Bull.Fac. Agric.,Cairo Univ.,64: 8-12(2013).

EVALUTION OF SOME PROMISING SUGAR CANE VARIETIES GROWN UNDER UPPER EGYPT CONDITIONS

(Received: 11. 12. 2012)

By
Kh. El-Sh. Mohamed and K.S. El-Sogheir

Sugar Crops Research Institute, Agriculture Research Center, Giza, Egypt

ABSTRACT

A field experiment was conducted at El-Mattana Agricultural Research Station, Luxor Governorate, Upper Egypt in 2009/2010 and 2010/2011 growing seasons to investigate the performance of five sugarcane varieties, including the four promising sugar cane varieties, G. 84/47, G. 98/28, G. 99/103, PH 8013 and commercial variety G.T.54-9. A randomized complete block design with three replications was used. The data obtained pointed out that the tested sugar cane varieties differed significantly in stalk yield (ton/fed), Brix and reducing sugars percentages (in both seasons), stalk height and sucrose% in the 2nd season. However, no significant variation was detected among varieties in sugar recovery% and sugar yield (ton/fed) in both seasons, and stalk height and sucrose % in the 1st season**.** It can be concluded from the obtained results that G. 98/28 variety's was superior to the other promising varieties with regard to sucrose and purity percentages and G.84/47 variety to get the highest stalk yield.

Key words: *sugar cane, performance evaluation, promising, varieties.*

1. INTRODUCTION

Egypt suffers from a gap between sugar production and consumption of about 0.8 million ton/annually. The Sugar Research Institute produced several promising varieties of sugar cane including G.84/47,G.98/28,G.99/103 and PH8013.

Sugar cane varieties are widely different in yield, performance and quality. Sharma *et al.* (1991) and Mohamed (2001) reported that sugar cane varieties differ significantly in brix %, sucrose %, and purity % as well as cane and sugar yields. Yousef, *et al.* (2000) observed that sugar cane varieties significantly differed in number of millable cane/m^2, stalk length, diameter and cane yield. El-Geddawy *et al.* (2002a) found that the sugar cane variety G. T. 54-9 significantly surpassed the other varieties in respect of stalk height and diameter in ratoon crops. However, the F.153 variety attained a significant superiority over the other varieties (G. T. 54-9 and G. 85-37) in stalk number/m^2. El-Geddawy *et al*. (2002b) observed that the sugar cane variety F. 153 almost attained the highest values of juice quality compared with the G.T. 54-9 and G. 85-37 varieties. Mohamed and Ahmed (2002) obtained significant differences among the cane varieties viz G.T.54-9, G. 87-55 and F. 160 in stalk height, net and sugar yields El-Sogheir and Mohamed (2003) found that sugar cane varieties G.T.54-9, F.160, ph.8013 and G85-37 significantly differ in stalk diameter and sucrose percentage in two seasons as well as stalk height and number of millable cane/m^2 in the 2nd season. However, no statistical differences were detected among varieties in juice purity percentage, cane and sugar yields/fed in both seasons. The differences in stalk weight, cane yield were ascribed to differences in genetic constitution and response to environmental factors. These traits were widely studied by Nassar *et al*. (2005), El- Shafai and Ismail (2006), Manjumath *et al*. (2007) and El-Sogheir and Abd-El-Fattah (2009). Ahmed *et al*. (2011) showed that sugar cane varieties differed significantly in stalk diameter, sucrose percentage and sugar yield ton/fed in the second season only, and cane yield was significantly affected by grown varieties in both seasons Ph.8013 showing significant superiority in all traits. Okaz *et al*. (2011) compared ten sugar cane genotypes G84-47, G95-19, G95-21, G98-28, G99-103, G99-165, Ph8013, Mex2001-80 and GT54-9 (check variety). They showed that in both seasons, stalk weight, cane and sugar yields of the sugar cane genotypes significantly differed. Osman *et al.* (2011) indicated that G98-28 surpassed G.T. 54-9 and G 99-80 varieties attaining the lowest values

of brix % and stalk fresh weight losses % while, the highest cane and sugar yield, purity %, and sugar recovery % were attained in sugar canes and 1st ratoon crops respectively. Daniel *et al*. (2013) studied the performance of twelve varieties (MY 55-14, HA 64-20, Q-96 (control), Mex 69-290 (control), CP 72-2086 (control), L 73-65, Mex 91-566, Mex 91-662, Mod Mex 93-404, Mod Mex 93-412, Mod 95-401 and Mod 95-419l; They found that there were no significant differences for yield ($p > 0.05$) with regard to planting cycle. Control variety Q-96 had the highest sucrose content (15.95%).

