The Journal of Animal & Plant Sciences 19(4): 2009, Pages: 197-201
ISSN: 1018-7081

COMPARATIVE PERFORMANCE OF ELITE SUGARCANE GENOTYPES IN 4TH CYCLE FOR CANE YIELD, YIELD COMPONENTS, QUALITY AND BORER COMPLEX INFESTATION

S. Junejo, M. Chohan, A. A. Junejo*, G. M. Kaloi, R. N. Panhwar and M. Y. Arain

National Sugar Crops Research Institute, Thatta *Sindh Agriculture University, Tando Jam
Corresponding authors e-mail: salah_junejo@yahoo.com

ABSTRACT

The study was conducted at National Sugar Crops Research Institute (NSCRI) experimental farm Thatta during 2005-06. The performance of twenty-two elite sugarcane genotypes developed from exotic fuzz (true seed) of USA origin along with two standard varieties Thatta-10 and BL-4 as local check was evaluated in 4th cycle. The results showed that there were significant differences amongst the genotypes for the traits under study. The genotype HoTh-518 exhibited maximum average cane yield (115.0 t ha^{-1}) with fairly better commercial cane sugar CCS (14.19%) followed by HoTh-544 and HoTh-548 with at par average cane yield (108 t ha^{-1}) and maximum commercial cane sugar (CCS) (14.25%). The genotype HoTh-517 also showed comparatively good performance with average cane yield (107 t ha^{-1}) and sufficient CCS (13.91%) followed by HoTh-514 and HoTh-550 with similar cane yield of 105 t ha^{-1} and better CCS of 14.09 and 14.15%, respectively, against Thatta-10 and BL-4 (local check) which showed average cane yield of 98.0 and 97.0 t ha^{-1} and CCS of 13.49 and 13.39%, respectively. However, rest of the genotypes exhibited comparatively lower results in terms of average cane yield and quality against the check varieties. The bore complex infestation data revealed that all the genotypes along with check varieties remained less susceptible to borer infestation except HoTh-529, HoTh-520, HoTh-523 and HoTh-537 which were observed highly susceptible with mean infestation of 14.08, 13.15 and 12.77%, respectively while, HoTh-519 and HoTh-540 were susceptible to borer complex attack with mean infestation of 10.21 and 10.19%, respectively.

Keywords: Sugarcane, true seed, genotypes, performance, development.

INTRODUCTION

Sugarcane, *Saccharum officinarum* L., is a giant perennial grass belonging to the family gramineae/poaceae. It is tropical crop and its maximum growth takes place under hot, humid and sunny conditions. An ideal climate for sugarcane crop consists of long, warm summer growing season with a maximum of 72 mm rainfall per month (Humbert and Ulrich, 1968).

Sugarcane is an important cash and industrial crop of Pakistan (Mehboob *et al*. 2000) . It is grown on an area of more than one million hectares with total production of 46.33 millon tons (Khan *et al.* 2003). It plays vital role in improving socio-economic status of growers and country (Sarwar *et al.* 2000). In addition to sugar production it provides raw material to many allied industries for alcohol and chipboard manufacture (Majidano *et al.* 2003). Pakistan occupies 5th position with respect to area under cane cultivation and 15th position in cane production but stands far below in sugar production (Anonymous, 2004). In Sindh province, during 2007 sugarcane was cultivated on an area of 214.9 thousand hectares, producing 11263.8 thousand tones of cane with an average cane yield of 52.4 t ha^{-1} (GOP, 2007). Hence, Sindh province has 23.5 percent share in total area of the country and 26.0 percent share in the total cane production (GOP, 2007). Only in Sindh province, 31 sugar mills are functioning and province has the potential to produce raw material for many more sugar factories (Nazir, 2000).

