J. bio-sci. 17: 41-44, 2009.
http://www.banglajol.info/index.php/JBS/index
ISSN 1023-8654

SUGAR PRODUCTIVITY ASSESSMENT OF NEWLY DEVELOPED PROMISSING GENOTYPES OF SUGARCANE

D K Tiawari *, P Pandey[1], R K Singh, S P Singh, S B Singh

UP Council of Sugarcane Research, Shahjahanpur – 242001 Uttar Pradesh, India
[1]Dept. of Genetics and Plant Breeding, Allahabad Agricultural Institute-Deemed University, Allahabad-211007, India

Abstract

Context: The prime concern of cane growers and the sugar industry is to achieve higher sugarcane productivity and high sugar recovery both of which support maximum economic return. This requires newly developed sugarcane genotypes.

Objectives: To study the performance of newly developed sugarcane genotypes for plant crop and ratooning ability in U.P. Condition.

Materials and Methods: The performance of newly developed sixteen promising sugarcane genotypes along with three standards check *viz.;* CoJ64, CoS95255 and CoS767 were evaluated during 2005-07 at Shahjahanpur, Uttar Pradesh, India.

Results: The experimental results revealed that significantly higher commercial cane sugar (CCS) yield was observed by the genotype UP49 (13.19 t ha^{-1}), CoS06262 (13.67 t ha^{-1}), CoS05263 (13.70 t ha^{-1}), CoS06247 (12.67 t ha^{-1}), CoS05259 (13.12 t ha^{-1}) over three standards CoS767 (9.41 t ha^{-1}), CoJ64 (9.54 t ha^{-1}) and CoS95255 (12.56 t ha^{-1}). The genotype UP49 (10.50 t ha^{-1}) recorded highest CCS% followed by CoS06247 and CoS05263 having 10.49 t $ha^{-1}$and 10.29 t ha^{-1} respectively in ratoon crop. Amongst all the genotypes UP49, CoS06262, CoS05263, CoS06248, CoS06253, CoS05259 and CoS06263 were proved significantly superior over all the three standards checks in respect of cane yield.

Conclusion: The UP49 was found the best performer and superior to widely adopted variety CoS767 in respect of cane yield, commercial cane sugar percent, sugar yield and pol percent in cane; under plant and ratoon crops.

Key words: Sugarcane, ratoon, CCS%, sugar yield and productivity.

Introduction

Sugarcane (S*accharum officinarum* L.), the principal source of sugar has been rated as one of the most efficient quantum converters to consumable form of energy sources. India is the second largest producer of sugarcane next to the Brazil with production of about 603 million metric tons (Mt) from a production area of approximately 8.05 M ha (USDA 2010). Sugarcane occupies 51% of the total cultivated area of Uttar Pradesh, with a large number of supporting sugar factories. Despite large total production of sugarcane in the state, average productivity (58.2 t ha^{-1}) is lower than the national average of 66.9 t ha^{-1} (Indian Sugar 2008).

Sugarcane ratoons have an additional advantage of better juice quality and sugar recovery in comparison to plant crop of same variety under similar conditions. However, due to improper attention towards ratoons, the farmers lose more than 35 percent productivity (Malik and Gurmani 2005). Properly managed ratoon crop is

*Corresponding author: dktiwari252003@yahoo.co.in

not only profitable but also it is energy saver. In addition, it reduces environmental pollution and saves soil along with its fauna. Thus ratooning is a sort of help to maintain soil in good condition (Chandra 1999).

