Plant Archives Vol. 26, No. 2, 2026 pp. 2335-2339 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.2.321

PERFORMANCE OF NEWLY RELEASED SUGARCANE VARIETIES WITH VARYING FERTILITY LEVELS AND ROW SPACINGS

Resabh Kumar Singh*, S.P. Yadav, S.K. Yadav and V.K. Shukla

U.P. Council of Sugarcane Research, Shahjahanpur, Uttar Pradesh, India.

*Corresponding author E-mail : resabhsingh085@gmail.com

(Date of Receiving-28-05-2026; Date of Revision-05-08-2026; Date of Acceptance-24-08-2026)

ABSTRACT

Field experiments were conducted for agronomical traits evaluation of newly released sugarcane varieties planted during spring season in two consecutive years *i.e.*; 2024-25, 2025-26 at the Research Farm of U.P. Council of Sugarcane Research, Shahjahanpur, Uttar Pradesh, India. The field experiments were laid out with eight treatments combination in factorial randomized block design and replicated thrice with two varieties CoS 19231 early and CoS 19235 mid late, with two fertility levels ie. F_1- 100% recommended dose of NPK, F_2- 100% recommended dose of NPK + 25% N through organic manure + bio-fertilizer (*Azotobacter* + PSB) @ 10kg/ha each and two spacing *i.e.*; S_1- 67:134 cm in deep furrow paired row planting, S_2- 30:120 cm in trench paired row planting. Recommended dose of NPK fertilizers were 180:80:60 kg per hectare and applied as per treatments. The data (two years mean data) were analysed and revealed that variety CoS 19235 with F_2- (100% recommended dose of NPK + 25 % N through organic manure + bio-fertilizers (*Azotobacter* +PSB) @ 10kg/ha each and with 67:134 cm in deep furrow paired row planting gave significantly better cane yield (110.25t/ha) than the variety CoS 19231 (91.5t/ha). This variety with same fertility and space geometry also have given better germination (66.51%), shoots (178872/ha), NMC (141741/ha) than the variety CoS 19231 with germination (43.79%), shoots (151153/ha) and NMC (128613/ha). CCS% were not affected significantly with varieties, fertility and planting methods.

Key words : Spacing, Performance, Fertility level, Newly released variety.

Introduction

Sugarcane (*Saccharum officinarum* L.) is an important cash crop of India grown in an area of 5.6 mha with annual production of 454.61 million tones and average yield is 80.3 t/ha. In Uttar Pradesh, it occupies an area of 29.51 lakh hectares with the production of 2250.00 lakh tones and productivity is 83.2 t/ha. Main reason for lower cane yield are lack of high-potential varieties, limited irrigation resources and technology (Bahadar *et al.*, 2002). According to Glaz (2000) sugarcane production could never be improve until unless promising varieties and technologies are adopted on large scale. Recent improvements in sugarcane productivity are evidences of technological advancements such as developing improved varieties, crop production and protection technologies and their dissemination. Efforts are made to increase cane production by introducing high yielding varieties and adoption of improved crop production techniques (Gill, 1995). The productivity of sugarcane in india is quite lower because of several factors *viz.*, poor management of crop, poor soil condition abiotic and biotic stresses etc. Adoption of balance and judicious use of all needed input can help in improving cane productivity and enhancement in sugar recovery by rendering resistance against biotic and abiotic stress and better synthesis and storage of sugar (Yadav *et al.*, 1993). The sugarcane yield could be increased through adoption of improved varieties developed for the region (Ram *et al.*, 2017). variety plays a key role in both increasing and decreasing per unit area sugarcane yield. While use of unapproved, inferior quality cane varieties affect sugarcane production negatively as situation prevails today (Mian, 2006). The solution of low cane yield and sugar recovery problem lies in the Planting of improved cane varieties (Chattha