Despite the fact sugarcane plays an important role in the economy of Pakistan, the cane and sugar yields per unit area in our country are much lower as compared to other sugarcane growing countries of the world. The prominent factors contributing to low tonnage and low sugar recovery are inherently low yielding varieties, less provision for evaluation and acclimatization of improved, high yielding, insect pest/disease resistant and stress tolerant varieties, substandard methods of farming, inadequate and imbalance use of fertilizers, shortage of irrigation water, damage by the pests and diseases as well as ignorance for production technology. This crop has a great potential. If the high yielding improved varieties are evolved and proper production inputs and new package of technology discovered through research and experimentation, the cane yield and CCS% can be doubled.

High yielding varieties have a decisive role in getting self sufficiency in local sugar consumption as well as to make surplus sugar to export. Bahadar *et al* (2004) suggested that introduction the new standard sugarcane varieties on large scale would surely change the existing

position. When a country starts or expands its sugar industry, it usually adopts selection practices of the country where the varieties were originally developed. Some times, even varieties are named of the station where they were developed. Importation, screening and comparing to standard is common as pointed by Donelan (1982) and Juan Jose Herrera (1983). The development of varieties is a lengthy, irksome and costly process (Miller,1971). Varieties are examined and selected that could meet the specific need of the farming environment and manufacturing process (Roman and Marin, 1982 and Shaw 1982).

The main part of sugarcane research is based on improvement of varieties. Heritability and its potential under the influence of environment are considered the key factors (Qayum, 1998). The evaluation of new sugar varieties through fuzz has been a successful practice in different research institutes of Pakistan. The genetic variability of seedlings obtain from fuzz is being exploited through the scientist in making selection (Panhwar and Memon, 2004). For evaluation, selection and screening of newly developed varieties, true seed of USA origin is to be materialized at NSCRI farm, Thatta, wherein evaluation and selection process of improved varieties is initiated. The main objectives of the study are to evaluate genotypes with better cane yield and recovery, resistance to pest and disease.

Keeping in view the importance of high yielding varieties, the present study was carried out to compare the cane and sugar yields of newly developed elite sugarcane genotypes with standard varieties under coastal climatic conditions of Thatta, Sindh.

MATERIALS AND METHODS

The experiment was conducted to see the performance of twenty-two elite sugarcane genotypes developed from exotic fuzz (true seed) of USA origin. The genotypes HoTh-508, HoTh-511, HoTh-512, HoTh-514, HoTh-515, HoTh-516, HoTh-517, HoTh-518, HoTh-519, HoTh-520 HoTh-522, HoTh-523, HoTh-529, HoTh-530, HoTh-536, HoTh-537, HoTh-538, HoTh-540, HoTh-544, HoTh-547, HoTh-548 and HoTh-550 along with two standard varieties Thatta-10 and BL-4 as local check were planted at National Sugar Crops Research Institute (NSCRI), Thatta during 2005-2006. The performance of genotypes was evaluated for cane yield, yield components, quality and insect pest infestation in 4th cycle. The trial was laid out in randomized complete block design (RCBD) with three replications. Each treatment had 5 meters long three rows at 1.25 meters row to row distance. The planting was done during autumn season. Thirty five thousand two-three budded sets per acre with overlapping arrangement were planted in single row system. The sets were placed overlapping in the centre of furrows, after covering the sets with soil, fertilizer dose @ 225 kg nitrogen, 112 kg phosphorus and 168 kg potassium per hectare was applied as, one third nitrogen with full dose of phosphorus and potassium at the time of sowing; the remaining nitrogen was applied in two splits, one in March and the other in May. All the cultural practices were uniformly applied.

The irrigation was applied at 7-10 days interval in summer (April- August) and 10-15 days interval in winter (November-March). In all, 25 irrigations were given during the entire growing period.

