PRODUCTIVITY AND TECHNOLOGICAL QUALITIES OF JUICE AND SYRUP OF NINE SWEET SORGHUM (*SORGHUM BICOLOR* L. MOENCH) VARIETIES.

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Abstract

Two field experiments were conducted at Mallawi Agric. Res., Station, El-Minia Governorate, Egypt, during 2002 and 2003 seasons to evaluate productivity and technological characteristics of juice and syrup of nine varieties of sweet sorghum (*Sorghum bicolor L.* Moench) namely Tracy, Umbrella, Planter, Brandes, Honey, Rio, S.S.301, Williams and Wiley. Randomized complete block design with four replications was used.

The evaluated varieties, differed significantly in their stalk height (cm), stalk diameter and number of internodes as well as yield and yield components in both growing seasons. The obtained results indicated that Brandes variety had the highest values of gross yield and stripped yield (ton/fed), while Umbrella variety showed the lowest values.

Sweet sorghum varieties exhibited a significant difference of its physical properties i. e. TSS%, purity%, JEP (juice extraction percentage) and SEP (syrup extraction percentage) while insignificant effect in relation to pH value was clear in the two growing seasons. S. S. 301 variety contained the highest values of SEP and purity%. Sweet sorghum variety its differed significantly in chemical analysis of sorghum juice and syrup, i.e. the total sugars and sucrose% and reducing sugars%, except the total sugars% of syrup in the first season only and reducing sugars% of juice in the two growing seasons. Planter variety contained the highest values of total sugars% and sucrose% of sorghum syrup. It is worth noting that Brandes variety followed by Honey and S. S. 301 varieties were preferable for sorghum syrup production under El. Minia Governorate conditions. Maximum stripped stalks yield and syrup as well as the high quality of syrup were obtained using Brandes variety followed by Honey and S.S. 301 varieties, respectively.

Key words: Sweet sorghum, TSS%, purity%, JEP and SEP.

INTRODUCTION

Sweet sorghum (*Sorghum bicolor* L. Moench) is considered to be one of the additional sugar crops suggested to increase the syrup (black honey) production , save sugar cane for sugar manufacturing and decrease the large gap between the sugar production and consumption which reached about 0.7 million ton, still imported that are sweet and juicy. These sweet varieties are also called " sweet sorghum" is a

warm- season crop that matures earlier under high temperatures and short days. So, it is one of the most important and useful crops in summer season. The great profitable of sweet sorghum is attributed tol lower cost of planting and all agricultural and agronomical practices, beside its short duration in the soil, i. e. about 120 dayes (Freeman and Boadhead 1973, Undersander *et al.* 1990, mokadem *et al.* l1999, Abo-El Wafa and Abo –El Hamd 2001 and Abbas 2002) the findings of miller and Creelman (1982) for Rio, Wary and Tracy varieties, Taha *et al.* (1994) for sart and Hony varieties, Ferweez (1997) for Honey and Roma varieties, Mokadem *et al.* (1999)

for Brandes, Dale, Sart, Tracy, Wiley, Williams, Honey, Sugar Drip, Brawley, Rio, Roma, Romada and Rex varieties and Abo-El Wafa and Abo-El Hamd (2001) for Umbrella, Smith, Leati, Williams, Tracy, Planter and S. S. 301 varieties supported a great differences between various sorghum varieties in stalk diameter, height of stalk, number of internodes, yield and its components, juice and syrup quality parameters.

Yield and composition of sweet sorghum are affected by variety. Selection of the grown variety is one of the most important decisions in the production of sweet sorghum syrup. A good variety should be of a high content of total soluble solids in the juice and adapted to the growing season in the area. This is considered an important task for grower and syrup manufacturer. Therefore, the objective of this work was to evaluate nine sweet sorghum varieties in relation to yield and its components, physical properties and chemical composition of their juice and syrup.

MATERIALS AND METHODS

Field experiments were conducted at Mallawi Agric. Res. Station El Minia Governorate Egypt, during two successive seasons 2002 and 2003. Nine varieties of sweet sorghum namely Tracy, Umbrella, Planter, Brandes, Honey, Rio, S. S. 301, Williams and Wiley were sown in a randomize complete block design with four replications. Some chemical and physical properties of the experimental soil before soil preparation were determined according to the procedures outlined by Jackson (1967). as shown in Table (1) and meterological data in Table (1-a).

