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Performances evaluation of sugarcane genotypes for yield and yield attributing characters

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Abstract
Evaluation of various sugarcane genotypes for yield & yield attributing traits was conducted at the experimental area of Sant Kabir College of Agriculture & Research Station, Kawardha (Kabirdham) Chhattisgarh. Twelve early genotypes along with 4 standard checks and twenty four mid late group genotypes along with 4 standard checks of sugarcane were tested Checks *viz.* Co 85004, Co 94008, CoC 671 and CoM 265 and four standards *viz.* Co86032, Co99004, Co 8014 and Co 8636 respectively. These genotypes of sugarcane were evaluated in the completely Randomized block design with three replications for their yield performance and other yield & quality attributing traits. The genotypes of sugarcane were collected from Central Sugarcane Research Station (MPKV), Padegaon (Maharashtra). In early group MS 13081 (116.47 t/ha), was found significantly superior over the best standard COM 265 (103.39 q/ha). However, the genotype MS 13081 exhibited better performance for cane yield also showed satisfactory performance for brix % (20.43) and sucrose % (10.96) while in mid late group of sugarcane genotypes CO 13013 (153.04 t/ha) followed by genotype CO 13009 (150.13 t/ha), CoN 13074 (147.16 t/ha) and CoM 13074 (146.25 t/ha) were found significantly superior over the best standard Co-99004 (113.10 t/ha). Genotypes MS 13081 early group and CO 13013 mid late group exhibited good performance in terms of average cane yield and yield components as compared to the standard checks. Stem height, single cane weight, length of nodes, brix percentage and sucrose percentage were play pivotal role for cane yield.

Keywords: evaluation, sugarcane, yield traits, quality traits

Introduction
Sugarcane (*Saccharum officinarum* L.) is the main sources of sugar in India and holds a prominent position as a cash crop. India is the world's largest consumer and the second biggest sugar producer. The major challenges faced by the crop are lower productivity, low sugar recovery and higher cost of production. Variety plays a vital role in both increasing and decreasing per unit area sugarcane yield, while use of unapproved, inferior cane quality varieties affects the sugarcane production negatively (Mian, 2006) [10]. There are number of reasons for lower cane yield, planting of low yielding varieties are one of them. Therefore, it is need of the time to introduce new high yielding varieties (Chattha and Ehsanullah, 2003) [2]. Varieties play a pivotal role in determining the yield, whereas, cultural practices and climatic factor help to explore their inherent potential. The solution of low cane yield and sugar recovery problem lies in the planting of improved cane varieties. The information on the nature and the magnitude of variability present in the breeding material is of prime importance for a breeder to initiate any effective selection program. The effectiveness of selection for sugar yield and its components depends largely on the genetic variability present in the breeding population of sugarcane and the heritability of the traits. It is necessary to identify traits with high genetic variation. A well matured high sugar recovery cane variety with reasonable juice extraction and purity is pre-requisite for a better quality sugar. Keeping in view the evaluation of various sugarcane genotypes for yield & yield attributing traits was conducted twelve genotypes along with four standard checks of early group and twenty-four genotypes along with four standard checks of mid-late group under the agro-climatic conditions of Kabirdham.

Material and Methods
The experiment was conducted at the Research Farm of Sant Kabir College of Agriculture & Research station, Indira Gandhi Krishi Vishwavidyalaya, Kawardha, Kabirdham (C.G.). The experimental material consisted of eight genotypes with four standard *viz.* Co-85004, Co-94008

and CoC-671 and CoM 265 of early group of sugarcane and tweny genotypes with four standards *viz.* Co86032, Co99004, Co 8014 and Co 8636 of mid late group of sugarcane were evaluated in the completely Randomized block design (RCBD) with three replications. The genotypes of sugarcane were collected from Central Sugarcane Research Station (MPKV), Padegaon (Maharashtra).

Each genotype had 5 meters long 4 rows at 1.2 meters row to row distance. The genotypes were planted first week of March by adopting all recommended agronomical practices. Two-three budded sets with overlapping arrangement were planted in single row system. The yield performance and other yield attributed characters were observed at time of maturity.

The observations taken in field on plant height, single cane weight, length of nodes, diameter of cane and yield quintal per hectare and other quality parameters *viz.* brix percentage, sucrose percentage, juice percentage and purity percentage. The sugar quality will be analyzed as per the procedure outlined by Spencer and Meade (1963) [17].

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) [4].

