CPF 248: RECENTLY APPROVED SUGARCANE VARIETY FOR PUNJAB

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Abstract

The sugarcane (*Saccharumofficinarum* L.) variety development is the main objective of the Sugarcane Research Institute (SRI), Faisalabad. Under our cropping pattern, development of early/medium maturing varieties are pre-requisite. Every year fuzz from differentexotic sources is imported and passed through various selection stages for evolution of new cultivar for commercial purpose. Untilnow, 22 cultivars have been released for commercial cultivation. The process of varietal development program comprises of selection, advancement, and testing of germplasm spanning a period of 10-12 years. The upcoming variety, CPF 248, excelled in cane and sugar recovery over HSF 240 by 25.40 and 9.24%, respectively. Although the main goal of the program has never changed, procedures and techniques have evolved and improved over the years. This paper will document and outline the procedures and techniques used at SRI, Faisalabad in sugarcane variety development program.

INTRODUCTION

Sugarcane, (*Saccharumofficinarum*L.*)* is an important cash crop and plays vital role in the economic uplift of the growers and viability of sugar industry. The vast expansion of sugar industry necessitatesprolonging the crushing season of sugar mills by introducing medium maturing varieties.

Sugarcane Research Institute, Faisalabad has developed a medium maturing variety CPF 248. After adaptation of this variety by the farmers, the sugar recovery pattern of mills will not only be improved but also proved its worth than other cultivars.

BREEDING HISTORY

The fuzz of the variety was imported during 2002 from Sugarcane Breeding Research Station, Canal Point, USA. The seedling number was assigned in 2003 as S2003-US-114 and was put in the preliminary varietal trial for comparison with other sugarcane varieties.

The test variety showed good performance in the preliminary varietal trial, so it was promoted and tested under semi-final and final varietal trials. The variety was also tested in different zones at farmers' fields and NUVYT.

1	Name of variety	CPF 248
2	Parentage	CP 89-879 × CP 90-956
3	Variety Origin (fuzz imported)	Canal Point, USA.
4	Type of variety	Pure line
5	Days to maturity (range)	270 – 300 days
6	Maturity duration	Medium
7	Planting date	Month of September and 15th February to 15th March
8	Ratoonability	Very good
9	Average cane yield(t ha^{-1})	112.48
10	Average Sugar Recovery(%)	12.71
11	Average sugar yield (t ha^{-1})	14.32

MATERIALS AND METHODS

The performance of CPF 248 was evaluated at Sugarcane Research Institute, Faisalabad with standard cane varieties SPF 245 & HSF 240. Similarly, the variety was also tested at Sugarcane Research Station, Khanpur with standard variety HSF 240. Moreover, the variety was also tested at farmers' fields throughout the Punjab Province and for NUVYT studies throughout the country. The experiments were laid out according to RCBD with 3 repeats at Sugarcane Research Institute, Faisalabad and Sugarcane Research Station, Khanpur. The recommended seed rate, fertilizer and irrigations were applied. The data on germination, tillering, cane stalk density and cane yield were recorded. For quality evaluation, the fortnight periodic juice analysis for Brix, Pol, purity, commercial cane sugar (CCS %)and sugarcane recovery % was done at Sugarcane Research Institute, Faisalabad. Disease reaction of CPF 248 was also studied under natural and artificial inoculation against red rot. The observations on Red Rot, Whip Smut, PokkahBoeng, Mosaic Virus, rust and Red Stripe were recorded, the data on borers, sucking insects etc. were also recorded during different selection stages. For identification, morphological characteristics were recorded at the end of November.

RESULTS
MORPHOLOGICAL DESCRIPTION OF CPF248

a. Morphological Description:

Clone name: S2003-US-114 **Parentage:** CP 89-879 × CP 90-956

a) **Plant**

Height	440 cm
Growth habit	Semi erect

b) **Leaf**

Colour	Green
Surface	Plain
Length	160 cm
Width	4.66 cm

c) **Sheath**

Length	36.00 cm
Spines	Slightly present

d) **Cane**

Length	236.00 cm
Colour	Light Purple
Shape	Straight
Hardness	Hard

e) **Internode**

Length	12.66 cm
Shape	Conoidal
Bud groove	Slightly present
Splits	Absent

f) **Node**

Growth Ring	Medium
Root zone rows	2
Root zone colour	Light purple

g) **Bud**

Size	Medium to large
Type	Ovate
Position	Over the growth ring

b. Agricultural Characteristics

The test variety is good in germination and tillering. It may lodge under poor management, whereas tiller mortality is less. The said variety is medium in maturity and maintains its quality through out the season. The ratoonability of the variety is good.The test variety CPF 248 exhibited better No. of canes per unit area and cane weight than standard varieties SPF 245 & HSF 240 (Table 1).

