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Response of Promising Sugarcane Genotypes to Different Fertilizer Regimes in Peninsular Zones of Maharashtra

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Abstract
The field experiment was conducted at the Vasantdada Sugar Institute (VSI), Manjari, Pune, during 2024–25 to evaluate the performance of promising elite sugarcane genotypes under different fertilizer regimes in the peninsular zone of Maharashtra. The study assessed growth and yield attributes, cane yield, and quality parameters of twelve sugarcane genotypes along with one standard check. Considerable variation was observed among the genotypes with respect to cane yield, its components, and quality traits. The results indicated that application of 25% additional fertilizer over the recommended dose of fertilizers (RDF) produced the highest cane yield (101.82 t/ha) and commercial cane sugar (CCS) yield (14.98 t/ha), though the differences were not statistically significant. Among the genotypes, Co 18012 recorded the highest cane yield (115.50 t/ha), whereas Co 18003 exhibited the highest CCS yield (16.90 t/ha).

Keywords: Sugarcane, promising genotypes, fertilizer regimes, growth and yield attributes, yield, quality, economics

Introduction

Sugarcane growers confront considerable hurdles, including decreasing output and greater production costs. Elite genotypes are crucial to enhancing sugarcane productivity. According to Nazir *et al*. (1997) [7], higher cane output is associated with a variety's higher genetic potential. The potential for expanding sugarcane area is limited due to industrialisation of cultivable land, production can only be increased through improved sugarcane genotypes and good management practices such as optimal plant spacing, nutrient management, and in-situ trash management. Selecting the right variety to plant in a specific agroecological zone is essential for determining yield and sugar recovery capability. Sugarcane productivity in India is low due to a variety of problems, including inadequate crop management, poor soil conditions, abiotic and biotic stresses, and so on. Adopting a balanced and prudent nutrient use can assist improve cane yield and sugar recovery by increasing tolerance to biotic and abiotic stresses, as well as boosting sugar synthesis and storage (Yadav 1993) [12].

Sugarcane responds to added inputs, and soils are frequently unable to match supply during high demand periods, therefore boosting nutrition with organic or inorganic sources is evident for achieving targeted yield. Singh *et al.* (2008) [9]. Sugarcane is a long-term crop that requires a proper nutrition. On average, a tonne of sugarcane removes 5, 1.15, and 5.25 kilogramme of N, P_2O_5, and K_2O from the soil. Soil alone cannot complement the enormous amount of nutrients necessary. As a result, nutrient requirement must be satisfied at regular intervals throughout crop growth (Keshavaiah *et al*., 2012).

Given the importance of the research, the current investigations were carried out to assess how sugarcane genotypes fared in terms of yield and yield attributes under the agroclimatic conditions of the peninsular region.

Material and Methods

The genotypes were evaluated during the year 2024-25 at the Research & Development farm of Vasantdada Sugar Institute, Manjari Bk., Pune, Maharashtra, India (latitude 18° 31′ 34.32″ N, longitude 73° 58′ 28.56″ E, and altitude 190 meters above mean sea level). One control variety, Co 09004, along with twelve sugarcane genotypes recommended by AICRP's were used for study. The agronomic performance of different genotypes were assessed under two different fertilizers levels.

All the genotypes were planted in a Split Plot Design (SPD) with three replications during the years 2024-25. In each plot five rows of eight-meter length, with a spacing of 135 cm between two rows were kept. The suggested agronomic practices included regular weeding, small earthing up (45 days after planting, final earthing up (120 days after planting) and plant protection measures were applied as required. The information on yield, quality and the factors that contribute to, was documented during the entire growing season. Among these parameters, the number of tillers were recorded at 120 days after planting. While, all other characteristics were recorded at the time of harvest. The number of millable canes (NMC) were recorded at harvest. Extracted the juice using a power crusher to assess the quality of the cane samples and measured the brix and sucrose content following the method proposed by Meade and Chen (1977) [6]. Sucrose percentage was determined using Schmitz's Tables. The commercial cane sugar (CCS) percent was determined using the formula CCS% = {Sucrose % - (Brix % - Sucrose %) X 0.4} X 0.74. The data on cane yield and yield parameters were analyzed statistically and interpreted as suggested by Panse and Sukhatme (1978) [8] and economics were worked out.

Results

The effect of various genotypes and fertiliser regimes on growth, yield-attributing traits, cane and CCS production, juice quality, and economics were demonstrated by the results displayed in Tables 1, 2, and 3.