This investigation was performed to evaluate the performance of five sugarcane varieties including four promising sugar cane varieties, viz G. 84/47, G. 98/28, G. 99/103, PH 8013 and the commercial variety G.T.54-9).

2. MATERALS AND METHODS

Two field experiments were conducted at El-Mattana Agricultural Research Station, Luxor Governorate, Upper Egypt, in 2009/2010 and 2010/2011 growing seasons to compare the performance of five sugarcane varieties, including four promising sugar cane verities G. 84/47, G. 98/28, G. 99/103 and PH 8013 with the commercial variety G.T.54-9). Sugarcane varieties were planted on March 1st and harvested 12 months later in both seasons. The randomized complete block design in three replications was used. Plot area was 35 m^2 (comprised of 5 ridges 1 m apart and 7-m long). The soil analysis of the experimental site showed that the upper 30 cm of the soil was clay loam including 40.4% sand, 14.4% silt and 45.2 clay and containing 79.0, 10.7, 198 ppm N, P, K, respectively, and pH of 7.6. The phosphorus fertilizer in the form of calcium super phosphate (15.5% P_2O_5) at the rate of 20 kg/fed was added during preparing of soil for planting. The nitrogen fertilizer was applied as ammonium nitrate (33.5%N) at the rate of 180 kg/fed at two equal rates, while potassium sulfate (48% K_2O) was applied at the rate of 48kg K_2O/ fed. All agricultural operations were practiced as recommended by the Sugar Crops Research Institute.

The following data were recorded at harvest:

1. Stalk height (cm), measured from soil level to the top visible dewlap.
2. Stalk yield, millable canes of three guarded rows of each plot were harvested, topped, cleaned, weighed to determine cane yield (tons/fed).
3. Brix % (total soluble solids, TSS % in juice), was determined using Brix Hydrometer.
4. Sucrose% was determined using the Saccharemeter, according to A.O.A.C. (1995).
5. Juice purity percentage was calculated by the following equation:
   Purity % = (Sucrose %/ brix %) x 100.
6. Reducing sugars /cm^3 was determined in the extracted cane juice according to chemical control in Egyptian production factories (Anonymous, 1981)
7. Sugar recovery% was estimated according to the formula described by Yadav and Sharma (1980) as follows:

Sugar recovery % = [sucrose % - 0.4 (brix – sucrose) 0.73].

8. Sugar yield (tons/fed) was estimated from multiplying cane yield (tons/fed) x sugar recovery percentage.

All the recorded data were statistically analyzed as shown by Snedecor and Cochran (1981).

3. RESULTS AND DISCUSSION

3.1. Stalk height (cm)

Data in Table (1) show significant variation between varieties in the 2nd season, where the G. 99/103 variety was superior to the other varieties and the PH 8013 variety recorded the lowest stalk weight. The differences could be due to the variation in their gene make up. This result is in agreement with those mentioned by Yousef *et al.* (2000), El-Geddawy *et al.* (2002a) and Mohamed and Ahmed (2002) who found that sugar cane varieties differ significantly in cane height.

3.2. Cane yield (tons/fed)

Data in Table (1) show that sugar cane varieties differed significantly in cane yield (tons/fed) in both seasons, where the commercial variety G.T. 54/9 produced the highest cane yield (tons/fed.) in both seasons. But the differences between the commercial variety G. T. 54/9 and the promising variety G. 84/47 did not reach the level of significance in the 2nd season. The superiority of G.T. 54/9 may be due to its best performance in terms of height of stalk. This trend is in agreement with Mohamed and Ahmed (2002), El-Sogheir and Mohamed (2003), and Okaz *et al.* (2011) who observed that sugar cane varieties significantly differed in cane yield (ton/fed.). The differences in cane yield (ton/fed.) may be due to their differences in genetic constitution and their response to the environmental factors in which they grew. The above traits were widely studied by Nassar *et al.* (2005) and El-Shafai and Ismail (2006) who reported the same results.

