to 'Rio' in stalk yield. 'Roma' and 'Mer. 65-2' exceeded 'Rio' in stalk yield by 33% and 27%, respectively, at Weslaco, Tex. Average stalk yield of 'Mer. 67-15', 'Mer. 69-10', 'Mer. 69-15', and 'Mer. 70-10' was lower than that of 'Rio'.

Total soluble solids in extracted juice is measured in degrees Brix. Total soluble solids in extracted juice of the different cultivars expressed as a percentage of 'Rio' Brix are shown in table 2. 'Rio' juice averaged 20.4 degrees Brix. Average Brix of all cultivars except 'Mer. 70-10' was equal to or exceeded the Brix of 'Rio'.

Sucrose content of extracted juice from the different cultivars expressed as a percentage of 'Rio' sucrose is presented in table 3. The sucrose content of 'Rio' juice varied from a low of 13.2% to a high of 17.2%. The six experimental cultivars tested in Georgia, Louisiana, and Mississippi were equal to or superior to 'Rio' in sucrose content. None of the experimental cultivars or 'Roma' were superior to 'Rio' in sucrose content at Weslaco, Tex.

The purity of sucrose from extracted juice is measured as "apparent purity." The apparent purity of sucrose as a percentage of 'Rio' purity is shown in table 4. The mean apparent purity for 'Rio' was 73.1%. Apparent purity of 'Rio' juice varied

from a low of 63.5% to a high of 76.7%. The purity of all experimental cultivars at all locations compared favorably with 'Rio' except at Weslaco, where only 'Mer. 70-15' compared favorably, and at Cairo, where 'Mer. 69-13' was inferior to 'Rio'.

Calculated sugar yield in pounds per ton of stalks of the cultivars, expressed as a percentage of 'Rio', is shown in table 5. Calculated sugar yield per ton of stalks is the most useful evaluation of the juice quality. Juice quality of 'Mer. 70-10', 'Mer. 70-15', and 'Roma' were inferior to 'Rio' at Weslaco, Tex. The quality of 'Rio' juice was unusually low at Bossier City, La., and 'Mer. 69-13' juice quality was low at Cairo, Ga. Average sugar yield per ton of stalks of 'Mer. 68-2', 'Mer. 69-10', 'Mer. 69-15', and 'Mer. 70-15' exceeded 'Rio' sugar yield per ton of stalks by 16%, 12%, 12%, and 10%, respectively.

Table 6 shows calculated sugar yield per acre as a percentage of 'Rio' yield. 'Rio' yield ranged from a low of 1,214 pounds at Cairo, Ga., to a high of 5,149 pounds at Meridian, Miss., and averaged 2,810 pounds of sugar per acre. 'Mer. 68-2' exceeded 'Rio' sugar yield by 14%. 'Roma' and 'Mer. 65-2' exceeded 'Rio' sugar yield by 21% and 14%, respectively, at Weslaco, Tex.

The number of days from planting to harvest of the cultivars at each test location is shown in table 7. In the Louisiana and Mississippi experiments, the cultivars were of the same maturity as 'Rio' when harvested. The cultivars in the Weslaco test varied in maturity from 101 to 128 days. This spread of maturity provides opportunity for management of planting and selection of varieties so that the harvest period may be extended for a sugar factory operation.

Diseases on the 11 sweet sorghum cultivars were rated on a scale of 0 to 4, with 4 representing destruction of 25% or more of leaf tissue; table 8 shows data on diseases rated 3 or 4. Every cultivar showed heavy infection of gray leaf spot, zonate leaf spot, or rough spot at one or more locations. 'Mer. 68-2' and 'Mer. 69-10' had rust ratings of 3 or 4 at Baton Rouge, La., and Meridian, Miss. Anthracnose was not found in damaging proportions except on 'Mer. 69-13' and 'Honey' (the susceptible check) at Meridian, Miss. Downy mildew was observed on several 'Mer. 69-13' plants at Baton Rouge, La., and on several 'Mer. 70-15' plants at Baton Rouge and at Weslaco, Tex., early in the season; however, the healthy plant population was sufficient at maturity to offset early damaging effects. This was the first time downy mildew was observed in the sweet sorghum test at Baton Rouge.

TABLE 1.—Yield of stripped stalks

Location	'Rio' (tons/acre)	Percent of 'Rio'								LSD at—		
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	0.05 level	0.01 level
Georgia: Cairo.....	5.9	71	85	90	93	86	88	—	—	—	22	30
Louisiana:												
Baton Rouge.....	22.8	86	96	75	107	79	104	—	—	—	10	14
Bossier City.....	14.1	86	103	64	98	98	123	—	—	—	20	27
Mean.....	18.4	86	100	70	102	88	114	—	—	—	—	—
Mississippi:												
Lorman.....	14.3	111	96	71	113	69	101	—	—	—	20	27
Meridian.....	25.1	94	102	81	113	92	96	—	—	—	10	14
Mississippi State.....	9.2	116	137	79	122	104	137	—	—	—	32	NS
Poplarville.....	13.8	74	111	69	99	64	103	—	—	—	13	19
Stoneville.....	18.0	91	100	54	90	85	97	—	—	—	16	21
Mean.....	16.0	97	109	71	107	83	107	—	—	—	—	—
Texas: Weslaco.....	16.1	—	—	—	—	—	88	67	127	133	17	24
Mean of States.....	14.1	85	98	77	101	86	99	—	—	—	—	—

LSD, Least significant difference. NS, Not significant.