Table 1: **Main characteristics of CPF 248 in comparison with SPF 245and HSF 240**

Variety	Germination (%)	Tillers/plant	Canes (000/ha)	Per cane weight (kg)
CPF 248	45.10	1.71	119.81	0.99
SPF 245	48.55	1.23	103.49	0.93

HSF 240	43.40	1.38	94.79	0.87

CANE YIELD PERFORAMNCE AT

a) Sugarcane Research Institute, Faisalabad

The cane yield performance of candidate sugarcane variety CPF 248in comparison with standard varieties SPF245and HSF 240 from 2008 to 2012 is given in table 2. The data disclosed that the test variety CPF 248gave25.40% more stripped cane yield (115.97 tha^{-1}) than standard varieties SPF245and HSF 240 with cane yields of 96.01and 82.60 t ha^{-1}, respectively.

Table 2. **Cane yield performance of CPF248 compared with SPF 245 and HSF 240at Sugarcane Research Institute, Faisalabad**

Year	Cane yield (t ha^{-1})			Difference (t ha^{-1}) with SPF 245/ HSF 240	Percent variation over SPF 245/ HSF 240
	CPF 248	SPF 245	HSF 240		
2008-09	148.38	120.40	-	27.98	23.24
2009-10	95.06	83.95	-	11.11	13.23
2010-11	112.15	83.68	-	28.47	34.02
2011-12	108.30	-	82.60	25.70	31.11
Average	**115.97**	**96.01**	**82.60**	**23.32**	**25.40**

b) Sugarcane Research Station, Khanpur

The variety was tested with standard variety HSF 240 for three years at Sugarcane Research Station, Khanpur. The data presented in table 3 revealed that the cane variety CPF248, on an average,yielded107.69 $tha^{-1}$and edged over the standard variety HSF 240 with cane yield of 97.41 tha^{-1}. The candidate variety CPF 248gave10.55% more stripped cane yield than the standard variety HSF 240.

Table 3: **Cane yield performance of CPF 248 compared with HSF 240 at Sugarcane Research Station, Khanpur.**

Year	Cane yield (t ha^{-1})		Difference (t ha^{-1}) with HSF 240	Percent variation over HSF 240
	CPF 248	HSF 240		
2008-2009	96.85	90.09	6.76	7.50
2009-2010	118.62	103.06	15.56	15.10
2010-2011	107.59	99.07	8.52	8.60
Average	**107.69**	**97.41**	**10.28**	**10.55**

c) Trials at farmers' fields

The test variety CPF 248 exhibited average cane yield of 109.00t ha^{-1}whichproduced10.10% more cane yield than standard variety HSF240with cane yield of 99.00 t ha^{-1}.

Table 4: **Cane yield performance of CPF 248 compared with HSF240.**

Year	No. of sites	Cane yield t/ha		Difference (t/ha) with HSF240	Percent variation over HSF240
		CPF248	HSF240		
2007-08	9	111.36	87.78	23.58	+ 26.86
2011-12	10	103.00	107.00	-4.00	-3.74
2012-13	9	114.33	104.29	9.71	+ 9.31
Average		**109.00**	**99.00**	**10**	**10.10**

d)Yield performance of CPF 248 inNUVYT during 2008-11.

The data given in table 5revealed that the candidate variety CPF248 has edge over all varieties under test in NUVYT during 2008-11.