Results and Discussions

The results of the study revealed that there were highly significant differences in the mean values for cane yield and yield components. The results of the performance evaluation of sugarcane genotypes revealed that the yield of both early and mid-late group of sugarcane genotype significantly superior over standard checks (Table-1 & 3). In early group of sugarcane genotype maximum cane yield was observed in the entry MS 13081 (116.47 t/ha) followed by entry CON 13071 (110.73 t/ha) and standard COM 265 (103.39 t/ha) and minimum was recorded in the entry CoSnK 13101 (67.69 t/ha). Moreover, rest of the sugarcane entries displayed average cane yield, but could not out yielded the best standard COM 265 (103.39 t/ha) variety. None of the entry was found significantly superior over the best standard.

The results of the study presented in Table-1 revealed that the average stem height maximum was observed in the entry CO 13004 (340.53 cm) followed by entry CO 13003 (301.93 cm) and CO 13002 (289.93 cm) and minimum was recorded in the entry CoN-13072 (270.60 cm). None of the entry was found significantly superior over the best standard CoC-671 (345.53 cm). In case of node length, the maximum average node length was observed in the entry CO 13004 (13.98 cm) followed by entry CoSnK 13102 (13.64 cm) and CoSnK 13101 13.30 cm) and minimum was recorded in the entry MS 13081 (11.17 cm). None of the entry was found significantly superior over the best standard CoC-671 (13.65 cm). The results regarding single cane weight (kg) revealed that the sugarcane entry CoSnK 13102 remained on top (2.126 kg per cane) followed by standard MS 13081 (2.002 kg) and Co 13003 (1.875 kg) and minimum average weight was recorded in the standard Co-13002 (1.610 kg). None of the entry was found significantly superior over the best standard COM 265 (2.348 kg). As regards the average cane diameter (cm), maximum was observed in the entry MS 13081 (3.36 cm) followed by standard CoSnK 13102 (3.33 cm) and CON 13072 (3.09 cm) and minimum was recorded in the entry Co-13004 (2.79 cm). None of the entry was found significantly superior over the best standard COM 265 (3.26 cm).

The results of biochemical analysis in early group of sugarcane genotypes presented in Table-2 revealed that the maximum cane Brix % was observed in the entry CO 13002 (21.04%) followed by Co 13003 (21.02%) and CoSnK 13101 (20.78%) and minimum was recorded in the entry CON 13072 (18.47%). In case of purity percent, the maximum Purity % was observed in the CoSnK 13102 (80.98%) followed by Co 13003 (80.79%) and co 13002 (80.57%) and minimum was recorded in the entry Co 13004 (79.33%) & CON 13072 (79.33%). The results regarding Juice Extraction percent, the maximum Juice Extraction % was observed in the entry Co-13003 (62.93%) followed by Co 13002 (61.35%) and CoSnK 13101 (59.07%) and minimum was recorded in the entry CoSnK 13102 (55.11%). As regards the sucrose percent in Juice, maximum was observed in the Co 13003 (12.05) followed by Co 13002 (11.80) and standard CoC 671 (11.19) and minimum was recorded in the entry Co 13004 (10.01). Similar results were also reported by Tena *et al*., (2016) [18], Shikanda *et al*. (2017) [14], Shitahun *et al*. (2018) [15], Singh *et al*. (2019) [16], Prabha, N (2020) [12] and Verma *et al*. (2021) [20].

The results of mid late group of sugarcane genotype presented in Table-3 revealed that the maximum cane yield was observed in the entry CO 13013 (153.04 t/ha) followed by entry CO 13009 (150.13 t/ha), Co 13074 (147.16 t/ha) and CoM 13074 (146.25 t/ha) and minimum was recorded in the entry PI 13132 (43.11 t/ha). Top four entries was found significantly superior over the best standard CO 99004 (113.10 t/ha). The results regarding cane height revealed that the maximum cane height was observed in the entry CO 13013 (385.1 cm) followed by standard CO 99004 (361.1 cm) and COSnk 13103 (352.9 cm) and minimum was recorded in the entry COT 13366 (268.9 cm). None of the entry was found significantly superior over the best standard Co-99004 (361.1 cm). In case of node length, the maximum node length was observed in the standard Co 99004 (16.55 cm) followed by entry COSnk 13103 (15.33 cm) and standard CO 8014 (15.10 cm) and minimum was recorded in the entry COSnk 13105 (11.50 cm). None of the entry was found significantly superior over the best standard Co 99004 (16.55 cm). The maximum single cane weight (kg) was observed in the entry CON 13073 (2.950 kg) followed by entry CON 13074 (2.850 kg) and standard Co 99004 (2.620 kg). and minimum was recorded in the entry Co 13006 (1.480 kg). None of the entry was found significantly superior over the best standard Co 99004 (2.620 kg). The results regarding cane diameter (cm) revealed that the sugarcane entry CON 13074 (3.58 cm) remained on top followed by entry Co 13014 (3.43 cm) and standard CO 99004 (3.39 cm) and minimum was recorded in the entry Co-13006 (2.62 cm). None of the entry was found significantly superior over the best standard Co 99004 (3.39 cm).