There are only two effective ways to increase the yield potential of crops through plant breeding: morphological improvement and the use of heterosis. However, the potential is very limited when using morphological improvement alone and heterosis breeding will produce undesirable results if it is not combined with morphological improvement. Now in breeding process, improvement has been made for the ratooning ability of the sugarcane by the process of introduction, selection and hybridization. Good sugarcane genotypes were selected by the process of hybridization and selection process method due to high cane yield and moderate cane quality. Selection of good acceptable variety for the crushing and agronomically suitable under different agro climatic condition is a need of the day for better crop production. Observation of different clone or variety is a continuous phenomenon and release of a good variety which is suitable for the various agro climatic regions will certainly give good response on the sugar recovery and productivity of cane and ratoon crop. The development of the new sugarcane genotypes or variety is the prime objective of the sugarcane breeding. Therefore, an attempt was made in the present experiment to study the performance of newly developed sugarcane genotypes for plant crop and ratooning ability in U.P. Condition.

Materials and Methods

The experiment was conducted during 2005-06 and 2006-07 on sandy loam soil of Shahjahanpur, UP, India in randomized block design having 3 replications. Sixteen newly developed sugarcane varieties along with three standard checks *viz.;* CoS95255 (early), CoJ64 and CoS767 (midlate) were evaluated both for their yield and quality. Every experimental plot had three rows of seven meter length and 90 cm width. The plot size for each genotype was 7.0 x 2.7 meters and the recommended set and two budded set were applied. The experimental genotypes of plant crop was planted in February 2005 and harvested in the month of March 2006 at maturity. Ratoon crop was raised after harvesting of plant crop to judge the rationing ability of genotypes. The crop received 150: 60: 40 Kg ha^{-1} NPK in plant crop and 180: 60:40 Kg ha^{-1} NPK in ratoon crop. Total quantity of phosphorus and potassium was applied at basal while nitrogen was given at three equal splits at germination, tillering and final ear thing up. All the culture practices were adopted during the entire cropping season to ensure a good crop. The fertilizer, irrigation and cultural practices were adopted as per recommendations. Just before harvest five cane samples from each replication for particular genotypes were randomly selected to study the growth and quality parameters *viz.;* sugar yield, CCS%, in cane were studied at 300 days in plant crop and 270 days in ratoon crop. The cane samples taken from each genotype were extracted by power crusher and juice was analyzed for pol percent as per the procedure of Meade and Chen (1977). The CCS% was estimated as per standard methods (Mathur 1981) and sugar percent was calculated as Schmitzts table

Results

The productivity was ranged from 57.31 to 90.47 t ha^{-1} in ratoon. The genotypes UP49 (90.47 t ha^{-1}), CoS06262 (83.24 t ha^{-1}) and CoS06247 (88.24 t ha^{-1}) recorded significantly high cane yield compared to the all three standard checks CoJ64 (65.25 t ha^{-1}), CoS95255 (82.88 t ha^{-1}) and CoS767 (62.34 t ha^{-1}). Rest of other genotypes CoS05263 (82.53 t ha^{-1}), CoS06248 (78.83 t ha^{-1}), CoS05260 (78.65 t ha^{-1}), CoS06253 (75.83 t ha^{-1}), CoS05259 (75.12 t ha^{-1}), CoS05265 (73.54 t ha^{-1}), CoS06257 (71.42 t ha^{-1}), CoS06252 (70.12 t ha^{-1}), CoS06251 (68.78 t ha^{-1}) and CoS06256 (67.89 t ha^{-1}) showed excellent productivity over two standard checks i.e. CoJ64 and CoS767.

Table 1. Mean performance of elite sugarcane genotypes for yield and quality traits