et al., 2006). Wide row spacing faciliated mechanical interculture operations and enhanced individual clumps extension. However, for ease of full scale tractor, mechanization and reduced lodging without sacrificing commercial sugar yield the 67:134. cm deep furrow paired and 30:120cm trench paired offers a superior agronomical alternative for sugarcane production. Planting of sugarcane in paired rows compared with that in single row has proved beneficial in India (Yadav *et al.*, 1997). Pawar *et al.* (2005) reported that wider row spacing improved the sucrose contents and commercial can sugar percentage. Sugarcane is a long duration, high biomass crop. It responds dramatically to this additional organic fraction across multiple location trials, switching from purely chemical 100% RDF program to one supplemented with 25% N through organic manure (*Azotobacter* +PSB) @10 kg/ha each creates distinct measurable shifts in crop. Performance and soil characteristics the organic fraction enhances the soil's organic carbon status, improves microbial nitrogen fixation and stabilizes secondary and micronutrient availability throughout the heavy vegetative growth stage of the sugarcane crop (Pal *et al.*, 2021). Application of *Azotobacter* resulted 7.7-15.7% more cane yield than *Azospirillum* at different N level (Bangar and Sharma, 1997). Sharma *et al.* (1999) also reported that application of bio-fertilizer also effects growth and yield of cane. Bio-fertilizers are capable of synthesizing growth hormones and/or regulators in addition to the fixation of N.

Materials and Methods

Field experiments were conducted during spring season in two consecutive years during 2024-25, 2025-26 at research farm of U.P. Council of Sugarcane Research, Shahjahanpur (Uttar Pradesh), India. The experiment consisted of eight treatment combination's. Two varieties *i.e.*; V_1- CoS 19231 (early), V_2- CoS 19235 (mid-late) and two fertility levels *i.e.*, F_1- 100% recommended dose of NPK, F_2- 100% recommended dose of NPK + 25%. N through organic manure (*Azotobacter* +PSB @ 10kg/ha each), and two spacing *i.e.*; S_1- 67: 134 cm in deep furrow paired row spacing, S_2- 30:120 cm in trench paired row spacing were tested in factorial randomized block design with three replications. The soil of experimental field was low in organic carbon (0.41%) and medium in phosphorus (120kg/ha) and potash (156.8kg/ha) with pH 7.27. The 100% recommended dose of NPK (180kg, 80kg, 60kg/ha) were applied on soil test basis. The experimental crop was planted in february and harvested in march after 12 months and number of millable canes and cane yield were recorded. Mean data analysis of two years were completed. Healthy cane from 10 months old plant crop was selected for seed cane with good internodel length and girth which were free from insect - pest and diseases.

Results and Discussion

Effect of varieties

Experimental results showed that significantly better germination (56.35%) higher shoots (163318/ha), NMC (133052/ha) and cane yield (96.77 t/ha) were recorded in Variety CoS 19235 than the CoS 19231 gave germination (47.32%), shoots (140659/ha), NMC (119382/ha) and cane yield (84.43t/ha). In case of CCS% variety CoS 19231 gave 12.93 CCS and CoS 19235 12.43 CCS. Early maturing varieties rely heavily on early season tiller population density to establish yield baselines. In contrast, mid late varieties show a high capacity to compensate for wider geometries by expanding individual stalk girth and height late in the vegetative phase. A characteristic that aligns perfect by the wide row configurations evaluated by Singh *et al.* (2014).

Effect of fertility levels

Experimental results showed that the fertility levels that 100% recommended of NPK +25% N through organic manure + bio-fertilizer (*Azotobacter* + PSB) @ 10kg each gave significantly higher germination (51.88%) shoots (162013/ha), NMC (133800/ha) and cane yield (97.67 t/ha) than that of 100% recommended dose of NPK with germination (51.79%) shoots (141964/ha), NMC (118634/ha) and cane yield (83.42 t/ha). CCS% (12.79) obtained in F_1-100% recommended dose of NPK and CCS% (12.57) in F_2 - 100% recommended dose of NPK +25% N through organic manure + Bio-fertilizer (*Azotobacter* + PSB) @ 10 Kg/ha each. Resulted also showed that shoot population, NMC and cane yield increased with increasing dose of fertilizer and this might be due to higher to conversion of shoots in to the millable canes, increased protein synthesis and promoted root development which resulted in increased nutrient uptake and photosynthesis that enhanced the growth and yield attributes. These results are conformed with in earlier findings of Singh *et al.* (2011) and Dev *et al.* (2011). Such benefits are attributed to synergistic effect of simultaneous application of FYM and organic fertilizer on crop yield and also application of FYM organic manure not only increase the nitrogen use efficiency of urea, but also increase the fertility status of the soil (Agrarwal, 1996). The result of present study is in agreement with these views; Shivshankar and Hegde (1997) reported that FYM as organic manure facilitates the availability of plant nutrients directly to the plant and also had solubilizing

Table 1 : Interaction effects of treatments on germination, shoots, NMC, cane yield and CCS% (mean data of two years 2024-25 and 2025-26).