The results of biochemical analysis in mid late group of sugarcane genotypes presented in Table-4 revealed that the maximum cane Brix % was observed in the entry COSnk 13105 (22.99%) followed by entry CO 13020 (22.72%) and COSnk 13106 (22.59%) and minimum was recorded in the entry CON 13074 (16.42%). The results regarding Purity %, the maximum Purity % was observed in the entry CO 13009 (86.27%) followed by entry CO 13013 (86.15%) and CO 13011 (85.03%) and minimum was recorded in the entry CON 13074 (77.95%). In case of Juice Extraction %, the

maximum Juice extraction % was observed in the entry CO 13018 (65.44%) followed by COM 13082 (64.65%) and entry PI 13131 (64.28%) and minimum was recorded in the entry CO 13006 (48.64%). As regards the sucrose percent in Juice, maximum was observed in the entry COSnk 13105 (13.75) followed by entry COSnk 13106 (13.69) and CO 13020 (13.53) and minimum was recorded in the entry CON 13074 (9.77).

This suggested that all sugarcane genotypes were genetically variable and a considerable amount of variability occurred among them, therefore, these sugarcane genotypes would respond positively to selection. It is accepted that sugarcane varieties are greatly affected by genetic makeup (El-Geddaway, *et al*., 2002) [3]. The variation in cane yield and yield components among the varieties may be attributed due to their dissimilarity in genetic makeup (Varghese *et al*., 1985 and Mali and Singh, 1995) [19, 7]. Memon *et al*., (2005) [9] and Panhwar, *et al*., (2008) [11] reported great variability among the sugarcane genotypes for cane yield and yield components.

Table 1: Average data of Cane yield and yield components of early group of sugarcane genotypes.

Entries	Plant height (cm.)	Nodal length (cm).	Weight of single cane (kg)	Diameter (Cm)	Cane yield (t/ha)
CO 13002	289.93	12.27	1.610	2.80	102.23
CO 13003	301.93	12.57	1.875	2.97	93.76
CO 13004	340.53	13.98	1.844	2.79	93.81
CON 13071	287.40	12.63	1.714	2.90	110.73
CON 13072	270.60	13.05	1.785	3.09	84.86
CoSnK 13101	288.53	13.30	1.690	2.97	67.69
CoSnK 13102	283.73	13.64	2.126	3.33	88.58
MS 13081	285.33	11.17	2.002	3.36	116.47
Standards					
CO 85004	261.27	9.69	1.489	2.64	78.21
CO 94008	316.00	12.74	1.933	3.02	85.9
COC 671	345.53	13.65	2.056	3.09	102.44
COM 265	316.40	12.71	2.348	3.26	103.39
Over All Mean	298.93	12.62	1.87	3.02	94.01
CD (5%)	28.47	1.02	0.31	0.17	15.58
CV%	5.77	4.89	9.94	3.48	10.06

Table 2: Sugar quality data of different early group of Sugarcane genotypes.

Entries	Juice Extraction %	Brix %	Sucrose % in Juice	Purity %
CO 13002	61.35	21.04	11.80	80.57
CO 13003	62.93	21.02	12.05	80.79
CO 13004	56.10	18.88	10.01	79.33
CON 13071	56.52	19.73	10.38	79.49
CON 13072	58.36	18.47	10.11	79.33
CoSnK 13101	59.07	20.78	11.15	79.72
CoSnK 13102	55.11	20.63	10.67	80.98
MS 13081	57.46	20.43	10.96	80.25
Standards				
CO 85004	56.53	20.43	10.82	80.21
CO 94008	58.70	19.33	10.50	79.47
COC 671	57.39	20.72	11.19	80.24
COM 265	57.64	18.61	10.22	79.45

Table 3: Average data of Cane yield and yield components of mid late group of sugarcane genotypes.

