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Evaluation of sugarcane genotypes for yield and yield contributing traits under Kabirdham location of Chhattisgarh state

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Abstract
Evaluation of sugarcane genotypes for yield and yield contributing traits was conducted at the experimental area of S. K. College of Agriculture& Research Station of Kawardha (Kabirdham) Chhattisgarh. Thirteen early genotypes along with 3 standard checks and fourteen mid late group genotypes along with 2 standard checks of sugarcane were tested Checks *viz.* Co 94008, CoC 671 and Co 85004 and two standards *viz.* Co99004 and Co86032, respectively. In early group Co-11001 (1216.43 q/ha) was found significantly superior over the best standard Co-85004 (883.4 q/ha). However, the genotype Co-11001 exhibited better performance for cane yield also showed satisfactory performance for brix% (26.88) and sucrose % (22.36) while in mid late group of sugarcane genotype Co-11073 (1189 q/ha) was found significantly superior over the best standard Co-86032 (886 q/ha). Genotypes Co-11001 early group and Co-11073 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, genotypes, *Saccharum officinarum*, yield, yield attributing charaters

Introduction
Sugarcane, *Saccharum officinarum* L. is an important agro-industrial crop in India. India is the second largest producer of sugar in the world after Brazil. Sugarcane is cultivated under diverse agro climatic conditions in about 84 countries of the world. Global production of sugarcane in 2018 was 1.91 billion tonnes, with Brazil producing 39% that is 746.8 million tonnes of the world total while India with 20% that is 376.9 million tonnes the second largest producer of sugarcane and cane sugar, after Brazil. 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) [8]. Thereare 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) [3]. 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 (Chattha *et al.*, 2006) [8].

In Chhattisgarh area of sugarcane is increasing as farmers are readily adopting modern cultivation technologies to raise their income and lift the economic condition. Kabirdham, Ambikapur and Balod are major sugarcane growing districts of Chhattisgarh, where Kabirdham contributing acreage 22,582 hectare with production 17,670 tonnes and productivity of 78.25 tonnes /ha hectare (Anonymous, 2019) [1]. Expansion of sugar industry efforts are being made to increase cane production by introducing high yielding varieties and adoption of improved crop production techniques (Gill, 1995) [4]. However, its taste, texture and structure depend upon the genotype used for sugar making because the quality of sugar is the same as the quality of cane juice. 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 sugarcane genotypes for yield and yield contributing traits was

conducted thirteen genotypes with three standard checks of early group and fourteen genotypes with two standard checks of mid late group under the agro-climatic conditions of Kabirdham.

Materials and Methods

Experiment on performance evaluation of sugarcane genotypes for yield and yield contributing traits under kabirdham condition was conducted during 2014-15, at the experimental area of S. K. College of Agriculture& Research Station of Kawardha (Kabirdham), Chhattisgarh, India. The experimental material consisted of thirteen genotypes with three standard *viz.* Co 94008, CoC 671, Co 85004 of early group sugarcane and fourteen genotypes with two standards *viz.* Co 99004, Co 86032 of mid late group sugarcane. The genotypes of sugarcane were collected from Central Sugarcane Research Station (MPKV), Padegaon (Maharashtra) under AICRP on Sugarcane (Volunteer centre) Kabirdham. The experiment for each genotype was constituted in randomized block design having two replication of plot size of 20 m^2 each and row to row spacing was maintained at 90 cm. The genotypes were planted first week of March by adopting all recommended agronomical practices. The yield performance and other yield attributed characters were observed at time of maturity. The observations were taken on stem height, single cane weight, length of nodes 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) [11].