Table 1: Germination percentage, tiller count, millable cane count and cane yield as affected by different fertilizer levels and genotype

Treatment	Germination At 30 DAP (%)	Tiller count at 120 DAPS (000'/ha)	NMC at harvest (000'/ha)	Yield (t/ha)	
				Cane	CCS
Factor A: Fertilizer levels					
F1: 100% RDF	68.17	88.13	68.67	96.22	14.04
F2: 125% RDF	65.00	97.67	77.21	101.82	14.98
Sem±	1.48	1.18	1.02	1.43	0.33
C.D. @ 5%	NS	3.45	2.98	4.17	NS
Factor B: Genotype					
V1: Co 18001	73.25	95.75	82.75	101.85	14.25
V2: Co 18002	64.00	89.00	74.75	96.94	14.69
V3: Co 18003	76.00	112.25	87.75	104.57	16.90
V4: Co 18009	62.00	75.75	62.75	95.30	14.18
V5: Co 18012	66.75	86.75	70.00	115.50	16.62
V6: Co 18013	71.25	117.0	81.25	90.66	13.22
V7: Co 18024	63.00	84.25	64.50	94.26	13.24
V8: CoVc 18061	54.75	105.00	78.75	113.13	14.60
V9: CoN 18071	59.50	88.00	63.50	89.05	13.06
V10: CoN 18072	76.00	95.25	77.00	95.40	13.98
V11: CoVSI 18121	63.50	83.00	62.00	94.61	13.82
V12: Co 09004	69.00	82.75	70.25	96.97	15.56
Sem±	3.63	2.90	2.50	3.50	0.80
C.D. @ 5%	10.60	8.45	7.31	10.23	2.34
Interaction F×V					
Sem±	5.14	4.10	3.54	4.95	1.13
C.D. @ 5%	NS	NS	NS	NS	NS

Table 2: Growth & yield attributes of sugarcane as influenced by different fertilizer levels and genotype

Treatment	No. of internodes	Girth of internodes (cm)	Total plant height (cm)	Single cane wt. (kg)
Factor A: Fertilizer levels				
F1: 100% RDF	23.95	9.71	269.40	1.39
F2: 125% RDF	25.16	10.27	293.59	1.68
Sem±	0.43	0.12	5.02	0.05
C.D. @ 5%	NS	0.34	14.65	0.14
Factor B: Genotype				
V1: Co 18001	24.83	9.79	258.41	1.35
V2: Co 18002	24.83	9.91	291.50	1.59
V3: Co 18003	24.16	9.66	294.58	1.36
V4: Co 18009	23.00	9.80	288.67	1.56
V5: Co 18012	25.58	10.42	317.58	1.91
V6: Co 18013	25.75	9.04	260.00	1.10
V7: Co 18024	22.83	10.25	224.08	1.32
V8: CoVc 18061	27.00	10.25	323.58	1.97
V9: CoN 18071	21.25	10.21	265.33	1.47
V10: CoN 18072	25.58	9.50	292.00	1.58
V11: CoVSI 18121	24.25	11.71	279.47	1.78
V12: Co 09004	25.66	9.37	282.75	1.40
Sem±	1.06	0.29	12.30	0.12
C.D. @ 5%	3.10	0.84	35.91	0.35
Interaction F×V				
Sem±	1.50	0.41	17.40	0.17
C.D. @ 5%	NS	NS	NS	NS

Table 3: Quality parameters and economics as affected by different fertilizer levels and genotype

Treatment	Brix (%)	Sucrose (%)	CCS (%)	B : C ratio
Factor A: Fertilizer levels				
F1: 100% RDF	22.36	20.50	14.62	1.33
F2: 125% RDF	22.80	20.73	14.72	1.38
Sem±	0.22	0.26	0.20	-
C.D. @ 5%	NS	NS	NS	-
Factor B: Genotype				
V1: Co 18001	21.83	19.78	14.03	1.39
V2: Co 18002	23.77	21.53	15.27	1.32
V3: Co 18003	23.83	22.39	16.14	1.43
V4: Co 18009	22.74	20.82	14.83	1.30

V5: Co 18012	22.53	20.32	14.38	1.58
V6: Co 18013	21.63	20.32	14.65	1.24
V7: Co 18024	22.01	19.85	14.05	1.29
V8: CoVc 18061	20.92	18.35	12.82	1.55
V9: CoN 18071	22.99	20.70	14.64	1.22
V10: CoN 18072	22.88	20.60	14.57	1.30
V11: CoVSI 18121	21.82	20.32	14.59	1.29
V12: Co 09004	24.06	22.37	16.06	1.33
Sem±	0.55	0.63	0.50	-
C.D. @ 5%	1.61	1.83	1.45	-
Interaction F×V				
Sem±	0.78	0.89	0.70	-
C.D. @ 5%	NS	NS	NS	-