The harvesting of sugarcane crop was done at maturity of the crop. The data on cane thickness, number of internodes per plant, cane height, millable canes thousand per hectare and cane yield tones per hectare were collected. For recording observations on borer population, all the canes in the central rows of each variety from each replication were selected. The healthy and infested canes were counted separately and infestation percentage was worked out on cane basis and was classified according to Khanzada (2002). The quality analysis of the crop was done in the laboratory of the Institute. The cane samples were taken from the plots and a compound sample of each genotype was used to perform periodic juice analysis (October-December) by using the relation given in the Queensland Sugarcane Lab. Manual (Anonymous, 1970). Since the compound cane samples were taken for each genotype, therefore, the replicated data regarding CCS% were not available and the statistical analysis of the same could not be performed. The data on cane yield and yield parameters were analyzed statistically using analysis of variance, and LSD test was applied to discriminate the superiority of the means of different varieties as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Cane thickness: Cane thickness is one of the most important and yield contributing parameters. The data presented in Table-1 shows that cane thickness was maximum (27.30 mm) in genotype HoTh-550, followed by HoTh-537 and BL-4 with cane thickness of 26.84 and 26.25 mm, respectively. The minimum cane thickness of 19.25 mm was recorded in HoTh-515 followed by HoTh-511, HoTh-547 and HoTh-516 with cane thickness of 20.46, 20.49 and 20.73 mm, respectively. While, the genotype HoTh-548 and Thatta-10 were on par with cane thickness of 23.70 mm. Moreover, the genotypes HoTh-529, HoTh-530, HoTh-518 and HoTh-514 exhibited cane thickness of 24.62, 24.52, 24.33 and 24.05 mm, respectively, against Thatta-10 but could not surpass BL-4 in terms of this trait. The results of the present investigation are in line with the findings of Singh and Singh (2000), who were of the opinion that varieties of different genetic groups behave differently even under similar climatic

conditions for cane girth; while Keerio *et al*. (2003) and Kadam *et al*. (2004) reported that all the varieties in their experiments behaved quite differently for cane girth and other yield components.

Cane height: Cane height is a major yield component and in variety selection, this character possesses vital significance. The significant differences in cane length of varieties were mainly associated with genetic makeup of the parental material of these varieties. The results in Table-1 reveal that the genotypes HoTh-517 and HoTh-518 were on top with on par average cane height of 200.00 cm, followed by HoTh-519, HoTh-538 and HoTh-514 with average cane height of 191.0, 189.0 and 186.0 cm, respectively. The minimum average cane height of 101.0 cm was recorded in HoTh-537 followed by HoTh-520, HoTh-523 and HoTh-529 with average cane height of 102.0, 103.0 and 106.0 cm, respectively. These results are supported by Singh and Singh (2000), who reported that varieties behave differently under different climatic conditions for cane length; while Keerio *et al*. (2003) and Kadam *et al*. (2004) found significantly high variation in cane length of different varieties developed under different climatic conditions.

Number of internodes per cane: The data presented in Table-1 shows that the genotypes HoTh-518, HoTh-519 and Thatta-10 exhibited on par results with maximum average internodes cane^{-1} (25.0) followed by BL-4 with 24.0 internodes cane-^{1}. However, the genotypes HoTh-540 and HoTh-547 were on par with average internodes cane^{-1} (23.0). The lowest number of internodes cane^{-1} (10.0) were recorded in genotype HoTh-523 followed by HoTh-529, HoTh-511 and HoTh-536 with alike results of 12.0 internodes cane^{-1}. Likewise, the genotypes HoTh-515 and HoTh-530 exhibited similar results with 13.0 internodes cane^{-1}.

Number of millable canes: Maximum 111.66 thousands millable canes ha^{-1} were recorded in genotype HoTh-550 followed by BL-4 and HoTh-518 with on par results of 105.00 thousands millable canes ha^{-1} (Table-1).

Table-1: Performance of different sugarcane genotypes for yield and yield components in 4th cycle at NSCRI, farm Thatta during 2005-06.

