

Performance of VCF 0517 (Bahubali) : A High Tonnage Sugar Rich, Midlate Maturing Sugarcane Variety for Yield and Quality in Southern Karnataka

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ABSTRACT

A new high yielding midlate maturing genotype VCF 0517 was developed from general cross collection of Co 8371. The genotype was evaluated in station varietal and final yield trial against the popular check varieties Co 62175 and Co 86032 (Zonal check) for its performance regarding cane, sugar and jaggery yield, quality traits, biotic and abiotic stress tolerance in plant and ratoon crops during 2014-2016 at ZARS, V.C. Farm, Mandya Karnataka. The genotype VCF 0517 recorded a mean cane yield of 229.35 t ha⁻¹ as compared to Co 62175 and Co 86032 (186.0 t ha⁻¹ and 169.75 t ha⁻¹) thereby an increase of 23.30 and 35.11 per cent over checks, respectively was recorded. It also showed higher sugar yield (32.87 t ha⁻¹), jaggery yield (23.92 t ha⁻¹) and juice sucrose percentage (20.09) at harvest. The variety matures in 360 days. It has also exhibited less susceptibility for borers and tolerance against foliar diseases. The ratoon cane yields recorded was also higher (219.5 t ha⁻¹) as compared to Co 62175 (139.7 t ha⁻¹) and Co 86032 (134.0 t ha⁻¹) and recorded an increase of 57.12 per cent and 63.8 per cent over checks, respectively. VCF 0517 has tall (320 cm), thick (3.3 cm), cylindrical and greenish white cane.

Keywords : Sugar rich, cane yield, midlate maturity

SUGAR industry is the second largest agro based industry in India and contributes significantly to the socio-economic development of the rural population. This sector plays an important role in rural economy of the country as it supports 6 million farmers and their families besides providing direct employment to over 0.6 million skilled and semi skilled persons in sugar mills and related industries situated in the rural areas (Solomon *et al.*, 2003). It also provides raw material to sugar and over 25 other industries producing alcohol, paper, chemicals and cattle feed. Sugarcane (*Saccharum officinarum* hybrid complex) is one of the important commercial crops of the tropical and subtropical regions of the country cultivated in an area of 5.03 million hectares with production of over 350 million tonnes and productivity of 70.8 t ha⁻¹ around 25 million tonnes of white sugar, 6-8 million tonnes of jaggery and khandsari to meet the domestic consumption needs of sweetener (Solomon, 2014). It forms basic raw material for the manufacturing of sugar in the country. Therefore, it has high industrial importance (Solomon, 2014). The per hectare yield of crop and per cent sugar recovery are the two prime factors of in breeding programmes. Variety is the pivot around which the entire production system revolves.

New varieties have been continuously evolved by the Sugarcane Breeding Institute, State Agricultural University and Sugarcane Research and Development Centre across the country. The farmers prefer the varieties based on cane and sugar yield potential, ability to ratoon, their tolerance to insect pests and disease, soil type and site suitability and length of the growing season (Nair, 2010). Also, the other desirable characters are good field appearance, higher tillering capacity, medium thick to thick cane, long stalks, long internodes, erect growing habit, non lodging, non or shy flowering, good ratooning ability, absence of spines on the leaf sheaths, absence of splits on the stalks, less bud sprouting and resistance to prevailing local problems (Reddy and Madhuri, 2014). To meet the requirements of the both the farmers and industry, it is always better to have more number of varieties with different maturity periods so that proper and effective varietal scheduling can be practiced to ensure quality cane supply to the factories throughout the crushing period for their economic sustainability (Solomon *et al.*, 2007). In Karnataka, sugarcane occupied an area of 4.2 lakh hectares (2014-15) and recorded the average cane yield of 85.5 t ha⁻¹. The average sugar recovery was 10.3 per cent during 2015-16 crushing