Table (1): Stalk height and stalk yield of some promising sugar cane varieties under Upper Egypt conditions in 2009/2010 and 2010/2011 seasons.

Varieties	2009/2010 Season		2010/2011 Season	
	Stalk height (cm)	Cane yield (tons/fed)	Stalk height (cm)	Cane yield (tons/fed)
G. T. 54/9	264.7	52.43	279.0	50.70
G. 84/47	253.7	45.83	274.7	53.09
G. 98/28	249.3	48.07	257.0	48.63
G. 99/103	270.3	43.10	281.3	46.98
PH 8013	246.0	45.23	244.3	42.25
L.S.D at 5%	NS	3.10	17.28	5.58

NS= no significant differences.

3.3. Brix percentage

The results in Table (2) show that differences between varieties in brix% were significant in both seasons, where the PH 8013 and G. 98/28 varieties recorded the highest values in both the 1st and 2nd seasons, respectively, compared with other varieties. The differences among sugar cane varieties in brix % could be attributed to their gene make-up. These results are in agreement with Gauer and Desai (1988) and El-Sogheir and Abd El-Razek (2008) who found that sugar cane varieties differ in quality traits of juice in cane stalks.

3.4. Sucrose percentage

Differences among the tested varieties in sucrose% were significant in the 2nd season only (Table, 2). The G. 98/28 variety had the highest sucrose percentage in the second season, while G. 99/103 variety rod the lowest.

These results are in line with those of El-Sogheir and Mohamed (2003) who found that sugar cane varieties differ in sucrose percentage in the two studied seasons. El-Sogheir and Mohamed (2003), Nassar *et al.* (2005), El-Shafai and Ismail (2006), Manjumath *et al.* (2007), El-Sogheir and Abd- El-Fattah (2009) and Ahmed *et al.*, (2011) showed that sugar cane varieties differ significantly in sucrose percentage. Such effect give evidence to the genetic variation among the used varieties in their efficiency of sugar synthesis and translocation of assimilates to storage organs. Varietal differences in sucrose content were also reported by Nassar (1996) and Besheit *et al*. (1998).

3.5.Purity percentage

Data in Table (3) reveal that there were no significant differences among the evaluated cane varieties in juice purity percentage, where the highest juice purity was obtained from the G. 98/28 variety, while the lowest juice purity value was obtained from the G. 99/103 variety in both seasons. El-Sogheir and Mohamed (2003) reported that no statistical difference was detected among several tested sugar cane varieties in juice purity percentage in two seasons.

Table (2): Brix and sucrose percentages of the tested promising sugar cane varieties under Upper Egypt conditions in 2009/2010 and 2010/2011 seasons.

Varieties	2009/ 2010 Season		2010/ 2011 Season	
	Brix %	Sucrose %	Brix %	Sucrose %
G. T. 54/9	20.03	16.95	20.63	19.64
G. 84/47	20.31	16.83	20.43	18.66
G. 98/28	20.82	17.35	21.48	20.17
G. 99/103	20.51	15.73	20.00	17.57
PH 8013	22.23	18.44	21.17	19.02
L.S.D at 5%	0.48	NS	0.32	0.56

Table (3): Purity and reducing sugars percentages of some promising sugar cane varieties under Upper Egypt conditions in 2009/2010 and 2010/2011 seasons.

Varieties	2009/ 2010 Season		2010/ 2011 Season	
	Purity%	Reducing sugars%	Purity%	Reducing sugars%
G. T. 54/9	82.97	0.570	90.83	0.791
G. 84/47	82.83	0.553	88.41	0.810
G. 98/28	83.37	0.610	93.91	1.197
G. 99/103	76.74	0.530	87.86	0.540
PH 8013	83.05	0.640	87.85	1.193
L.S.D at 5%	NS	0.060	NS	0.220

Table (4): Sugar recovery percentage and sugar yield of some promising sugar cane varieties under Upper Egypt conditions in 2009/2010 and 2010/2011 seasons.