S. No	Entries	Plant height (cm.)	Nodal length (cm).	Weight of single cane (kg)	Diameter (Cm)	Cane yield (t/ha)
1	CO 13005	318.9	12.52	1.92	2.99	131.40
2	CO 13006	335.7	13.36	1.48	2.62	109.92
3	CO 13008	345.9	13.97	2.11	3.00	133.91
4	CO 13009	351.4	13.47	2.55	3.32	150.13
5	CO 13011	302.7	13.17	1.85	3.08	95.73
6	CO 13013	385.1	12.88	2.53	3.10	153.04
7	CO 13014	312.4	13.56	2.45	3.43	138.90
8	CO 13016	297	13.24	2.02	3.18	102.22
9	CO 13018	277.3	14.15	1.64	2.90	101.49
10	CO 13020	330	14.08	2.15	3.13	124.46
11	COM 13082	339	13.46	2.10	2.97	146.25
12	CON 13073	320.4	12.26	2.95	3.30	144.19
13	CON 13074	338.4	11.7	2.85	3.58	147.16
14	COSnk 13103	352.9	15.33	1.73	2.75	105.84
15	COSnk 13104	301.7	13.76	1.99	3.12	125.03
16	COSnk 13105	288.5	11.5	2.14	3.19	101.86
17	COSnk 13106	308.5	13.64	1.72	2.98	102.11

18	COT 13366	268.9	11.93	1.74	3.03	85.74
19	PI 13131	275	14.16	1.71	3.02	98.30
20	PI 13132	304.4	13.62	1.91	3.07	43.11
Standards						
21	CO 86032	323.3	14.68	1.99	2.95	106.49
22	CO 99004	361.1	16.55	2.62	3.39	113.10
23	CO 8014	325.4	15.1	2.09	2.98	104.07
24	CO 8036	335.8	13.07	2.24	3.24	103.09
	Mean	320.82	13.54	2.10	3.10	115.31
	CD at 5%	38.75	1.52	0.63	0.27	31.28
	CV%	5.98	5.56	14.81	4.31	13.42

Table 4: Sugar quality data of Mid-late group of Sugarcane genotypes

S. No.	Entries	Juice Extraction %	Brix %	Sucrose % in Juice	Purity %
1	CO 13005	51.17	19.60	11.35	82.50
2	CO 13006	48.64	19.50	10.73	81.69
3	CO 13008	57.53	20.50	12.70	84.73
4	CO 13009	57.62	17.70	11.16	86.27
5	CO 13011	56.09	18.04	10.74	85.03
6	CO 13013	57.86	20.50	12.77	86.15
7	CO 13014	54.05	20.08	11.17	79.30
8	CO 13016	59.90	20.90	12.50	81.05
9	CO 13018	65.44	21.48	12.91	81.72
10	CO 13020	62.28	22.72	13.53	83.10
11	COM 13082	64.65	19.60	11.93	79.80
12	CON 13073	60.81	20.04	12.00	81.24
13	CON 13074	62.12	16.42	9.77	77.95
14	COSnk 13103	61.72	22.18	12.73	81.83
15	COSnk 13104	63.81	20.54	12.27	80.96
16	COSnk 13105	61.68	22.99	13.75	83.78
17	COSnk 13106	63.39	22.59	13.69	81.94
18	COT 13366	61.97	19.32	11.52	79.97
19	PI 13131	64.28	20.42	12.17	80.51
20	PI 13132	63.35	21.29	13.26	81.82
Standards					
21	CO 86032	64.21	21.79	13.46	82.29
22	CO 99004	61.23	22.00	13.41	82.50
23	CO 8014	62.32	20.49	12.56	80.72
24	CO 8036	62.82	21.29	13.13	81.59

Conclusion

On the basis of overall performance, it was concluded that in early group of sugarcane, entry Co 13081 (116.47 t/ha) exhibited better performance for cane yield but showed satisfactory performance for brix (20.43%) and sucrose (10.96%) thus, mid late group of sugarcane genotypes CO 13013 (153.04 t/ha) followed by CO 13009 (150.13 t/ha), Co 13074 (147.16 t/ha) and CoM 13074 (146.25 t/ha) were found significantly superior over the best standard CO 99004 (113.10 t/ha). Stem height, single cane weight, length of nodes, brix percentage and sucrose percentage were play pivotal role for cane yield.

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