season (Annon, 2014). The goal of increasing production can be attained either by increasing the area of cultivation or increasing the productivity of the crop. However, there are many constraints on and off the field with respect to production and productivity in the state *viz.*, lack of high yielding, differential maturing varieties of cane to replace the existing varieties and to suit different planting time. Stagnation of productivity is a major challenge which has to be broken to achieve breakthrough with breeding of new varieties suitable for the region. Keeping in view, the current scenario of sugarcane in Southern Karnataka, it is very essential to identify a high yielding and high sugar varieties to tackle low productivity and recovery. The concerted efforts in this study had led to development of new genotype VCF 0517 and was evaluated for cane, sugar and jaggery yields with other economic traits *viz.*, resistance to pests and disease.

MATERIAL AND METHODS

The experimental material was developed from biparental open pollinated, general cross collection and poly crosses of sugarcane fluff generated at Zonal Agricultural Research Station, V.C. Farm, Mandya, Karnataka. The experimental material for the present study consisted of 12 clones of sugarcane including two standards *viz.*, Co 62175 and Co 86032 representing mid-late maturing groups and the experiment was laid out during August season of 2014-2016 for plant and ratoon crops in randomized complete block design comprising 12 treatments with three replications. Each genotype was planted in six rows and each row having of six meter length with a plot size of 32.4 m². The setts having three eye buds each were planted with three setts per meter length. The crop received 25 ton of FYM, 250 kg N, 100 kg P₂O₅ and 125 kg K₂O ha⁻¹. All the recommended package of practices were adopted during the entire crop season. The crop was harvested at 12th months and ratooned thereafter. The ratoon crop was harvested at 12th months of age. The observations were recorded on five randomly tagged canes at 12th months stage. The field and laboratory observations were recorded for number of tillers ('000 ha⁻¹), number of millable canes ('000 ha⁻¹), cane length (cm) cane diameter

(cm), single cane weight (kg), internodal length (cm), number of internodes, juice brix per cent, juice pol per cent, juice purity per cent, CCS per cent, sugar yield (t ha⁻¹) and cane yield (t ha⁻¹) adopting standard procedure.

The data recorded for cane yield and quality parameters were statistically analyzed. The significance of variation among the treatments was compared by applying 'F' test and critical difference (CD) at 5 per cent level of significance.

RESULTS AND DISCUSSION

The analysis of variance for all the characters revealed that there exist significant differences among genotypes in plant and ratoon crops for different parameters *viz.*, cane yield, number of millable canes at harvest, cane length, cane diameter and single cane weight and juice quality parameters namely commercial cane sugar yield (CCS t ha⁻¹), juice sucrose per cent, CCS per cent and purity percentage indicating the genetic difference among genotypes for these parameters and scope of their improvement. Significant differences among the sugarcane genotypes with high magnitude of variances for cane yield, single cane weight, cane length and sucrose per cent have been reported in earlier studies (Sanghera *et al.*, 2014). The performance of newly developed elite genotype VCF 0517 with respect to cane, sugar and jaggery yield and yield components, juice quality parameters in comparison with the standard/check varieties revealed that genotype VCF 0517 recorded a mean cane yield of 229.35 t ha⁻¹ and found to be superior over Co 62175 (186.0 t ha⁻¹) and Co 86032 (169.75 t ha⁻¹) and increase was by a margin of 23.30 and 35.11 per cent, respectively in plant crop (Table I).

Average sugar yield (CCS t ha⁻¹) among genotypes in plant crop ranged from 24.12 to 32.87 t ha⁻¹. Higher sugar yield was recorded with VCF 0517 (32.87 t ha⁻¹) while the check varieties Co 62175 and Co 86032 recorded a sugar yield of 25.23 t ha⁻¹ and 24.12 t ha⁻¹, respectively which indicate superior performance of VCF 0517 over checks to the tune of 30.28 per cent over Co 62175 and 36.27 per cent over Co 86032.