Results and Discussion

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 Co-11001 (1216.43 q/ha) followed by entry Co-11081 (1148.23 q/ha) and Co-11016 (1140.40 q/ha) and minimum was recorded in the entry CoN-11071 (513.18 q/ha). Entry Co-11001 (1216.43 q/ha) was found significantly superior over the best standard check Co-85004 (883.4 q/ha).The maximum cane height was observed in the entry Co-11083 (287.5 cm) followed by entry Co-11014 (277.90 cm) and Co-11016 (273.70 cm) and minimum was recorded in the entry CoN-11071 (196.9 cm). None of the entry was found significantly superior over the best standard CoC-671 (260.30cm).The maximum node length was observed in the entry Co-11016 (14.71 cm) followed by entry CoM-11082 (14.06 cm) and CoM-11083 (13.96 cm) and minimum was recorded in the standard Co-85004 (10.68 cm). None of the entry was found significantly superior over the best standard check CoC-671 (13.61cm).The maximum single cane weight (kg) was observed in the entry Co-11016 (1.847 Kg) followed by entry PI-11131 (1.843 Kg) and CoM-11083 (1.664 Kg) and minimum was recorded in the entry CoN-11071 (1.109 Kg). None of the entry was found significantly superior over the best standard CoC-671 (1.585 Kg). The maximum cane diameter (cm) was observed in the entry PI-11131 (3.18 cm) followed by entry Co-11016 (3.05 cm) and Co-11001 (2.85 cm) and minimum was recorded in the entry Co-11004 (2.66 cm). Entry PI-11131 (3.18 cm) was found significantly superior over the best standard CoC-671 (2.97 cm).The maximum cane Brix% was observed in the entry Co-11017 (26.88%) followed by standard CoC-671 (26.12%) and CoM-11082 (25.88%) and minimum was recorded in the entry CoN-11071 (22.68%) (Table-2).The maximum Sucrose% was observed in the entry Co-11017 (22.36%) followed by standard CoC-671 (21.88%) and CoM-11082 (21.14 %) and minimum was recorded in the entry CoN-11071 (18.28%). The maximum Purity% was observed in the standard CoC-671 (83.77%) followed by Co-11017 (83.18%) and CoM-11082 (81.68 %) and minimum was recorded in the entry Co-11018 (80.14%). The maximum Extraction% was observed in the entry Co-11081 (58.18%) followed by PI-11131 (57.55%) and standard Co-85004 (57.16 %) and minimum was recorded in the entry CoT-11366 (53.30%).

In mid late group of sugarcane genotype maximum cane yield was observed in the entry Co-11073 (1189 q/ha) followed by entry Co-11012 (1148 q/ha) and Co-11020 (1101 q/ha) and minimum was recorded in the entry CoN-11021 (540 q/ha). Entry Co-11073 (1189 q/ha) was found significantly superior over the best standard check Co-86032 (886 q/ha).The maximum cane height was observed in the entry Co-11007 (289.9 cm) followed by entry Co-11019 (278 cm) and CoN-11073 (276 cm) and minimum was recorded in the entry Co-11021 (191.10 cm). None of the entry was found significantly superior over the best standard Co-99004 (262.80cm). The maximum node length was observed in the entry Co-11012 (14.13 cm) followed by entry Co-11073 (13.82 cm) and Co-11005 (13.68 cm) and minimum was recorded in the entry CoM-11087 (12.2 cm). None of the entry was found significantly superior over the best standard Co-86032 (13.09cm). The maximum single cane weight (kg) was observed in the entry Co-11007 (2.036 Kg) followed by entry CoN-11074 (1.788 Kg) and Co-11012 (1.643 Kg) and minimum was recorded in the entry Co-11021 (0.981 Kg). Entry Co-11007 (2.036 Kg) was found significantly superior over the best standard Co-86032 (1.568 Kg). The maximum cane diameter (cm) was observed in the entry Co-11023 (2.939 cm) followed by entry CoN-11074 (2.933 cm) and Co-11012 (2.761 cm) and minimum was recorded in the entry CoM-11086 (2.315 cm). None of the entry was found significantly superior over the best standard Co-86032 (2.752 cm).The maximum cane Brix% was observed in the entry Co-11007 (25.92%) followed by standard Co-99004 (25.72%) and Co-11019 (25.68%) and minimum was recorded in the entry CoN-11074 (20.04%) (Table-4). The maximum Sucrose% was observed in the standard Co-99004 (21.66%) followed by entry Co-11007 (21.48%) and CoM-11086 (21.08 %) and minimum was recorded in the entry CoN-11074 (16.05%). The maximum Purity% was observed in the standard Co-99004 (84.21%) followed by Co-11007 (82.87%) and CoM-11086 (82.60 %) and minimum was recorded in the entry CoN-11073 (78.80%).The maximum juice extraction% was observed in the entry CoN-11074 (58.92%) followed by Co-11021 (58.84%) and entry CoN-11073 (57.49 %) and minimum was recorded in the entry Co-11005 (53.68%).