Table5 **Yield performance of CPF248 in NUVYT**

Sr. #.	Year	Locations	Cane yield (t ha^{-1})	Local Check	Percent variation over local check
1	2008-10	QAARI, Larkana	100.25	99.90	+ 0.35
2	2009-10	SRI, Faisalabad	111.20	123.20	-9.74
3	2010-11	SRI, Faisalabad	131.60	124.90	+5.36

QUALITY PERFORMANCE AT

a) Sugarcane Research Institute, Faisalabad

The cane quality was studied in different trials at fortnight intervals. The data regarding sugar recovery are presented in Table-6. The data revealed that CPF248showed12.91% sugar recovery against standard varietiesSPF 245 and HSF 240with 11.58%and 12.60% sugar recovery, respectively. Thus gave 9.24% increased sugar recovery over standard varieties.

Table 6: **Sugar recovery comparison of CPF 248 with SPF 245and HSF 240 at Sugarcane Research Institute, Faisalabad.**

Year	Sugar recovery (%)			Difference with SPF245/HSF 240	Percent variation over SPF 245/HSF 240
	CPF 248	SPF 245	HSF 240		
2008-09	12.54	11.87	-	0.67	5.64
2009-10	13.16	11.83	-	1.33	11.24
2010-11	12.77	11.05	-	1.72	15.57
2011-12	13.17	-	12.60	0.57	4.52
Average	**12.91**	**11.58**	**12.60**	**1.07**	**9.24**

b. Trials at farmers' fields

The candidate variety was tested for its quality with standard variety HSF-240 during 2007-08, 2011-12& 2012-13. The data presented in Table-7showed that on an average the candidate variety CPF 248gave 12.52% sugar recoveryagainst standard varietyHSF 240with 12.03% sugar recovery thus the candidate variety showed 4.07% more sugar recovery.

Table 7: **Sugar recovery% comparison of CPF 248 with HSF 240at farmers' fields.**

Year	No. of Sites	Sugar recovery (%)		Difference with HSF240	Percent variation over HSF240
		CPF 248	HSF 240		
2007-2008	9	12.25	11.60	0.65	5.60
2011-12	10	12.90	12.90	-	-
2012-13	9	12.41	11.61	0.80	6.89
Average		**12.52**	**12.03**	**0.49**	**4.07**

c. National Uniform Varietal Yield Trials (NUVYT)

The variety was tested in NUVYT during 2008-11. The data expressed that the candidate variety CPF 248 gave 12.44% sugar recovery against the local check variety HSF 240 with 12.38% sugar recovery thus candidate variety showed 0.50% more sugar recovery than local check.

Table 8: **Performance in National Uniform Varietal Yield Trials (NUVYT)**

Sr. #.	Year	Locations	Sugar recovery (%)	Local Check	Percent variation over local check
1	2008-10	QAARI, Larkana	19.33 (brix %)	19.30 (brix %)	+ 0.15

2	2009-10	SRI, Faisalabad	11.68	12.09	-0.03
3	2010-11	SRI, Faisalabad	13.19	12.66	+ 4.00
Average			12.44	12.38	+ 0.50

Ratoonability

Ratooningability of candidate variety CPF 248 was studied at Sugarcane Research Institute, Faisalabad (Table 9). The data showed that CPF 248 on an average gave 70.93 tha^{-1} stripped cane yieldagainst cane yield of 55.63t ha^{-1} recorded for standard variety HSF 240. Thus the candidate variety gave 27.50% more cane yield than the standard variety.

Table-9 **Ratoonability of CPF248 at Sugarcane Research Institute, Faisalabad (2008-09)**

Cane yield (t/ha)		Difference (t/ha) with HSF 240	Percent variation over HSF 240
CPF-248	HSF 240		
70.93	55.63	15.30	27.50

Agronomic studies

a. Irrigation

Table-10: **Effect of different irrigationregimes on cane yield (t ha^{-1}) of CPF248 (2011-12)**

Varieties	I_1 (1.0 coefficient)	I_2 (0.8 coefficient)	I_3 (0.6 coefficient)
CPF 248	92.95	81.25	67.45
CPF 246	85.07	77.41	69.44

The data showed that CPF248 performedcomparatively better than standard CPF 246 under stress conditions.

b. Fertilizer

Table 11: **Performance of sugarcane under varying nitrogen levels (2012-13)**

a. Cane yield(t ha^{-1})

Variety	Cane Yield (t ha^{-1})	Difference	Percent variation over HSF 240
CPF 248	105	-	
HSF 240	90.11	14.89	16

b. Sugar yield (t ha^{-1})

Variety	Sugar yield (t ha-^{1})	Difference	Percent variation over HSF 240
CPF 248	14.14	-	
HSF 240	11.72	2.42	20

The data in table 11 dilated that CPF 248 excelled in cane yield (t ha^{-1}) over HSF 240 by 16% and 20% for sugar yield (t ha^{-1}).