Varieties	Season 2009/ 2010		Season 2010/ 2011	
	Sugar recovery %	Sugar yield (tons/fed)	Sugar recovery %	Sugar yield (tons/fed)
G. T. 54/9	12.32	6.464	14.67	7.436
G. 84/47	11.99	5.498	13.46	7.154
G. 98/28	12.80	6.069	12.73	6.217
G. 99/103	11.80	5.084	12.64	5.935
PH 8013	13.22	5.985	13.41	5.666
L.S.D at 5%	NS	NS	NS	NS

3.6. Reducing sugars percentage

Reducing sugars result from hydrolysis and conversion of sucrose (di-saccharide) to glucose and fructose (mono-saccharide), as a result of cane moisture reduction and increased in respiration of canes after ripening. Sugar cane varieties vary in reducing sugars percentage and in this experiment; for these traits differences were significant in both seasons, with the variety G. 99/103 showed the lowest percentage of reducing sugar of 0.530 and 0.540% in the 1st and 2nd seasons, respectively.

3.7. Sugar recovery percentage

Data in Table (4) show that differences in sugar recovery percentage among the studied varieties were insignificant in both seasons. The PH 8013 variety and the commercial variety G.T. 54/9 gave the highest sugar recovery % in the first and the second seasons, respectively.

3.8. Sugar yield (tons/fed)

Data illustrated in Table (4) clearly show that G. T. 54/9 tended to produce the highest sugar yield in both seasons of (6.464 and 7.436 ton/fed in the first and second season, respectively). This result may be due to that variety had the highest cane yield/ fed. In this connection, El-Sogheir and Mohamed (2003) found that no statistical variances were detected among the tested sugar cane varieties in sugar yields in two seasons. But Mohamed and Ahmed (2002) obtained differences among studied cane varieties in sugar yield (ton/ fed). Ahmed *et al.* (2011) reported that sugar cane varieties differed significantly in sugar yield in the second season only. Okaz *et al.* (2011) showed that sugar yield of sugar cane genotypes differed significantly in both seasons. The differences among varieties in sugar yield (ton/fed.) could be attributed to the variation in their gene make up.

It can be concluded from the obtained results in this work that G.98/28 variety was superior to the other promising variety with regard to sucrose and purity percentages and G.84/47 variety to get the highest stalk yield.

4. REFERENCES

Ahmed A. M., Nafi A. I. and Bekheet M. A. (2011). Yield and quality of some promising sugar cane varieties as affected by planting pattern. J. Plant Production, Mansoura Univ., Vol. 2 (9): 1221-1232.

Anonymous (1981). Chemical control in Egyptian sugar production factories. 232. pp.

A.O.A.C. (1995). Official methods of analysis, published by the A.O.A.C., Washington, D.C.

Besheit S.Y., A. Abo Dooh Maria G. Beshay, M.K. Ali and H.A. Abd El- Kareem (1998). Evaluation and borer sensitivity of some new Egyptian promising sugar cane varieties. Egypt. J. Agric. Res. 76 (1): 191-202.

Daniel R.M.T., Cesáreo L.S., Alejandra S.E., Gustavo L.R., Bladimir V.L. and Juan C.M.S. (2013). Agroindustrial evaluation of sugarcane varieties in the Central Zone of Veracruz, Mexico. J. of Agric. Sci., 5:1, 147- 153.

El-Geddawy I. H., Darweish D. G., El-Sherbiny A. A. and El-Hady E. E. A. (2002a). Effect of row spacing and number of buds/seed setts on: 1. growth characters of ratoon crops for some sugar cane varieties. Pakistan Sugar J., 17(3): 7-14.

El-Geddawy I. H., Darweish D. G., El-Sherbiny A. A. and El-Hady E. E. A. (2002b). Effect of row spacing and number of buds/seed setts on: 2. juice quality of ratoon crop for some sugar cane varieties. Pakistan Sugar J., 17(4): 10-17.

El-Shafai A.M.A. and Ismail A.M.A. (2006). Effect of row spacing on yield and quality of some promising sugarcane varieties. Egypt J. Appl. Sci. 21 (11), 32-46.

El-Sogheir K. S. and Mohamed A. M.(2003). Optimal seed rate for some promising sugar cane varieties. Egypt. J. Agric., 81 (41) 1693-1705.

El-Sogheir K.S. and Abd El-Razek A. M.(2008). Post-harvest changes in five sugar cane varieties as affected by delivery delaying period. Egypt. J. Appl.Sci.,23(1):124-140.

El-Sogheir K. S. and Abd- El-Fattah A. I. (2009). Evaluation of some promising sugar cane varieties under different row spacing. J. Bio. Chem. Environ. Sci., 4(1): 285-318.