Both group of sugarcane genotype *viz.* early and mid late group cane yield was found significantly superior over standard check in terms of yield contributing traits *viz.* cane height, single cane weight and length of nodes yield quintal per hectare and other quality parameters *viz.* brix percentage, sucrose percentage, juice extraction percentage and purity percentage were correlated with yield results revealed that the yield positively correlated with cane height 0.55 and 0.86, single cane weight 0.18and 0.73, length of nodes 0.35 and 0.60, brix percentage 0.70 and 0.46 and sucrose percentage

0.71 and 0.42 in both early and mid late group of sugarcane genotypes (Table-5).

Genotypes Co-11001 early group and Co-11073 mid late group during 2014-15 exhibited good performance in terms of average cane yield and yield components as compared to standard checks (Table-1&3). The higher cane yield and sugar content in the varieties might be due to their adoptability to the climatic conditions of Kabirdham. It is evident that cane having high cane height, maximum single cane weight, length of nodes, high brix and sucrose percentage produced higher yields during course of study while the varieties with lowest yield contributing traits resulted into reduced yield. Khan *et al*, (2003) [7] reported that increase in cane yield might be due to maximum plant height, weight per stool and cane girth. Nazir *et al.* (1997) [9] reported that higher cane yield is the function of high potential variety. Javed *et al.* (2001) [6] reported that cane yield tonnes per hectare depend upon number of stalks per hectare and weight per stalk. Weight per stalk consequently depends upon stalk length and stalk girth. Sharma and Agrawal (1985) [10] suggested that good germination and tillering with synchronized millable canes of average thickness are desired selection parameters to evaluate the agronomic performance of sugarcane varieties. Habib, *et al*. (1991) [5] stated that number of millable stalks per plot and stalk diameter are the most important components of cane yield.

Table 1: Cane yield and yield components of different early group of sugarcane genotypes in Initial Varietal Trial 2014-2015 under AICRP on Sugarcane (Volunteer centre) Kabirdham

S. No.	Entries	Plant height (cm.)	Nodal length (cm).	Single Cane Weight (kg)	Cane Diameter (Cm)	Cane Yield (Q/ha)
1.	Co-11001	263.6	12.91	1.513	2.85	1216.43
2.	Co-11081	247.6	13.92	1.329	2.69	1148.23
3.	Co-11016	273.7	14.71	1.847	3.05	1140.40
4.	Co-11004	277.9	13.64	1.390	2.66	937.45
5.	CoN-11072	252.5	12.87	1.364	2.80	893.33
6.	CoM-11083	287.5	13.96	1.664	2.78	885.70
7.	CoT-11366	245.6	11.92	1.380	2.75	883.15
8.	CoM-11084	236.3	12.37	1.200	2.67	852.18
9.	CoM-11082	252.6	14.06	1.383	2.69	834.05
10.	Co-11018	241.9	13.41	1.431	2.80	782.30
11.	Co-11017	267.2	13.62	1.653	2.82	660.88
12.	PI 11131	204.9	10.97	1.843	3.18	644.50
13.	CoN-11071	196.9	12.94	1.109	2.71	513.18
14.	Co 85004	207.5	10.68	1.188	2.42	883.4
15.	CoC 671	260.3	13.61	1.585	2.97	866.65
16.	Co 94008	231.8	11.73	1.173	2.72	759.85
CD (5%)		30.45	1.31	0.273	0.2	273.53

Table 2: Sugar quality of different early group of sugarcane genotypes in Initial Varietal Trial 2014-2015 under AICRP on Sugarcane (Volunteer centre) Kabirdham

S. No.	Entries	Juice Extraction %	Brix%	Sucrose%	Purity%
1.	Co-11017	55.04	26.88	22.36	83.18
2.	CoM-11082	54.06	25.88	21.14	81.68
3.	Co-11004	54.17	25.72	20.92	81.34
4.	Co-11081	58.18	25.24	20.50	81.22
5.	CoM-11083	56.62	24.42	19.73	80.79
6.	Co-11016	55.80	24.32	19.64	80.76
7.	CoN-11072	54.77	24.28	19.60	80.72
8.	CoM-11084	54.94	25.12	20.26	80.65
9.	Co-11001	55.06	24.88	20.06	80.63
10.	CoN-11071	53.76	22.68	18.28	80.60
11.	CoT-11366	53.30	24.92	20.06	80.50
12.	PI 11131	57.55	23.32	18.75	80.40
13.	Co-11018	56.14	23.92	19.17	80.14
14.	Co 94008	56.48	26.12	21.88	83.77
15.	Co 85004	57.16	24.08	19.55	81.19
16.	CoC 671	55.52	24.88	20.12	80.87