Treatments		Germination (%)	Shoots (ha)	NMC (ha)	Cane yield (t/ha)	CCS (%)
$F_1S_1V_1$		44.02	135898	110055	80.05	13.09
$F_1S_1V_2$		48.39	153404	123924	89.9	12.63
$F_1S_2V_1$		50.10	127663	113184	77	13.06
$F_1S_2V_2$		65.00	150892	127370	86.7	12.36
$F_2S_1V_1$		43.79	151153	128613	91.5	12.56
$F_2S_1V_2$		66.51	178872	141741	110.25	12.19
$F_2S_2V_1$		51.34	147926	125674	88.71	12.98
$F_2S_2V_2$		45.5	170103	139171	100.22	12.54
SE±	VxS	4.20	582.12	3532.29	6.86	0.23
	FxS	4.20	582.12	3532.29	6.86	0.23
	SxV	4.20	582.12	3532.29	6.86	0.23
	VxFxS	5.94	823.24	4995.41	9.70	0.23
CD at 5%	VxS	NS	NS	NS	NS	NS
	FxS	NS	NS	NS	NS	NS
	SxV	NS	1248.64	NS	NS	NS
	VxFxS	NS	NS	NS	NS	NS

effect on fixed form of the nutrients application of *Azotobacter* produced a marginal increase in cane and sugar yield in addition to the saving of 75 kg N/ha irrespective of nitrogen level (Bangar *et al*., 1992). Bangar and Sharma (1997) reported that application of phosphate increased yield of sugarcane and appreciable results were obtained by the using P.S.B particularly at lower level of phosphate (60kg/ha). This may be due to solubilizing of insoluble phosphate present in the soil (Kapoor *et al*., 1989). By the using of PSB in sugarcane 20kg/ha could be saved (Bangar and Sharma, 1997). Baktiar *et al*. (2008) reported the beneficial effect of the combined application of organic and inorganic fertilizers in sustaining soil fertility and crop productivity. Nitrogen fixing bacteria *Azotobacter* converts atmospheric nitrogen into a form that sugarcane plants can use for growth. Phosphate solubilizing bacteria helps in solubilizing phosphorous in the soil, making it available to sugarcane plants.

Effect of row spacings

Experimental results showed that various

Table 2 : Effects of single factor on germination, shoots, NMC, cane yield and CCS% (mean data of two years 2024-25 and 2025-26).

Treatments	Germination (%)	Shoots (000/ha)	NMC (000/ha)	Cane yield (t/ha)	CCS (%)
A- Varieties					
V_1 - CoS 19231	47.32	140.66	119.38	84.43	12.93
V_2 – CoS 19235	56.35	163.32	133.05	96.77	12.43
SE ±	2.97	0.41	2.50	4.85	0.16
CD at 5%	6.37	0.88	5.36	10.4	NS
B – Fertility level					
F_1 - 100% RDF NPK	51.88	141.96	118.63	83.42	12.79
F_2 - 100% RDF NPK+ 25% N through organic manure + Bio-fertilizers (*Azotobacte*r +PSB @ 10 kg/ha each)	51.79	162.01	133.80	97.67	12.57
SE ±	2.97	0.41	2.50	4.85	0.16
CD at 5%	NS	0.88	5.36	10.40	NS
C – Planting Method					
S_1 -67 :134 cm in deep furrow paired row planting	55.85	161.76	129.37	97.22	12.53
S_2 – 30:120 cm in trench paired row planting	58.24	149.15	116.35	86.16	12.74
SE ±	2.97	0.41	2.50	4.85	0.16
CD at 5%	NS	0.88	5.36	10.4	NS