Table 1. Physical and chemical properties of the experimental soil for 2002 and 2003 seasons.

Seasons	2002	2003
Soil depth	0-15 cm	0-15 cm
Mechanical analysis		
Sand %	12.00	12.40
Silt %	50.50	49.60
Clay %	37.50	38.00
Texture grade	Silty Clay Loam	Silty Clay Loam
Cations & Anions, meq/L		
Na+ meq/L	4.85	4.35
K+ meq/L	0.34	0.33
Ca++ + Mg++ meq/L	12.30	11.60
Co3 + HCO3-	3.85	3.42
Cl-	5.80	4.90
Chemical analysis		
Total N %	0.11	0.10
Available P (ppm)	11.80	11.00
Available K (ppm)	200	190
pH (1:2:5 suspention)	8.10	8.00
EC m.mohs/cm	1.80	1.60
Organic Matter %	1.22	1.19

* Each value represents the mean of 5 samples.

Table 1-a. Meterological data recorded at Mallawi Agricultural Research Station (of the two seasons).**

Seasons	Month	Temp. Aver. °C	R.H.%	W.S.	S.R.	S.H.
2002	May	24.70	51.00	181.00	27.80	11.90
	June	27.80	53.00	199.00	28.90	12.60
	July	27.80	61.00	190.00	28.20	12.20
	August	26.90	65.00	138.00	25.90	11.20
	September	24.90	67.00	138.00	23.50	10.80
2003	May	26.40	49.00	259.00	26.60	11.10
	June	27.30	52.00	216.00	28.60	12.40
	July	29.20	52.00	112.00	28.20	12.20
	August	29.80	53.00	112.00	26.60	11.70
	September	28.20	53.00	173.00	23.60	10.80

** Weather bureau station,

Where: Temp. Aver. °C R.H. = relative humidity % W.S. = wind speed (m/sec).

S. R. = solar radiation cal/ cm^2/ day. S. H. = sunshine hours.

Plot consisted of the five rows, 6 meter long and 70 cm apart. Sowing was done on June 24th in both seasons. Nitrogen fertilizer was applied as recommended (60 kgs N/ fed) in two equal doses (the first one after 30 days from sowing and the second one 15 days later), as well as phosphorus fertilizer was applied as recommended (15 P_2O_5 kg/ fed at planting).

Data recorded

At dough stage (content of seeds are firm and easily crushed between thumb and index fingers), plants were harvested. A sample of twenty stalks were taken at random to determine the following parameters,

1- **Vegetative characters,** stalk length, diameter and number of internodes were measured.

2- **Yield and yield components,** gross yield and stripped yield were determined by weighing the three guarded rows for eash treatment, they were used to estimate the corresponding values/ fed. While, juice and syrup yields were determined by weighing the juice extracted and syrup produced (A. O. A. C.1995).

3- **Physical properties of sorghum juice and syrup,** total soluble solids% (TSS%) or Brix % was determined by Brix hydrometer standardized at 20°C, purity% was determined by the following equation: Purity % = Sucrose%x 100/TSS%. Juice and syrup extraction%=juice or syrup yield (ton/fed)x 100/stripped stalks (ton/fed.). However, pH value was measured by a Beckman pH (Collins *et al.* 1977).

4- **Chemical analysis** of **sorghum juice and syrup,** such as sucrose%, reducing sugars % and total sugars% were determined according to the methods described in A. O. A. C. (1995).

The stripped stalks of sweet sorghum were passed through a three roller mill to extract the juice. The raw juice was screened though layers of clean cheesecloth to remove the large pieces of suspended matters. Then, evaporated in open stainless steel pan (capacity 6 liters). The concentration process was carried out as rapidly as possible, first using direct flame to boiling point, then, indirect using a hot plate (to TSS % about 73% after cooling reached 75. 00 ± 0.50%). All data were subjected to the proper statistical analysis according to the procedures outlined by Gomez and Gomez (1984). Means of treatments were compared at the probabilities level of 5% using the Least Significant Difference (LSD). Combined analysis over the two seasons was carried out.