Gauer S. L. and Desai B. B. (1998). Influence of storage time on post-harvest deterioration of juice quality in some promising Co varieties of sugar cane. J. Maharashtra. Agric., Univ., 13 (2): 129-131.

Manjumath B.L., Wasnik H.M. and Korikanthimath V.S. (2007). Selection of sugar cane varieties for higher yield and recovery in west coast region. J. of Farming System Res. and Development, 13(2): 266-268.

Mohamed B. D. (2001). Effect of nitrogen fertilizer and duration of post- harvest period on sugar cane quality. Assiut Agric. Sci., 32 (3): 11.21.

Mohamed B. D. and Ahmed A. Z. (2002). Influence of planting seasons and nitrogen fertilizer levels on productivity of three sugar cane varieties. Egypt. J. Appl. Sci.; 17(3):64-77.

Nassar A.M. (1996). Yield and quality response of some sugar cane (Sacchrum spp) cultivars to potassium nutrition and harvest date. Ph. D., Thesis Agric. Fac., Cairo Univ., Egypt.

Nassar A. M., El- Sogheir K. S. and Ramadan B.S.H. (2005). Effect of nitrogen levels on yield and juice quality of some sugar cane varieties (*Saccharum* spp, L). Egypt. J. Agric. Res., 82 (3):681-692.

Okaz A.M., Mohamed B.D., Abd- El-Haleem S.H.M. and Yousif E.M.M. (2011). Stability parameters of cane yield and its components under various planting dates and inter-row spacing for ten sugar cane genotypes (*Sacharum* spp.). American-Eurasian J.Agric. & Environ. Sci., 11(6): 929-937.

Osman A. M. H., Aly E. F. A. and Abd El-Aziz Rania M. (2011). Performance of some promising sugar cane varieties as affected by delivery delaying periods. J. of Plant Production, Mansoura Univ., Vol. 2 (5): 705-714.

Sharma A. A., Sharma S. C. and Tomar S. S. (1991). Response of sugar cane varieties to planting and harvesting time in Chambal Command area of Rajasthan. Indian Sugar, 41 (7): 551-552.

Snedecor G. W. and Cochran W.G. (1981). Statistical methods., Iowa State Univ. Press, Ames, Iowa, USA.

Yadav R. L. and Sharma R. K. (1980). Effect of nitrogen level and harvesting date on quality characteristics and yield of four cane genotypes. Indian J. Agric. Sci., 50: 581-589.

Yousef M. A., Taha E. M. and Ahmed A. Z. (2000). Influence of some cultural practices on yield and yield components of some sugar cane varieties. J.Agric.78 (5) 1995-2008.

تقييم لبعض أصناف قصب السكر المبشرة تحت ظروف مصر العليا

خليل الشناوى محمد- كمال سيد الصغير

معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية - جيزة- جمهورية مصر العربية

ملخص

أقيمت تجربة حقلية بمحطة البحوث الزراعية بالمطاعنة بمحافظة الاقصر خلال موسمى 2010/2009، 2011/2010 لتقييم بعض أصناف قصب السكر تشمل أربعة اصناف مبشرة هى G84/47, G98/28, G99/103, PH 8313 ومقارنتها بالصنف التجارى G.T54/9 وكان التصميم الأحصائى المستخدم هو القطاعات الكاملة العشوائية فى ثلاث مكررات.

وقد أوضحت النتائج إختلاف الأصناف معنويا فى محصول السيقان ومحتواعا من المواد الصلبة الذائبة الكلية (البركس%) والنسبة المئوية للسكريات المختزلة فى كلا الموسمين، وفى صفة طول الساق والنسبة المئوية للسكر فى الموسم الثانى فقط، بينما لوحظ عدم وجود فرق معنوى بين الأصناف فى النسبة المئوية للسكر المستخلص و محصول السكر فى كلا الموسمين، وفى طول الساق ونسبة السكر % فى الموسم الأول فقط. كما لوحظ من تفوق الصنف G. 98/28 على الأصناف المبشرة الأخرى المدروسة فى صفتى النسبة المئوية لكل من السكروز والنقاوة بالاضافة الى تفوق الصنف G.84/47 للحصول على أعلى محصول سيقان.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (64) العدد الأول (يناير 2013): 8-12.