treatments with different row spacings. Significantly higher cane yield (97.22t/ha) was obtained in 67:134 cm in deep furrow paired row planting as compared to 30:120 cm in trench paired row planting (86.16t/ha). Germination (55.85%), shoots (161762/ha), NMC (129366/ha) and CCS% (12.53) obtained in 67: 134 cm in deep furrow paired row planting and germination (58.24%), shoots (149146/ha), NMC (116350/ha) and CCS% (12.74) recorded with 30:120 cm in trench paired row planting. Thus in most of the case paired row trench planting method of planting also improved sugarcane yield (Yadav and Kumar, 2005). Wide row spacing increased cane yield obtained over narrow spacing reported by Malik and Ali (1990). Chattha (2007) concluded that planting in 120 cm apart trenches recorded highest cane height millable canes, cane yield. Trench planting results in a higher proportion of densely packed primary shoots which contributes more to the final population and output. Kumar (2012) discovered that the trench method out performed traditional planting methods in terms of cane lodging, millable canes and cane weight and cane yield higher over conventional planting. Row spacing significantly affects the final count. Research demonstrates that a spacing of 90cm typically yields higher number of millable canes compared to wider spacing like 150 cm, where the count can become a limiting factor for productivity (Chakrawal and Kumar, 2001). Wider space helps to maintain a higher percentage of mother shoots and early stage tillers. Wide row Spacing also tends to increase cane height compared to narrow spacing (Nadeem *et al*. 2020). Singh *et al*. (2011) also found more cane available sugar, commercial cane sugar under trench planting methods. This could be attributed to more availability of light, space and moisture under paired row planting which might lead to more availability of land per shoot for growth and development under paired row planting as compared to single row planting resulted into higher number of leaves per shoot available for the purpose of photosynthesis process under paired row planting (More, 2003).

Conclusion

In light of the above discussion, it can be concluded that variety CoS 19235 gave significantly better germination (56.35%) and higher cane yield (96.77t/ha) than the variety CoS 19231 having germination (47.32%) and cane yield (84.43t/ha). Regarding fertility levels, 100% recommended dose ef NPK + 25% N through organic manure +bio-fertilizers (*Azotobacter*+ PSB) @ 10kg/ha each gave significantly higher cane yield (97.67t/ha) than that of 100% recommended dose of NPK (83.42t/ha). In case of planting methods significantly higher cane yield (97.22t/ha) was obtained with 67:134 cm in deep furrow paired row planting as compared to 30:120 cm in trench paired row planting (86.16t/ha). Interaction effect between all three factors were non-significant in respect to germination, shoots, NMC, cane yield and CCS%.

References

Aggarwal, R.K. (1996). *Integrated nutrient management in dry lands*. Land Resource and their Sustainability in Arid Region, Scientific Publishers, Jodhpur: 263-272.

Bangar, K.S. and Sharma S.R. (1997). Role of organic manuring in improving sugarcane and sugar productivity. *Indian J. Sugarcane Technol*., **12(1)**, 59-66.

Bangar, K.S., Sharma S.R. and Namdeo S.L. (1992). Effect of bio fertilizers in presence of fertilizer nitrogen on quality of sugarcane (*Saccharum officinarum*). *Indian J. Agri. Sci*., **62 (12)**, 815-818.

Bakhtier, S.M., Paul G.C. and Alam K.M. (2008). Effect of organic and inorganic fertilizer on growth, yield and quality and residual effect on ratoon crops of sugarcane. *J. Plant Nutr.*, **31(10)**, 1832-1843.

Bahadar, K., Jamal M., Sadiq M., Sulaman M., Azim H. and Balouch M.S. (2002). Genetic variation and ecological suitability of new sugarcane genotypes under the agro-climatic conditions of Bannu (NWFP). *Pakistan Sugar J.*, **17**, 15-17.

Chattha, A.A., Rafique M., Afzal M., Ahmed F. and Bilal M. (2006). Prospects of sugar industry & sugarcane cultivation in Punjab. *Proceedings of 41th Annual Convention of Pakistan Society of Sugar Technologists held at Rawalpindi* on August 21-22, 2006. p. 173-181.