TABLE 2.—Total soluble solids in extracted juice

Location	'Rio' (Brix)	Percent of 'Rio'										LSD at—	
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	0.05 level	0.01 level	
Georgia: Cairo.....	20.7	105	108	100	114	98	113	—	—	—	—	8	11
Louisiana:													
Baton Rouge.....	20.8	102	108	109	107	103	112	—	—	—	—	6	8
Bossier City.....	20.6	96	108	99	108	104	110	—	—	—	—	6	8
Mean.....	20.7	99	108	104	108	104	111	—	—	—	—	—	—
Mississippi:													
Lorman.....	23.8	102	104	106	105	106	105	—	—	—	—	3	4
Meridian.....	20.4	105	107	117	106	111	112	—	—	—	—	7	9
Mississippi State.....	21.9	99	99	108	96	99	103	—	—	—	—	3	5
Poplarville.....	23.3	102	104	100	105	101	105	—	—	—	—	NS	—
Stoneville.....	19.3	102	118	113	96	116	111	—	—	—	—	8	11
Mean.....	21.7	102	106	109	102	107	107	—	—	—	—	—	—
Texas: Weslaco.....	18.6	—	—	—	—	—	94	95	101	96	—	4.3	6.2
Mean of States.....	20.4	102	107	104	108	103	106	—	—	—	—	—	—

LSD, Least significant difference. NS, Not significant.

TABLE 3.—*Sucrose content of extracted juice*

Location	'Rio' (percent)	Percent of 'Rio'										LSD at—	
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	0.05 level	0.01 level	
Georgia: Cairo	15.3	104	110	103	88	106	111	—	—	—	—	11	15
Louisiana:													
Baton Rouge	15.8	101	112	113	110	104	113	—	—	—	—	6	8
Bossier City	13.2	107	123	100	125	126	126	—	—	—	—	NS	—
Mean	14.5	104	118	106	118	115	120	—	—	—	—	—	—
Mississippi:													
Lorman	17.2	105	99	106	106	105	101	—	—	—	—	5	NS
Meridian	15.2	99	103	120	108	110	108	—	—	—	—	NS	—
Mississippi State	15.9	99	102	112	101	92	107	—	—	—	—	NS	—
Poplarville	16.3	104	113	102	110	104	110	—	—	—	—	NS	—
Stoneville	13.5	107	130	118	96	127	121	—	—	—	—	17	23
Mean	15.6	103	109	112	104	108	109	—	—	—	—	—	—
Texas: Weslaco	14.3	—	—	—	—	—	92	92	94	93	—	5.6	NS
Mean of States	14.9	104	112	107	103	110	108	—	—	—	—	—	—

LSD, Least significant difference. NS, Not significant.

TABLE 4.—*Apparent purity of sucrose*

Location	'Rio' (coefficient of apparent purity)	Percent of 'Rio'						LSD at—				
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	0.05 level	0.01 level
Georgia: Cairo.....	74.2	102	101	102	77	108	98	—	—	—	10	14
Louisiana:												
Baton Rouge.....	75.8	98	104	104	103	101	100	—	—	—	NS	—
Bossier City.....	63.5	112	116	101	117	122	117	—	—	—	NS	—
Mean.....	69.6	105	108	102	110	112	108	—	—	—	—	—
Mississippi:												
Lorman.....	72.4	102	95	100	100	98	96	—	—	—	NS	—
Meridian.....	74.6	94	95	103	102	99	97	—	—	—	NS	—
Mississippi State.....	72.8	99	103	104	105	92	104	—	—	—	NS	—
Poplarville.....	70.2	102	108	102	104	102	104	—	—	—	NS	—
Stoneville.....	69.9	105	110	104	100	108	109	—	—	—	NS	—
Mean.....	72.0	100	102	103	102	100	102	—	—	—	—	—
Texas: Weslaco.....	76.7	—	—	—	—	—	98	97	93	97	2.4	3.3
Mean of States.....	73.1	102	104	102	96	107	102	—	—	—	—	—

LSD, Least significant difference. NS, Not significant.