TABLE I
Performance of VCF0517 for cane yield and quality traits

Varieties	Cane yield (t ha ⁻¹)			Sugar yield (t ha ⁻¹)			Sucrose % juice at harvest		
	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean
VCF0517	243.33	215.4	229.35	35.32	30.42	32.87	20.26	19.92	20.09
Co62175	188.39	183.7	186.00 (23.30)	25.10	25.35	25.23 (30.28)	18.17	19.29	18.73 (7.26)
Co86032	180.36	159.2	169.75 (35.11)	25.20	23.03	24.12 (36.27)	19.5	20.24	19.87 (1.10)
CD @ 5 per cent	20.89	16.18	-	3.41	2.91	-	1.14	1.00	-

Figures in the parentheses shows per cent increase over standards

The ratoon performance of VCF 0517 : The results revealed that higher ratoon cane yield (219.5 t ha⁻¹) and sugar yield (29.95 t ha⁻¹) compared to Co 62175 (139.7 t ha⁻¹ and 17.56 t ha⁻¹, respectively) (Table II) and Co 86032 (134.0 t ha⁻¹ and 18.43 t ha⁻¹, respectively) with an increase of 57.12 per cent, 70.55 per cent over Co 62175 and Co 86032 (63.80 per cent

and 62.50 per cent), respectively. The sucrose per cent juice was on par with sugar rich variety Co 86032. VCF 0517 exhibited very good ratoon potential compared to checks varieties.

TABLE II

Ratoon performance of VCF0517

Varieties	Cane yield (t ha ⁻¹)	Sugar yield (t ha ⁻¹)	Sucrose % juice at harvest	CCS %
VCF0517	219.5	29.95	19.28	13.66
Co62175	139.7 (57.12)	17.5 (70.55)	617.60 (9.54)	12.56 (8.75)
Co86032	134.0 (63.80)	18.43 (62.50)	19.26 (0.10)	13.76 (0.72)
CD @ 5 per cent	15.81	2.48	1.65	1.35

Figures in the parentheses shows per cent increase over standards

Performance of VCF0517 for jaggery yield and recovery : The results showed that VCF 0517 has recorded higher jaggery yield of 23.92 t ha⁻¹ and found to be superior over checks Co 62175 (17.90 t ha⁻¹) (Table III) and Co 86032 (16.28 t ha⁻¹) by a margin of 33.63 and 46.92 per cent, respectively. VCF 0517 also recorded higher jaggery recovery (11.11%) over Co 62175 (9.74%) and Co 86032 (10.22%) with an increase of 14.06 per cent, 8.70 per cent over Co 62175 and Co 86032, respectively.

Performance of VCF0517 for ancillary characters : The higher yield of genotype VCF 0517 was attributed to maximum number of millable canes 110 (000³ ha⁻¹), cane length (320 cm), cane diameter (3.3 cm), internode length (17.8 cm) and single cane weight (2.7 kg) compared to standard varieties Co 62175 and Co 86032 (Table IV). The present results

TABLE III

Performance of VCF0517 for jaggery yield and recovery

Varieties	Cane yield (t ha ⁻¹)	Jaggery yield (t ha ⁻¹)	Per cent increase over check for jaggery yield	Jaggery Recovery (%)	Per cent increase over check
VCF0517	215.4	23.92	-	11.11	-
Co62175	183.7	17.90	33.63	9.74	14.06
Co86032	159.2	16.28	46.92	10.22	8.70
CD @ 5 per cent	16.18	2.64	-	0.87	-

TABLE IV
Performance of VCF0517 for ancillary characters

Varieties	Cane length (cm)	Cane diameter (cm)	Inter nodal length (cm)	Single cane weight (kg)	NMC ('000 ha ⁻¹)
VCF0517	320	3.3	17.8	2.7	110.0
Co62175	290 (10.34)	2.8 (17.85)	12.6 (41.26)	2.0 (35.0)	116.0 (-5.17)
Co86032	280 (14.28)	2.9 (13.79)	15.4 (15.58)	2.1 (28.57)	103.0 (6.79)
CD @ 5 per cent	0.56	0.41	2.46	0.52	10.07

Figures in the parentheses shows per cent increase over standards

are also in agreement with findings of Das *et al.* (1996), Ravishankar *et al* (2004) and Sanghera *et al.* (2015).