Genotypes	Cane Thickness (mm)	Cane height (cm)	Number of Internodes Plant^{-1}	Millable canes 000 ha^{-1}	Cane yield (t ha^{-1})
HoTh-508	23.25 f	180.0 c	18.0 f	88.33 bc	90.0 c
HoTh-511	20.46 j	112.0 hi	12.0 m	86.66 bc	64.0 de
HoTh-512	21.33 i	123.0 h	15.0 k	103.33 ab	99.0 bc
HoTh-514	24.05 de	186.0 bc	17.0 i	93.33 b	105.0 b
HoTh-515	19.25 k	142.0 g	13.0 l	70.00 cd	70.0 d
HoTh-516	20.73 j	180.0 c	18.0 f	75.00 c	87.0 c
HoTh-517	22.70 g	200.0 a	19.0 e	96.66 b	107.0 ab
HoTh-518	24.33 de	200.0 a	25.0 a	105.00 ab	115.0 a
HoTh-519	22.79 g	191.0 b	25.0 a	70.00 cd	73.0 d
HoTh-520	23.12 fg	102.0 i	15.0 k	63.33 cd	60.0 e
HoTh-522	21.96 h	116.0 hi	16.0 j	58.33 d	57.0 ef
HoTh-523	23.28 ef	103.0 i	10.0 n	75.00 c	65.0 de
HoTh-529	24.62 d	106.0 i	12.0 m	50.00 d	50.0 f
HoTh-530	24.52 d	120.0 h	13.0 l	63.33 cd	58.0 ef
HoTh-536	22.55 gh	108.0 i	12.0 m	48.33 d	48.0 f
HoTh-537	26.84 b	101.0 i	16.0 j	66.66 cd	67.0 de
HoTh-538	22.67 g	189.0 b	18.0 f	63.33 cd	70.0 d
HoTh-540	22.87 fg	141.0 g	23.0 c	55.00 d	53.0 ef
HoTh-544	23.87 e	150.0 f	18.0 f	103.33 ab	108.0 ab
HoTh-547	20.49 j	123.0 h	23.0 c	88.33 bc	83.0 c
HoTh-548	23.70 ef	160.0 e	20.0 d	98.33 ab	108.0 ab
HoTh-550	27.30 a	170.0 d	20.0 d	111.66 a	105.0 b
Thatta-10	23.70 ef	184.0 bc	25.0 a	95.00 b	98.0 bc
BL-4	26.25 c	170.0 d	24.0 b	105.00 ab	97.0 bc
CV%	6.07	12.22	12.18	16.26	24.84
LSD 5%	0.45	5.38	0.66	13.90	6.93
LSD 1%	0.60	7.18	0.89	18.55	9.25

Means followed by the same letters in a column do not differ significantly at 1 and 5% levels of probability.

The genotypes HoTh-512 and HoTh-544 displayed next good performance with alike results of 103.33 thousands millable canes ha^{-1}. The lowest 48.33 thousands millable canes ha^{-1} were recorded in genotype HoTh-536 followed by HoTh-529 and HoTh-540 with 50.00 and 55.00 thousands millable canes ha^{-1}, respectively. However, rest of the genotypes in the trial could not surpass the check varieties in terms of this trait except HoTh-517 which showed 96.66 thousands millable canes ha^{-1} against Thatta-10 (95.00 thousands millable canes ha^{-1}), the defference was non significant ($P>0.05$).

Cane yield: Yield is always an ultimate objective behind any research effort. The results of the study showed varying trend of genotypes for cane yield and yield components (Table-1). Maximum average cane yield of 115 t ha^{-1} was recorded from genotype HoTh-518 followed by HoTh-544 and HoTh-548, which were at par (108 t ha^{-1}). The genotype HoTh-517 displayed next good performance with average cane yield of 107 t ha^{-1} followed by genotypes HoTh-514 and HoTh-550 which showed alike cane yield of 105 t ha^{-1}. However, rest of the genotypes could not exceeded check varieties (Thatta-10 and BL-4) in terms of average cane yield except HoTh-512 that gave average cane yield of 99 t ha^{-1}. The variability among the genotypes for cane yield may be attributed to their genetic make up. Keerio *et al* (2003) and Panhwar and Memon (2004) reported great variability for cane yield and yield components among the newly developed sugarcane genotypes under agro-climatic conditions of Thatta.