RESULTS AND DISCUSSION

I. Vegetative characters

The recorded results in Table (2) reveale that all of the evaluated varieties (Tracy, Umbrella, Planter, Brandes, Honey, Rio, S.S. 301, Williams and Wiley), differed significantly in their stalk height (cm), stalk diameter (cm) and number of internodes /stalk in both growing seasons. It could be demonstrated from combined analysis that the highest values of the aforementioned characters were exhibited in Brandes variety, while Umbrella variety contained the lowest value of stalk height and diameter. Wiley variety had the lowest value of number of inter-nodes /stalk among the studied varieties. This result might be mainly attributed due to the genetic variation and the superiority of Brandes cultivar in growth parameters.

Table 2. Some vegetative characters of nine sweet sorghum varieties.

Vegetative Characters	Stalk height (cm)			Stalk diameter (cm)			No. of internodes/stalk		
Varieties	2002	2003	Com.*	2002	2003	Com.	2002	2003	Com.
Tracy	306.33	317.67	312.00	2.48	2.52	2.50	16.83	16.86	16.85
Umbrella	215.00	224.67	219.83	1.92	1.92	1.92	16.22	16.27	16.25
Planter	295.67	299.00	297.33	2.02	2.07	2.05	16.37	16.36	16.37
Brandes	390.00	395.00	392.50	2.89	2.78	2.84	19.66	19.70	19.68
Honey	346.33	350.33	348.33	2.69	2.66	2.68	18.60	18.63	18.62
Rio	330.00	333.33	331.67	2.56	2.58	2.57	17.19	17.21	17.20
S.S. 301	346.00	349.00	347.50	2.58	2.62	2.60	17.33	17.32	17.33
Williams	318.33	324.33	321.33	2.12	2.11	2.12	17.07	17.10	17.09
Wiley	298.33	303.67	301.00	2.49	2.54	2.52	16.17	16.22	16.20
F value	* *	* *	- -	* *	* *	- -	* *	* *	- -
LSD 0.05	9.76	9.76	N.S	0.10	0.08	N.S	0.13	0.10	N.S

Com.* = Combined

The present results are in a good trend with those obtained by Taha, (1990) and Abo El Wafa and Abo El Hamd (2001) who came to the same results. However, results obtained by Mokadem *et al.* (1999) indicated that Honey cultivar ranked first for plant height and number of internodes among the studied cultivars.

II. Yield and its components

Results obtained in (Table 3) show significant difference among the studied sweet sorghum varieties in relation to gross yield and stripped yield (ton/fed) as well as juice yield and syrup yield (ton/fed) in both two seasons.

It could be pointed out from combined data that Brandes variety had the highest values of gross yield and stripped yield (ton/fed), while the lowest values were recorded for Umbrella variety. This pronounced influence might be attributed to the differences in the growth parameters which surely reflected on gross yield and stripped yield (ton/fed) of sweet sorghum variety. These findings are in accordance with those reported by Nour (1963) and Taha, *et al.* (1994).

It is observed from the combined analysis that the maximal values of juice yield and syrup yield (ton/ fed) were scored for Honey and Brandes varieties, while Williams variety recorded the minimal values, respectively. This might be due to that Honey variety had the highest juicy stalks, while, the highest stripped yield (ton/fed) of Brandes variety were the cause for the highest value of syrup yield (ton/fed).

Table 3. Yield and its components of nine sweet sorghum varieties.

Yield	Gross yield (ton/fed)			Stripped yield (ton/fed)			Juice yield (ton/fed)			Syrup yield (ton/fed)		
Variety	2002	2003	Com.*	2002	2003	Com.*	2002	2003	Com.*	2002	2003	Com.*
Tracy	30.76	31.40	31.08	23.05	23.75	23.40	11.99	12.46	12.23	1.64	1.68	1.66
Umbrella	23.23	24.01	23.62	17.44	17.11	17.28	9.13	9.33	9.23	1.48	1.49	1.49
Planter	28.32	29.08	28.70	21.16	21.65	21.41	10.11	10.51	10.31	1.85	1.98	1.91
Brandes	41.52	42.17	41.84	31.24	31.70	31.47	15.63	16.02	15.83	2.59	2.63	2.61
Honey	37.27	38.07	37.67	28.36	28.97	28.67	16.24	15.74	15.99	2.30	2.38	2.34
Rio	30.58	30.59	30.58	22.44	22.62	22.53	12.34	12.15	12.25	1.95	1.98	1.97
S.S. 301	32.62	32.80	32.71	24.04	24.27	24.16	11.38	11.70	11.54	2.30	2.33	2.32
Williams	25.57	25.83	25.70	18.99	19.40	19.20	8.77	9.10	8.94	1.35	1.41	1.38
Wiley	26.61	27.02	26.81	20.02	20.43	20.22	10.08	10.30	10.19	1.47	1.43	1.45
F value	**	**	--	**	**	--	**	**	--	**	**	--
LSD 0.05	1.63	1.27	N.S	1.28	1.20	N.S	0.89	0.60	N.S	0.17	0.15	N.S