Reaction of VCF 0517 for important pest and disease incidence : The test clone was screened for pest and disease reactions. Comparative pest and disease scores of new clone and standards were presented in Table V, revealed that VCF 0517 has showed less susceptibility reaction to early shoot borer, internode borer and moderately susceptible to top shoot

TABLE V

Reaction of VCF 0517 for important pest and disease incidence

Pest/Disease	Genotypes		
	VCF 0517	Co 62175	Co 86032
Pest Incidence (%)			
Early shoot borer	7.5	5.3	7.1
Top shoot borer	3.7	5.8	6.0
Internode borer	22.5	18.0	10.5
Disease Incidence (0-5 Scale)			
Leaf spot disease	MR	MR	MR
Yellow leaf disease (YLD)	MR	R	S
Grassy shoot disease (GSD)	R	MR	S

R: Resistant, MR: Moderately Resistant and S: Susceptible

borer and moderate resistance to leaf spot disease, yellow leaf disease (YLD) and resistance to grassy shoot disease (GSD).

Further, VCF 0517 had better performance in the study (Fig. 1) conducted at farmers' fields of

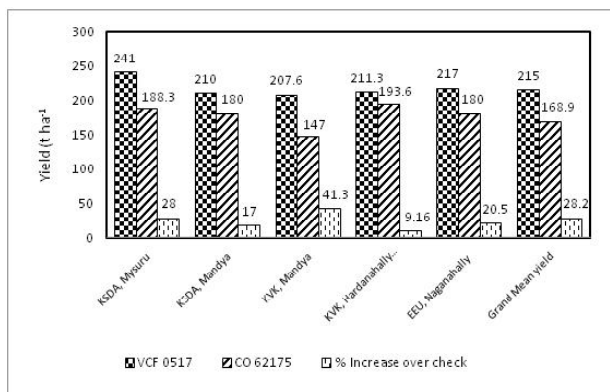


Fig. 1 : Performance of VCF 0517 in Farm Trials conducted during 2015-16

Mandya, Mysuru and Chamarajanagar districts. It has recorded mean cane yield of 215 t ha⁻¹ compared to local check Co 62175 (168.95 t ha⁻¹) and the magnitude of yield increased is 28.2 per cent. This variety is very well appreciated by farming community, jaggery and sugar industries for its yield and quality.

The big mill test of VCF 0517 was conducted at M/s. NSL Sugars, Koppa, Maddur taluk, Mandya district (Fig. 2). The results revealed that all the quality

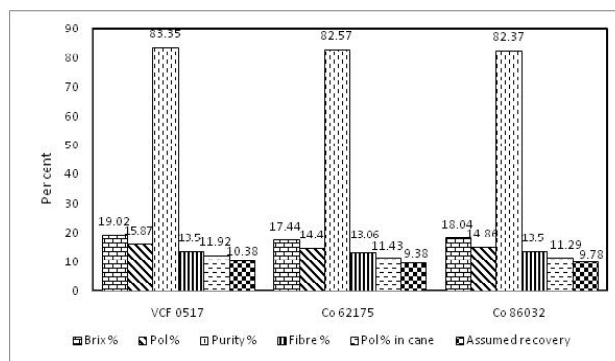


Fig. 2 : Big mill test of VCF 0517 conducted at M/s NSL Sugars

parameters are encouraging in this variety compared to standards Co 62175 and Co 86032. Additional advantages of this clone is also attributed to its field tolerance to moisture stress and non lodging due to deep root system.

The newly released sugarcane variety VCF 0517 having desirable morphological characters like higher cane, sugar, jaggery yield, tolerance to pest and diseases and has been accepted largely by the farmers and industries in Southern Karnataka.

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