Commercial Cane Sugar: The month wise quality analysis data revealed that genotypes HoTh-544 and HoTh-548 showed at par results with highest mean CCS of 14.25% relative to check varieties Thatta-10 and BL-4 which showed mean CCS of 13.49 and 13.39% respectively. Moreover, the genotypes HoTh-518, HoTh-550, HoTh-512, HoTh-514, HoTh-517 and HoTh-508 exhibited next good performance with mean CCS of 14.19, 14.16, 14.13, 14.09, 13.91 and 13.74% respectively against the check varieties. Contrary to this, genotypes HoTh-523, HoTh-530 and HoTh-520 displayed lowest result with mean CCS of 12.27, 12.33 and 12.38% respectively. Rest of the genotypes could not surpass the check varieties in terms of mean CCS%.

Table-2: Infestation% of different sugarcane genotypes by borer complex in 4th cycle.

Genotypes	Infestation %					
	Top Borer	Stem Borer	Root Borer	Gurdaspur Borer	Mean Infestation%	Remarks
HoTh-508	5.26	21.92	6.14	0.0	8.33	LS
HoTh-511	4.60	18.42	3.94	0.0	6.74	LS
HoTh-512	4.90	16.66	5.88	5.88	8.33	LS
HoTh-514	4.76	11.11	7.93	0.0	5.95	LS
HoTh-515	5.88	17.64	3.92	0.0	6.86	LS
HoTh-516	5.66	7.54	9.43	0.0	5.65	LS
HoTh-517	3.73	14.18	10.13	0.0	6.92	LS
HoTh-518	1.16	5.81	4.65	0.0	2.90	LS
HoTh-519	8.69	19.13	13.04	0.0	10.21	S
HoTh-520	12.50	28.57	12.50	1.78	13.83	HS
HoTh-522	11.45	19.08	6.87	0.0	9.35	MS
HoTh-523	12.28	29.82	8.77	1.75	13.15	HS
HoTh-529	10.90	30.90	14.54	0.0	14.08	HS
HoTh-530	6.06	21.21	11.36	0.0	9.65	MS
HoTh-536	9.23	11.53	6.92	0.0	6.92	LS
HoTh-537	7.77	26.66	16.16	0.0	12.77	HS
HoTh-538	8.72	16.27	6.97	2.32	8.57	LS
HoTh-540	6.57	15.78	9.21	0.0	10.19	S
HoTh-544	10.22	14.77	5.65	0.0	7.66	LS
HoTh-547	6.84	17.12	6.16	0.0	7.53	LS
HoTh-548	6.65	12.40	9.30	0.0	6.58	LS
HoTh-550	3.79	6.96	8.22	0.0	4.74	LS
Thatta-10	3.84	12.50	7.69	0.0	6.00	LS
BL-4	5.21	15.65	6.08	1.73	7.17	LS

LS= Less susceptible (Above 8.00-9.00%), MS= Moderately susceptible (Above 9.01-10.00%), S = Susceptible (Above 10.01-11.00%), HS= Highly susceptible (Above 11%).

Borer Complex Infestation: The mean borer infestation (Table-2) revealed that genotype HoTh-529, HoTh-520, HoTh-523 and HoTh-537 were highly susceptible to borer attack with mean infestation of 14.08, 13.83, 13.15 and 12.77%, respectively, followed by HoTh-519 and Hoth-540 which remained susceptible with mean infestation of 10.21 and 10.19%, respectively. While, rest of the genotypes along with check varieties remained less susceptible to borer infestation.

Conclusion: On account of better performance, the genotypes HoTh-514, HoTh-517, HoTh-518, HoTh-544, HoTh-548, and HoTh-550 were found promising. The cane yield and quality potential of these genotypes need to be tested for several years under different agro-climatic conditions to draw out substantial conclusions.

REFERENCES

Anonymous, (1970). Sugarcane Lab Manual for Queensland Mills. 5th Ed. Bureau of Sugar Experiment Station, Queensland.

Anonymous, (2004). Agricultural statistics of Pakistan; Ministry of Agriculture, Livestock and Fisheries. Govt. of Pakistan, Islamabad.