Com.* = Combined

In this respect, Taha, *et al.* (1994) and Ferweez (1997) reached to a similar results. On the other hand, Mokadem *et al.* (1999) found that Honey cultivar had higher value of biomass and stripped stalk yields than Brandes cultivar. These

differences might be due to the variations in the studied environmental conditions and soil type.

III. Physical properties of juice and syrup

Details of various observations for physical properties of juice extracted from the studied sweet sorghum varieties, i.e. TSS% (total soluble solids%), purity%, juice extraction% (JEP) and pH value are recorded in Table (4).

Table 4. Physical properties of the extracted juice of nine sweet sorghum varieties.

Property	Total soluble solids (TSS%)			Purity % juice			Juice extraction %			pH value		
Varieties	2002	2003	Com*	2002	2003	Com*	2002	2003	Com*	2002	2003	Com*
Tracy	16.3	16.5	16.4	55.7	55.8	55.8	52.0	52.5	52.2	5.33	5.37	5.35
Umbrella	18.0	18.1	18.1	53.3	52.0	52.6	52.3	53.5	52.9	5.33	5.37	5.35
Planter	18.5	18.0	18.0	61.3	62.2	61.8	47.8	48.6	48.2	5.47	5.43	5.45
Brandes	17.5	17.7	17.6	54.9	54.9	54.9	50.0	50.5	50.2	5.43	5.33	5.38
Honey	17.2	17.3	17.3	60.0	58.8	59.4	57.3	54.3	55.8	5.67	5.37	5.52
Rio	18.2	18.0	18.1	61.1	61.1	61.1	55.0	53.7	54.4	5.43	5.20	5.32
S.S. 301	20.6	19.8	20.2	62.0	64.9	63.4	47.3	48.2	47.8	5.67	5.47	5.57
Williams	16.1	16.2	16.1	53.7	54.0	5389	46.2	46.8	46.5	5.50	5.40	5.45
Wiley	16.3	15.9	16.1	54.2	56.2	55.2	50.3	50.2	50.4	5.53	5.37	5.45
F value	* *	* *	- -	* *	* *	- -	* *	* *	- -	- -	- -	- -
LSD 0.05	0.92	0.73	N.S	3.76	5.10	N.S	2.03	1.94	N.S	N.S	N.S	N.S

Com.* = Combined

Sweet sorghum variety exhibited a highly significant variation in TSS%, purity% and JEP of sorghum juice but no significant variation was noticed in relation to pH value in the two growing seasons. It could be observed from combined analysis that S.S.301 variety contained the highest values of TSS% and purity%, while the lowest values were recorded for Wiley and Umbrella varieties, respectively. This might be mainly due to surplus sugar formed in photosynthesis for S.S. 301 variety than than others. Generally, there were a positively relationship between TSS% and sucrose% consequently purity% of sorghum juice.These results agree with those obtained by Taha (1990), Taha *et al.* (1994) and Ferweez (1997). Also, the results indicated that Honey variety had the highest value of JEP, while, Williams variety exhibited the lowest value. This result might be mainly due to the fiber content of stalks which was

the lowest for Honey variety. Similar findings were also obtained by Ferweez (1997) and Mokadem *et al.* (1999).

Concerning physical properties of syrup produced from sweet sorghum, the data in Table (5) indicate that there were a highly significant differences in syrup extraction% (SEP) and purity% among the studied sweet sorghum varieties but differences did not reach the significant level for pH value in the two growing seasons.

Table 5. Physical properties of the produced syrup of nine sweet sorghum varieties.