Genotypes	Cane yield (t ha^{-1})		CCS %		Sugar yield (t ha^{-1})		Pol % in cane	
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
UP 49	104.05*	90.47*	12.68	11.61	13.19*	10.50*	13.39	12.49
CoS 06252	87.12*	70.72	13.07	11.32	11.38*	8.00	13.59	12.28
CoS 06257	73.89	71.42	12.63	11.38	9.33	8.12	13.52	12.26
CoS 06248	97.70*	78.83	12.55	11.76	12.26*	9.27	13.36	12.31
CoS 06262	101.75*	83.24*	13.44	11.75	13.67*	9.78	13.75	12.53
CoS 05265	91.17*	73.54	12.84	11.52	11.70*	8.47	13.54	12.45
CoS 05263	98.93*	82.53*	13.85*	12.48*	13.70*	10.29*	13.87	12.86
CoS 06247	94.88*	88.24*	13.41	11.89	12.72*	10.49*	13.69	12.52
CoS 06254	76.36	59.96	12.04	11.98	9.19	7.18	13.16	12.56
CoS 06251	71.07	68.78	12.64	11.55	8.98	7.94	13.45	12.35
CoS 06253	95.58*	75.83	12.41	11.42	11.86*	8.65	13.25	12.19
CoS 06249	64.72	57.31	13.69	11.79	8.86	6.75	13.47	12.48
CoS 06263	95.58*	61.37	12.92	11.98	12.34*	7.35	13.53	12.56
CoS 06256	88.35	67.89	13.14	11.59	11.60*	7.86	13.57	12.44
CoS 05259	95.58*	75.12	13.73	12.31	13.12*	9.24	13.85	12.59
CoS 05260	85.35	78.65	13.84*	11.94	11.81*	9.39	13.80	12.55
CoS 767	74.27	62.34	12.67	11.49	9.41	7.16	13.16	12.36
CoJ 64	69.30	65.25	13.78	12.07	9.54	7.87	13.76	12.68
CoS 95255	92.17	82.88	13.63	12.34	12.56	10.22	13.78	12.76
SE±	7.57	7.96	0.16	0.13	0.99	0.78	0.14	0.20
CV	10.52	10.30	1.45	1.32	8.78	10.04	1.12	1.59
CD	15.45	15.23	0.34	0.26	2.11	1.66	0.32	0.40

The significantly highest sugar yield was produced by the genotype UP49 (13.19 t ha^{-1}), CoS0626 (13.67 tha^{-1}), CoS05263 (13.70 t ha^{-1}), CoS06247 (12.67 t ha^{-1}), CoS05259 (13.12 t ha^{-1}) over three standards CoS767 (9.41 t ha^{-1}), CoJ 64 (9.54 t ha^{-1}) and CoS95255 (12.56 t ha^{-1}). In plant crop some of the other genotypes such as CoS06263 (12.34 t ha^{-1}), CoS 05260(11.81 t ha^{-1}), CoS 06248 (12.26 t ha^{-1}), CoS 05265(11.70 t ha^{-1}), CoS06256 (11.60 t ha^{-1}), CoS06253 (11.68 t ha^{-1}) and CoS06252 (11.38 t ha^{-1}) proved superior to two standard checks COJ64 and CoS767. In ratoon the performance of various genotypes ranged between 6.75 t ha^{-1} (CoS06249) to 10.50 t ha^{-1} (UP49). The genotype UP49 (10.50 t ha^{-1}) recorded highest sugar yield followed by CoS06247 and CoS05263 having 10.49 t ha^{-1} and 10.29 t ha^{-1}respectively.

Data (Table1) showed that the significantly higher commercial cane sugar percent (CCS %) was recorded by genotypes CoS05263 (13.84 %) followed by CoS05260 (13.84 %). These two genotypes were superior over all the three checks in plant crop in respect of commercial cane sugar percent. The genotype CoS05263 (12.48 %) exhibited best performer (12.85 %) in ratoon crop which was significantly superior over the all three checks. Further, the genotypes CoS05263 (13.87 %), followed by CoS05259 (13.85 %) and CoS05260 (13.80 %) proved significantly superior to standard checks like; CoS 767 (13.16 %), CoJ (13.76 %) and CoS 95255 (13.78 %) in respect of pol percent.