Bahadar, K., H. Azim and A. Khan (2004). Genetic stability and production potential of new sugarcane genotypes on farmers fields in Bannu (NWFP). Pakistan Sugar. J. 19(6):12-17.

Donelan, A. F. (1982). Plant cane yields of imported sugarcane varieties compared with clones selected in Trinidad. Proc. III. Int-Am. Sugarcane seminar held at Int. Univ., Florida, USA.pp. 175-179.

Gomez, K. A. and A. A. Gomez (1984). Statistics for Agricultural Research (3rd ed.) John Willey and Sons, New York. pp. 142.

GOP. (2007). Economic Survey of Pakistan, 2006-07. Economic Advisors Wing, Ministry of Finance, Government of Pakistan, Islamabad.

Humbert, R. and A. Ulrich (1968). Fertilizer use on sugarcane. Soil Sci: Soc. Am. 1968:401.

Juan-Jose Herrera, B. (1983). Methods used by Casha in the field testing of sugarcane varieties. Proc. III. Int-Am. Sugarcane seminar held at Int. Univ., Florida, USA.pp. 144-150.

Kadam, U.A., R.R. Hasure, J.P. Patil and B.R. Kanse (2004). Response of sugarcane varieties for different dates of harvesting under pre-seasonal conditions. Cooperative Sugar, 35(6):471-473.

Keerio, H. K., R. N. Panhwar, Y. M. Memon, M. Y. Arain and B. R. Qazi (2003). Qualitative and quantitative performance of some promising and commercial sugarcane varieties under the agro-climatic conditions of Thatta. Pakistan J. Applied Sci., 3 (10/12):670-673.

Khan, M. A., H. K. Keerio, S. Junejo, R. N. Panhwar, M. A. Rajput, Y. M. Memon and B. R. Kazi (2003). Evaluation of sugarcane genotypes developed through fuzz. Correlation of cane yield and yield components. Pakistan J. Applied Sci. 3(4):270-273.

Khanzada, A. G. (2002). Sereening of Sugarcane cultivars against the borer infestation Pakistan J. Agri. Res. 17: 368-372.

Majidano, H. I., Y. J. Minhas, A. D. Jarwar, S. D. Tunio and H. K. Puno(2003). Effect of potassium levels and methods of application on sugarcane yield. Pakistan Sugar J. 3:17-19

Mehboob, A., F. G. Ali, M. Saeed and S. Afghan (2000). Effect of moisture regime and fertilizer levels on yield and yield parameters of spring sugarcane. Pakistan Sugar J. 15(5):2-6.

Miller, J. D, (1971). USDA. Sugarcane Selection Programme in Florida. Proc. ASSCT. Vol. 1: Pp.145-149.

Nazir, M. S. (2000). Crop Production. National Book Foundation Islamabad, Pp. 421-422.

Panhwar, R. N and Y. M. Memon. (2004). Different genetic behavior of some newly developed sugarcane genotypes for yield and yield contributing characters under Thatta conditions. Pakistan Sugar. J. 19(6): 47-54.

Qayum, A. (1998). Comparative performance of sugarcane varieties and genotypes X environment interaction. Ph.D Thesis Department of Plant Breeding and Genetics, University of Agri. Faisalabad.

Roman, M. and S. Marin, (1982). Methods for field testing of varieties. Proc.III.Int-Am. Sugarcane seminar held at Int. Univ., Florida, USA. pp. 152-153.

Sarwar, M., M. Afzal, M. Iqbal and A. A. Chatta. (2000). Effect of proper nutrition and agro management practices on lodging, cane yield and juice quality of sugarcane genotype CP77-400. Pakistan Sugar J. 15(6):135-139.

Shaw, M. E. A. (1982). Aspects of variety improvement. Proc.III.Int-Am. Sugarcane seminar held at Int. Univ., Florida, USA. pp. 106-114.

Singh, R. K. and D. N. Singh (2000). Evaluation of early sugarcane varieties for sustaining high sugar recovery in Uttar Pradesh. Cooperative Sugar 31(10):797-804.