Economic benefits

The data in Table 12 indicated that on an average CPF 248 produced 3.2 t ha^{-1}more sugar yield than standard variety SPF-245 and 3.16 t ha^{-1} more sugar yield than HSF-240. Thus on an average CPF-248 gave an additional benefit of Rs. 160000/-ha^{-1} over standard variety SPF-245 and Rs. 158000 than HSF-240.

Table-12 **Economic benefits of CPF 248 over SPF-245 and HSF 240**

Location	Variety	Cane yield (t ha^{-1})	Sugar recovery (%)	Sugar Yield (t ha^{-1})	Difference over SPF 245 (t ha^{-1})	Difference over HSF 240 (t ha^{-1})	Increased value Over SPF 245 (Rs.)	Increased value Over HSF 240 (Rs.)
Sugarcane Research Institute, Faisalabad	CPF 248 SPF 245 HSF 240	115.97 96.01 82.60	12.91 11.58 12.60	14.98 11.12 10.41	3.86	4.57	193000	228500
Out field trials	CPF 248 HSF 240	109.00 99.00	12.52 12.03	13.65 11.91		1.74		87000
Average	**CPF 248 SPF 245 HSF 240**	**112.48 96.01 90.80**	**12.71 11.58 12.31**	**14.32 11.12 11.16**	**3.20**	**3.16**	**160000**	**158000**

Sugar @ Rs. 50000/t

Disease Reaction

The candidate variety is tolerant to all the prevalent diseases of sugarcane i.e. red rot, whip smut, pokkahboeng, red stripe and rust under natural and artificial inoculation conditions.

Table-13 **Reaction against different diseases in variety CPF 248**

Year	Varieties	Reaction to diseases					
		Red rot	Whip Smut	Pokkah boeng	Red stripe	Rust	Mosaic virus
2008-09	CPF 248 SPF 245	R R	R R	R R	R R	R MR	R MR
2009-10	CPF 248 SPF 245	MR R	R R	R R	R R	R MR	R MR

2010-11	CPF 248 SPF 245	MR R	R R	R R	R R	R MR	R MR
2011-12	CPF 248 SPF 245	MR R	R R	R R	MR R	R MR	R MR

Grading scale for screening against red rot disease(0-9)
0: I (Immune), 1:HR, 2: R, 3-4: MR, 5-6: MS, 7-8: S, 9: HS
Grading for other diseases:
0-5%: R, 5.1-15%:MR, 15.1-30%: MS, Above 30%: S

The candidate variety is resistant to all the diseases during, 2008-09 to 2011-12, however, showed MR reaction to red rot during 2009-12 and tored stripeduring 2011-12.

Table-14 **Disease data of sugarcane NUVYT, 2009-2010, Islamabad.**

Name of varieties	Whip smut	Red rot	Sugarcane mosaic virus
CPF-248	R	MR	NIL
HSF-240	HR	MR	NIL

HR= Highly resistantR=Resistant MR = Moderately resistant

Borer infestation

The candidate variety CPF 248 is tolerant to all the borers on dead heart and cumulative internode damage basis under field conditions(Table-15).

Table-15: **Borer infestation onCPF 248 and HSF 240.**

Year	CPF 248		HSF 240	
	Dead heart (%)	Cumulative internode damage (%)	Dead heart (%)	Cumulative internode damage (%)
2009-2010	3.15	13.61	0.62	7.75
2010-2011	4.19	13.74	4.34	14.50
2011-2012	1.23	10.14	1.06	8.47
Average	2.86	12.50	2.00	10.24
Reaction	R	R	R	R

Criteria for Resistance:0.00-15.00: R, 15.10-20.00: MR, 20.10-25.00: MS, 25.10.00-30.00: S, Above 30.00: HS