Effect of fertilizer regimes

Except germination percentage, internode numbers, juice quality and CCS yield rest of the parameters affected by different fertilizer regimes. Significantly highest tiller count (97.67 thousand/ha) at 120 DAPS, number of millable cane (77.21 thousand/ha) was observed in 125% RDF compare to 100 % RDF.

Different fertilizer regimes influenced significantly on cane yield. The highest cane yield (101.82 t/ha) was noted in 125% RDF as compared to 100% RDF.

In case of growth and yield attributes, significantly maximum girth of internodes, total plant height and single cane weight was observed highest (10.27 cm. 293.59 cm and 1.68 kg) in 125 % RDF. According to the benefit cost ratio, adding 25% more RDF resulted in the highest (1:1.38) B: C ratio. Maximum outcomes were observed for the numerically recommended fertiliser dose of 125%, irrespective of the sugarcane genotypes. The modest difference in growth and yield-related characteristics revealed that applying more fertiliser than recommended dose is not a good option for maximising production. These findings are consistent with those of Thakur *et al*. (1991) [10] and Bharathalakshmi *et al*. (2003) [1].

Effect of genotypes

The results revealed that the genotype CoN 18072 recorded the highest germination percentage (76.00%), which was statistically at par with Co 18003 (76.00%). The tiller count was significantly higher in Co 18013 (117.00 thousand/ha), followed by Co 18003 (112.25 thousand/ha) and CoVc 18061 (105.00 thousand/ha), whereas, millable cane population was also significantly influenced by different genotypes. The genotype Co 18003 recorded the highest millable cane population (87.75 thousand/ha), followed by Co 18001 (82.75 thousand/ha) and Co 18013 (81.25 thousand/ha).

The cane and CCS yield differed significantly among genotypes. The highest cane yield was obtained in Co 18012 (115.50 t/ha), followed by CoVc 18061 (113.13 t/ha). The CCS yield (t/ha) was significantly higher in Co 18003 (16.90 t/ha), followed by Co 18012 (16.62 t/ha).

Mean data indicated that the growth parameters of sugarcane were significantly affected by the genotypes. The genotype CoVc 18061 recorded the highest number of internodes (27), followed by Co 18013. The internode girth was significantly higher in CoVSI 18121 (11.71 cm), followed by Co 18012 (10.42 cm). The plant height (323.58 cm) and single cane weight (1.97 kg) were also highest in CoVc 18061, followed by Co 18012 (317 cm & 1.91 kg).

Different genotypes also showed significant variation in juice quality and CCS percentage. The genotype Co 18003 recorded the highest brix (23.83°), sucrose (22.39%), and CCS (16.14%), followed by Co 18002 with brix (23.77°), sucrose (21.53%), and CCS (15.27%). The economic analysis revealed that the maximum benefit–cost ratio (1.58) was obtained from CoVc 18061, followed by Co 18012 (1.55).

This could be due to variances in growth attributes, cane, CCS yield, and juice quality, which are intrinsic properties of the genotype and are unaffected external factors. This implied that all sugarcane genotypes differed genetically and had a high degree of diversity. Genetic makeup is known to have a substantial impact on sugarcane (Junejo *et al*., 2010 [3]; El-Geddaway *et al*., 2002) [2]. Genetic differences across varieties may explain the variation in cane production and yield components (Varghese *et al*., 1985 [11]; Mali and Singh, 1995) [5].

Interaction effect

It was found that growth characteristics such cane, CCS yield, and juice quality were not significantly impacted by the genotype and fertilizer interaction. These results demonstrated that the growth, cane, CCS yield, and juice quality parameters are independently controlled by fertilizer and the genetic attributes of the sugarcane.

Conclusion

The results indicated that the application of 25% additional fertilizer dose over the recommended dose (RDF) resulted in the highest cane yield (101.82 t/ha) and CCS yield (14.98 t/ha), although the differences were not statistically significant. Among the genotypes, Co 18012 recorded the highest cane yield (115.50 t/ha), while Co 18003 produced the maximum CCS yield (16.90 t/ha). However, these differences were also not significant compared to the other genotypes.

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