Chakrawal, M. L. and Kumar S. (2001). Performance of sugarcane cultivars under different row spacings. *Indian J. Sugarcane Technol*., **16(1)**, 42–46.

Chattha, U.M., Ali A. and Bilal M. (2007). Influence of planting techniques on growth and yield of spring planted sugarcane (*Saccharum officinarum*). *Pak. J. Agricult. Sci*., **44(3)**, 452-456.

Dev, C.M., Meena R.N., Kumar Ashok and Mahajan G. (2011). Earthing up and nitrogen levels in sugarcane ratoon under subtropical India condition. *Indian J. Sugarcane Technol.*, **26(1)**, 1-5.

Glaz, B. (2000). *Sugarcane variety census*. P: 23. Florida Sugar Y. Azucar.

Gill, M.B. (1995). Physio agronomic studies on flat versus pit plantation of autumn and spring sugarcane (*Saccharum officinarum* L.). *M.Sc. Thesis*, Department of Agronomy, University of Agriculture, Faisalabad. p.49-89.

Kapoor, K.K, Mishra M.M. and Kudrejaga (1989). Phosphate solubilization by soil microorganisms. *Indian J. Microbial.*, **29 (2)**, 119-127.

Mian, A.M. (2006). Sugarcane variety composition in Pakistan. Proceedings of Seminars on Agriculture. organized by Pakistan Society of Sugar Technologists held at Faisalabad on 19th June 2006. pp.107-121

Malik, K.B. and Ali F.G. (1990). Cane yield response to seed

density and tow spacing in spring and autumn planting. *Proceedings of the Pakistan Society of Sugar Technologists*, **25**, 239-254.

More, S.M. (2003). Study on the effect of row spacing, planting system and intercropping on growth, yield, quality and economics of Suru sugarcane (cv. Co 86032) and its ratoon under drip irrigation (*Doctoral dissertation*). Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.

Nadeem, M., Ahmad S., Anjum S.A., Ali I. and Hasanuzzaman M. (2020). Spatial configuration and seeding rate modifications affecting the growth, population dynamics, and qualitative traits of sugarcane cultivars. *Sugar Cane Technol.*, **22(4)**, 211–218.

Pal, R., Singh O., Sanghera G.S. and Gupta R.K. (2021). Influence of INM on Sugarcane productivity and soil fertility under indo - Gangetic Plain. *The Indian J. Agricult. Sci.*, **91(5)**, 703-707.

Ram, B. (2017). Development of sugarcane varieties for abiotic stresses suitable for sub-tropical conditions. *J. Sugarcane Res.*, **7 (1)**, 11-26.

Shivshankar, K. and Hegde B.R. (1997). Biomass generation through farming system approach in organic farming and sustainable agriculture. *Proc. National Seminar held at University of Agril. Sciences*, Bangalore, 9-11 oct. 1997: 92-101.

Singh, R., Mishra A. and Godara A.S. (2014). Growth, Yield and quality of mid late and late varieties of Sugarcane (*Saccharum* spp. complex hybrid) as influenced by row Spacing and fertility levels. *The Indian J. Agricult. Sci.*, **84 (10)**, 1280-1283.

Sharma, B.L., Singh S. and Sharma S. (1999). Effect of integrated nutrient management on yield and quality of sugarcane. *Indian J. Sugarcane Technol.*, **14(1)**, 22-27.

Singh, A.K., Lal M. and Singh S.N. (2011). Agronomic performance of new sugarcane genotypes under different planting geometry and nitrogen levels. *Indian J. Sugarcane Technol.*, **26 (1)**, 6-9.

Yadav, R.L. and Kumar R. (2005). On farm comparison of ring-pit and conventional flat planting methods for yield and quality of sugarcane in northwest India. *Indian J. Agricult. Sci.*, **75**, 605-607.

Yadav, R.L. (1993). *Agronomy of sugarcane principal and practices*. 1st Edn. International Book Distribution Co. Lucknow, India.

Yadav, R.L., Singh R.V., Singh R. and Srivastava V.K. (1997). Effect of planting geometry and fertilizer nitrogen on nitrate leaching, nitrogen use efficiency and sugarcane yield. *Tropical Agriculture*, **74**, 115-120.