Discussion

The varied tonnage of canes for different genotypes could be due to their different genetic makeup and potential for the exploitation of edaphic and aerial factors of crop production as has been reported by Yadav, (1991) and Singh *et al.,* (2003). Bhatnagar *et al.* (2003) reported that sugarcane clones vary in their ability to survive and produce a profitable ratoon crop. Since the ratooning behaviour of a sugarcane variety is the function of genotype and environment interaction, a good ratooning genotype may not necessarily be a good ratooner if grown in another situation. In the present study it was found that some genotypes posses significantly high cane yield in plant crop but had very low ratooning ability like; CoS06263 (95.58*, 61.37 t ha^{-1}), CoS05265 (91.17, 73.54 t ha^{-1}), CoS 06253 (95.58, 75.83 t ha^{-1}) and CoS 05259 (95.58*, 75.12 t ha^{-1}).

Differential behaviour of genotypes was attributed to the variability in their genetic constitution to exploit environment (Singh and Dey, 2002). These results highlight the importance of testing for ratooning ability and suggest that substantial gains from selection could be achieved by increasing the number of crop-years over which genotypes are tested. Similar results were reported by Rattey and Kimbeng (2001) and Zhou (2004). With regards to sugar yield the new genotypes UP49, CoS05262, CoS05263, CoS05259, CoS06247 and CoS06248 registered the highest productivity which might increase cane yield and above elite genotypes were significantly superior over standard checks in both plant and ratoon crop. It is apparent that seven elite genotypes *viz.;* UP49, CoS06262, CoS05263, CoS05259, CoS06247, CoS06248 and CoS06263 are promising for both sugar yield in plant as well as ratoon crop. They have no flowering tendency.

Conclusion

From the present experiment it is concluded that the genotype UP49 was found the best performer; superior to widely adopted variety CoS767 in respect of cane yield, commercial cane sugar percent (CCS %), sugar yield and pol percent in cane; under both condition (i.e. plant and ratoon crops) and may replace Cos767 and Cos8436 in this state.

References

Bhatnagar PK, Khan AQ, Singh A and Khan KA. 2003. Studies on genetic variability, heritability and genetic advance in plant and ratoon crops of sugarcane. *Indian Sug* LIII (3), 183-185.

Chandra, GD. 1999. *Fundamentals of Agronomy.* Oxford & IBH Publishing Co., (Pvt). Ltd., Calcutta. Pp. 126.

Anon. 2008. *Sugar Statistics. Indian Sug* Vii (11), 57&70.

Malik KB, Gurmani MH. 2005. *Cane production guide*. Dewan Farooque Sugarcane Research Institute, Dewan City, Sindh, Pakistan.

Mathur RBL. 1981. *Handbook of cane sugar technology* 2nd edition, Oxford and IBH Publisher Co. Ltd. 66, Janapath, New Delhi- 110001. pp.680.

Meadle GP, Chen JCP. 1977. *Cane sugar handbook* .10th edition John Wiley and Sons publishers, New York, USA.

Rattey AR, Kimbeng CA. 2001. Genotype by Environment interactions and resource allocation in final stage selection trials in the Burdekin district. *Proc Aust Soc Sugarcane Technol* 23, 136-141.

Singh RK, Dey P. 2002. Genetic variability in plant and ratoon of sugarcane genotypes grown under saline conditions. *Indian Sug* LI (10), 725-727.

Singh IS, Singh R, Yadav MP, Singh RR, Singh SB. 2003. Ratooning behaviour of new promising varieties of sugarcane under Bhat soil conditions. *Indian Sug* LIII (5), 333-336.

USDA. 2010. *Sugar world production, supply and distribution* (May, 2010). www//http.far.gov/http/sugar/2010/sugar.

Yadav RL. 1991. *Sugarcane Production Technology; Constraints and Potentialities*. Oxord & IBH Publishing Co. (Pvt.) Ltd. Bombay. pp.204.

Zhou M. 2004. Strategies for variety selection in the breeding program at the Zimbabwe Sugar Association Experiment Station. *Proc SASTA* 78, 137-147.