TABLE 5.—*Calculated sugar yield per ton of stalks*

Location	'Rio' (lb/ton)	Percent of 'Rio'									
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	
Georgia: Cairo.....	206	105	110	115	72	111	110	—	—	—	
Louisiana:											
Baton Rouge.....	215	100	115	115	112	104	113	—	—	—	
Bossier City.....	159	117	137	101	140	144	145	—	—	—	
Mean.....	187	108	126	108	126	124	129	—	—	—	
Mississippi:											
Lorman.....	228	106	95	106	106	103	98	—	—	—	
Meridian.....	205	94	100	122	109	109	106	—	—	—	
Mississippi State.....	211	99	105	115	104	87	109	—	—	—	
Poplarville.....	211	106	119	104	113	105	113	—	—	—	
Stoneville.....	175	110	138	122	133	96	129	—	—	—	
Mean.....	206	103	111	114	113	100	111	—	—	—	
Texas: Weslaco.....	196	—	—	—	—	—	91	90	90	91	
Mean of States.....	199	105	116	112	104	112	110	—	—	—	

TABLE 6.—*Calculated sugar yield per acre*

Location	'Rio' (lb/acre)	Percent of 'Rio'								
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'
Georgia: Cairo.....	1,214	75	94	94	67	96	97	—	—	—
Louisiana:										
Baton Rouge.....	4,910	86	110	86	121	83	118	—	—	—
Bossier City.....	2,240	100	142	65	137	141	178	—	—	—
Mean.....	3,575	93	126	76	129	112	148	—	—	—
Mississippi:										
Lorman.....	3,257	118	91	75	120	72	99	—	—	—
Meridian.....	5,149	89	103	98	124	101	102	—	—	—
Mississippi State.....	1,944	115	143	92	127	91	150	—	—	—
Poplarville.....	2,918	78	132	71	112	67	116	—	—	—
Stoneville.....	3,143	100	138	66	120	82	98	—	—	—
Mean.....	3,282	100	121	80	121	83	113	—	—	—
Texas: Weslaco.....	3,168	—	—	—	—	—	80	60	114	121
Mean of States.....	2,810	89	114	83	106	97	110	—	—	—

TABLE 7.—Days from planting to harvest

Location	Standard (‘Rio’)	Test cultivar									
		‘Mer. 67-15’	‘Mer. 68-2’	‘Mer. 69-10’	‘Mer. 69-13’	‘Mer. 69-15’	‘Mer. 70-10’	‘Mer. 70-15’	‘Mer. 70-15’	‘Mer. 65-2’	‘Roma’
Georgia: Cairo.....	133	146	146	119	133	104	146	—	—	—	—
Louisiana:											
Baton Rouge.....	133	133	133	133	133	133	133	133	—	—	—
Bossier City.....	112	112	112	112	112	112	112	112	—	—	—
Mean.....	122	122	122	122	122	122	122	122	—	—	—
Mississippi:											
Lorman.....	133	133	133	133	133	133	133	133	—	—	—
Meridian.....	135	135	135	135	135	135	135	135	—	—	—
Mississippi State.....	138	138	138	138	138	138	138	138	—	—	—
Poplarville.....	140	140	140	140	140	140	140	140	—	—	—
Stoneville.....	127	127	127	127	127	127	127	127	—	—	—
Mean.....	135	135	135	135	135	135	135	135	—	—	—
Texas: Weslaco.....	107	—	—	—	—	—	—	—	107	128	121
Mean of States.....	124	134	134	125	130	120	126	—	—	—	—

TABLE 8.—*Leaf diseases of economic importance on 11 sweet sorghum sugar varieties*¹

Location	Standard ('Rio')	Test cultivar												
		'Mer. 67-15'	'Mer. 68-2'	'Mer. 69-10'	'Mer. 69-13'	'Mer. 69-15'	'Mer. 70-15'	'Mer. 70-10'	'Mer. 65-2'	'Roma'	'Honey'			
Georgia: Cairo.....	RS	RS	RS	RS	RS	—	RS	—	—	—	—	—	—	RS
Louisiana:														
Baton Rouge.....	GLS	GLS, R	INS, GLS, R	—	GLS	—	R	—	—	—	—	—	—	R
Bossier City.....	ZLS	GLS, ZLS	ZLS	ZLS	ZLS	ZLS	GLS, ZLS	—	—	—	—	—	—	INS
Mississippi:														
Lorman.....	GLS, ZLS	GLS	ZLS	ZLS	ZLS	GLS, RS	—	—	—	—	—	—	—	RS
Meridian.....	—	R	R	A, RS	RS	—	RS	—	—	—	—	—	—	A
Mississippi State.....	—	—	—	INS	—	—	—	—	—	—	—	—	—	—
Poplarville.....	—	RS	RS	—	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS
Stoneville.....	—	—	—	—	—	—	BS	BS	BS	BS	BS	BS	BS	INS
Texas: Weslaco.....	—	—	—	—	—	—	DM	DM	DM	DM	DM	DM	DM	DM

¹The presence of a disease is noted only when it was severe enough to have reduced yield or quality. A, Anthracnose. BS, Bacterial stripe. DM, Downy mildew. GLS, Gray leaf spot. INS, Insecticide injury. R, Rust. RS, Rough spot. ZLS, Zonate leaf spot.

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