Table 3: Cane yield and yield components of different Mid late group of sugarcane genotypes in Initial Varietal Trial 2014-2015 under AICRP on Sugarcane (Volunteer centre) Kabirdham

S. No	Entries	Plant height (cm.)	Nodal length (cm).	Single Cane Weight (kg)	Cane diameter (Cm)	Cane yield (Q/ha)
1	CO-11005	259.6	13.68	1.337	2.471	868
2	CO-11007	289.6	13.16	2.0365	2.615	955
3	CO-11012	268.7	14.13	1.6425	2.761	1148
4	CO-11019	278	12.38	1.5105	2.739	991
5	CO-11020	265.6	13.64	1.615	2.589	1101
6	CO-11021	191.1	12.32	0.981	2.366	54
7	CO-11022	248	13.04	1.239	2.545	600
8	CO-11023	234.3	13.58	1.5095	2.939	778
9	CO-11024	228.6	12.38	1.4077	2.545	699

10	COM-11085	247.2	13.62	1.403	2.615	797
11	COM-11086	261.4	12.6	1.1755	2.315	725
12	COM-11087	242.7	12.2	1.4901	2.522	612
13	CON-11073	276	13.82	1.6085	2.627	1189
14	CON-11074	264.5	12.77	1.788	2.933	974
15	Co86032	250.1	13.09	1.568	2.752	886
16	Co99004	262.8	12.93	1.438	2.525	872
CD at 5%		35.07	1.18	0.243	0.203	285.34

Table 4: Sugar quality of different Midlate group of sugarcane genotypes in Initial Varietal Trial 2014-2015 under AICRP on Sugarcane (Volunteer centre) Kabirdham

S. No.	Entries	Juice Extraction %	Brix%	Sucrose%	Purity%
1	CO-11005	53.68	23.34	18.88	80.89
2	CO-11007	56.74	25.92	21.48	82.87
3	CO-11012	55.63	25.34	20.67	81.57
4	CO-11019	55.95	25.68	20.56	80.06
5	CO-11020	55.99	25.12	20.26	80.65
6	CO-11021	58.84	20.09	16.11	80.19
7	CO-11022	56.89	24.52	19.73	80.46
8	CO-11023	56.37	23.72	19.31	81.41
9	CO-11024	56.91	21.68	17.34	79.98
10	COM-11085	54.93	23.68	19.17	80.95
11.	COM-11086	54.92	25.52	21.08	82.60
12.	COM-11087	53.73	25.08	20.46	81.58
13	CON-11073	57.49	23.96	18.88	78.80
14.	CON-11074	58.92	20.04	16.05	80.09
15.	Co-86032	55.26	24.68	20.11	81.48
16.	Co 99004	54.10	25.72	21.66	84.21

Table 5: Correlation coefficient between sugarcane yield and yield contributing traitson different early and Mid-late group of sugarcane genotypes in Initial Varietal Trial 2014-2015 under AICRP on Sugarcane (Volunteer centre) Kabirdham

Yield contributing traits	Sugarcane yield	
	Early group	Mid late group
Cane Height (cm.)	0.55*	0.86**
Nodal length (cm).	0.35	0.60**
Single Cane Weight (kg)	0.18	0.73**
Diameter (Cm)	-0.07	0.50*
Juice %	-0.19	-0.18
Brix%	0.70**	0.46
Sucrose%	0.71**	0.41
Purity%	0.61**	-0.01

*: Significant (5%)
**: Highly significant (1%)

Conclusion

It was observed that both group of sugarcane genotype were superior over standard check. In early Co-11001 (1216.43 q/ha) was found significantly superior over the best standard Co-85004 (883.4 q/ha). However, the genotype Co-11001 exhibited better performance for cane yield but showed satisfactory performance for brix (26.88%) and sucrose (22.36%) thus, mid late group of sugarcane genotype Co-11073 (1189 q/ha) was found significantly superior over the best standard Co-86032 (886 q/ha). Stem height, single cane weight, length of nodes, brix percentage and sucrose percentage were play pivotal role for cane yield. For satisfactory performance of the potentiality of genotype Co-11001 early group and Co-11073 mid late group of need to be tested for some more years under the agro-climatic conditions of Kabirdham.

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