Property	Syrup extraction %			Purity % syrup			pH value		
Varieties	2002	2003	Com.*	2002	2003	Com.*	2002	2003	Com.*
Tracy	7.12	7.10	7.11	36.91	35.45	36.18	4.90	4.83	4.87
Umbrella	8.48	8.55	8.52	35.44	35.07	35.26	4.83	5.00	4.92
Planter	8.73	9.13	8.93	43.02	44.00	43.51	5.10	5.13	5.12
Brandes	8.29	8.28	8.29	38.53	38.21	38.37	5.00	5.03	5.02
Honey	8.12	8.20	8.16	40.30	40.87	40.58	5.10	5.00	5.05
Rio	8.70	8.75	8.73	41.47	41.87	41.67	5.00	5.00	5.00
S.S. 301	9.57	9.60	9.58	43.16	43.58	43.37	5.20	5.10	5.15
Williams	7.08	7.23	7.16	34.16	34.07	34.12	5.07	4.87	4.97
Wiley	7.32	6.98	7.15	35.87	36.13	36.00	5.13	5.10	5.12
F value	* *	* *	- -	* *	* *	- -	- -	- -	- -
LSD 0.05	0.46	0.41	N.S	1.68	1.40	N.S	N.S	N.S	N.S

Com.* = Combined

It could be concluded from the combined data that S.S. 301 variety contained the highest values of SEP and purity%, while the lowest values were recorded for Tracy and Williams varieties. This might be attributed mainly due to that the highest values of TSS% and purity% in the sorghum juice were recorded for S.S. 301 variety (Table 4) and consequently of SEP% increased.

IV- Chemical composition of juice and syrup

Data recorded in Table (6) clarify that sweet sorghum varieties differed significantly in the total sugars% and sucrose% of sorghum juice in the two growing seasons. While, difference in reducing sugars% of sorghum juice was not significant. It could be concluded from combined analysis that S.S. 301 variety exhibited the highest values of total sugars% and sucrose% of sorghum juice. This might be attributed to surplus sugars, i. e. sucrose% and reducing sugars% juice, formed in

photosynthesis of S.S. 301 variety. Generally, the highest values of total sugars% and sucrose% of sorghum juice were shown from the preferable characters for high quality of final sorghum syrup. Such data are in the same line with the findings of (Cowley and Smith 1972, Taha *et al.* 1994 and Mohamed *et al.*1996).

Table 6. Chemical composition of the extracted juice of nine sweet sorghum varieties.

Constitute	Total sugars %			Sucrose %			Reducing sugars %		
Varieties	2002	2003	Com.*	2002	2003	Com.*	2002	2003	Com.*
Tracy	13.63	13.82	13.73	9.06	9.20	9.13	4.09	4.14	4.12
Umbrella	15.53	15.46	15.50	9.59	9.42	9.50	5.46	5.58	5.52
Planter	16.80	16.53	16.67	11.35	11.50	11.42	4.83	5.13	4.65
Brandes	14.96	15.00	14.98	9.60	9.68	9.64	4.88	5.03	4.87
Honey	15.18	13.81	14.50	10.32	10.20	10.26	4.32	5.00	4.36
Rio	15.63	15.53	15.58	11.08	11.00	11.04	4.00	5.00	3.99
S.S. 301	18.11	18.21	18.16	12.76	12.83	12.80	4.65	5.10	4.68
Williams	13.07	13.18	13.12	8.63	9.10	8.87	4.00	4.87	3.98
Wiley	13.20	13.45	13.33	8.82	8.90	8.86	3.93	5.10	4.03
F value	* *	* *	- -	* *	* *	- -	- -	- -	- -
LSD 0.05	1.05	1.43	N.S	0.84	0.82	N.S	0.53	0.38	N.S

Com.* = Combined

Results obtained in Table (7) indicate that sweet sorghum variety had a highly significant effect on the total sugars % in the second season only and sucrose % and reducing sugars% of sorghum syrup in the two growing seasons. It could be concluded from combined analysis that Planter variety contained the highest values of total sugars% and sucrose% of sorghum syrup. This is suggested that purity% of syrup was the highest for Planter variety. Williams variety recorded the highest value of reducing sugars% and this might be mainly due to that the purity% of syrup which was the lowest. While, Umbrella and Williams and S.S.301varieties contianed the lowest values of total sugars%, sucrose% and reducing sugars% of sorghum syrup, respectively. Such results are in agreement with those obtained by Taha, (1990), Ferweez (1997), Mokadem *et al.* (1999) and Abbas and Taha, (2000).

Table 7. Chemical composition of the produced syrup of nine sweet sorghum varieties.

Constitute	Total sugars %			Sucrose %			Reducing sugars %		
Varieties	2002	2003	Com.*	2002	2003	Com.*	2002	2003	Com.*
Tracy	61.04	60.62	60.83	27.68	26.59	27.14	31.90	32.63	32.27
Umbrella	60.54	59.89	60.21	26.58	26.30	26.44	32.55	32.20	32.38
Planter	62.10	62.57	62.34	32.67	33.00	32.83	27.72	27.83	27.78
Brandes	60.94	61.15	61.04	28.90	28.65	28.78	30.52	30.99	30.75
Honey	62.43	62.57	62.50	30.22	30.65	30.44	30.62	30.30	30.46
Rio	61.81	61.92	61.86	31.10	31.40	31.25	29.07	28.86	28.97
S.S. 301	61.21	60.94	61.08	32.37	32.69	32.53	27.13	26.53	26.83
Williams	60.92	61.02	60.97	25.62	25.55	25.89	33.95	34.12	34.04
Wiley	61.05	60.94	61.00	26.90	27.10	27.00	32.73	32.42	32.58
F value	- -	* *	- -	* *	* *	- -	* *	* *	- -
LSD 0.05	N.S	1.20	N.S	1.09	1.05	N.S	1.16	1.30	N.S

Com.* = Combined

Generally, sweet sorghum is an important sugar crop beside sugar cane and sugar beet. The highest values of sucrose% and reducing sugars% of juice, beside the lowest value of pH value in variety of sweet sorghum led to improving quality of sorghum syrup by increasing sucrose% and decreasing pH value in the produced syrup. This led to use of sweet sorghum for syrup production is increased. Therefore, this led to save cane yield for sugar production and reduce the vast gap between sugar production and consumption which reached about 0.7 million ton. It is still importing annually. It is worthy to mention that Brandes followed by Honey and S. S. 301 varieties were preferable for sorghum syrup production under El. Minia governorate conditions. Where, Maximizing stripped stalks yield and syrup yield as well as the high quality of sweet sorghum syrup was obtained using Brandes variety followed by Honey variety and S. S. 301 variety, respectively.

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الانتاجية والصفات التكنولوجية لجودة عصير وشراب تسعة أصناف من الذرة السكرية

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أقيمت تجربتين حقليتين بمحطة البحوث الزراعية بملوى ، محافظة المنيا ،مصر خلال موسمي ٢٠٠٢ ، ٢٠٠٣ لتقييم إنتاجية وصفات جودة عصير وشراب تسعة أصناف من الذرة السكرية هى (تراسى، امبريلا ، بلانتز ، براندز ، هنى ، ريو ، S. S. 301 ، ويليمز وويلى) تحت ظروف محافظة المنيا في تصميم قطاعات كاملة العشوائية.

- **وقد أوضحت النتائج المتحصل عليها على ما يلي :**

– اختلفت الأصناف المختبرة من الذرة السكرية معنويا في طول العود ، سمك العود و عدد السلاميات للعود وكذلك المحصول ومكوناته في كلا الموسمين الزراعيين ، وسجل صنف براندز أعلى القيم في كل من ناتج العيدان الكلى وناتج العيدان النظيفة طن/فدان في حين سجل صنف امبريلا أقل القيم.

– أظهر صنف الذرة السكرية تفوقا معنويا على الصفات الطبيعية لكل من عصير وشراب الذرة السكرية (نسبة المواد الصلبة الذائبة الكلية للعصير ، نسبة النقاوة ، نسبة استخلاص العصير و نسبة استخلاص العسل عدا قيمة رقم الحموضة) أظهر الصنف S. S. 301 اعلى القيم في نسب استخلاص العسل و النقاوة. – كذلك أشارت النتائج في هذه الدراسة إلى تباين اصناف الذرة السكرية فى الصفات الكيميائية لكل من العصير والشراب (نسبة السكريات الكلية ، نسبة السكروز و نسبة السكريات المختزلة عدا نسبة السكريات الكلية للشراب) في الموسم الأول ونسبة السكريات المختزلة في العصير في الموسمين، واحتوى شراب صنف بلانتر على اعلى القيم في نسبة السكريات الكلية ونسبة السكروز.

– من الجدير بالذكر آن أصناف براندز ، هنى و S. S. 301 كانت الأفضل لانتاج شراب الذرة السكرية تحت ظروف محافظة المنيا حيث تحصل منها على النواتج الأعلى من العيدان النظيفة والشراب وكذلك الجودة العالية للشراب.