

CSV 30F : NEW HIGH YIELDING SINGLE CUT FORAGE SORGHUM VARIETY FOR KHARIF SEASON

M. S. SHINDE¹, V. R. AWARI^{2*}, V. R. PATIL³, U. D. CHAVAN⁴, U. S. DALVI⁵ AND S. R. GADAKH⁶

All India Sorghum Improvement Project
Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722 (M. S.), India
**(e-mail : vilasawari15@gmail.com)*

(Received : 12 October 2015; Accepted : 30 November 2015)

SUMMARY

CSV 30F, a new single cut forage sorghum variety developed from the cross NSS 223 x NARI 111 at Rahuri was found superior in green and dry fodder yield over three checks viz., CSV 21F, HC 308 and Local variety. Average of 44 tests, it gave the green fodder yields of 443.4 q/ha against 413.8 q/ha of CSV 21F and 417.7 q/ha of HC 308 and 400.9 q/ha of local variety, thus amounting to an increase of 7.2, 6.2 and 10.6 per cent over checks, respectively. In respect of dry fodder yield, it gave the yields of 139.6 q/ha against 125.3 q/ha of CSV 21F and 125.4 q/ha of HC 308 and 118.9 q/ha of Local variety, thus amounting to an increase of 11.4, 11.3 and 17.4 per cent over checks, respectively. Besides being the higher yielder, SPV 2057 had tall plant stature (267 cm) and flowered in 76 days. It was tolerant to shootfly (37.4% dead heart), stem borer (20.6%) and leaf blight (4.55 scale), Anthracnose (3.90 scale), Zonate leaf spot (3.30 scale) and Gray leaf spot (4.20 scale). It had higher protein yield (9.67 q/ha), low HCN ppm (56.5), higher IVDMD (50.2%), higher DDM (57.6 q/ha) and more TSS (8.86%). This variety was observed to be more vigorous with higher number of leaves, leaf length, width, girth and leaf stem ratio. Due to distinct superiority in yield and forage quality parameters coupled with tolerant to shootfly, stem borer and foliar diseases were found over the CSV 21F, HC 308 and Local variety. The variety SPV 2057 was, therefore, recommended for release by 43rd Annual Group Meeting of Sorghum scheduled on 20 to 22 April 2013 at DSR Hyderabad for the cultivation in the **kharif** forage sorghum growing states of Zone I (Rajasthan, Gujarat, Uttarakhand, UP, Haryana and Punjab) and zone II (Maharashtra, Karnataka and Tamil Nadu) of India for single cut.

Key words : Single cut, forage sorghum, green and dry fodder yield, **kharif** season

Sorghum is one of the gifted grass genera of the tropics. It provides food, feed, stover and fuel to millions of poor farm families and their livestock in the arid and semi-arid tropical region of the world. India is a notable for its huge livestock population and its economic integration with farm production, particularly under the less mechanized dry land agriculture. Sorghum is very important crop to resource poor farmers for nutritional and livelihood security. The importance of sorghum as a forage crop is growing in many regions of the world because of its high fodder product ability and ability to use water efficiency even under drought conditions. As the diversified use of sorghum as forage is increasing

owing to higher demand for fodder from dairy industry. Forage sorghum is grown in about 2.5 million ha of area in the country. While single cut forage sorghum caters to fodder need of rainfed dry land areas and small farmers, the multi-cut types are preferred for areas with irrigation and large dairy enterprises. The higher adaptability and greater biomass production potential of sorghum makes it the most popular forage crop across the country. The quality of sorghum fodder is next to maize but maize requires more moisture than sorghum hence less preferred as fodder crop.

The future projections of aggregate demand patterns suggest that there will be substantial increasing

¹Asstt. Sorghum Breeder.

²Sr. Res. Asstt.

³Sr. Res. Asstt.

⁴Senior Cereal Food Technologist.

⁵Asstt. Sorghum Biochemist.

⁶Senior Sorghum Breeder, AICSIP.

demand for animal product (meat, milk and eggs) in developing countries by 2020 (Gowda, 2004).

In the present day, emphasis has been given on animal based agriculture and dairy industry leading to white revolution. The higher milk producing animals yield more milk in exchange of nutritive and succulent feed in greater quantities. Because of heavy presence of human population, it is not possible to divert more cultivable land for forage crop, but get more production from the same land by way of evolving high yielding forage varieties suitable for single cut.

In brief, this paper describes the procedure followed in developing such a variety and an account of the performance of the variety when compared with existing varieties viz., CSV 21F, HC 308 and Local variety.

MATERIALS AND METHODS

The genotype CSV 30F is developed at MPKV, Rahuri through a cross NSS 223 x NARI 111. The cross was effected during the year 2000-01 and F_1 was grown during the year 2001-02 at Rahuri. It was isolated from F_2 population in 2002-03 **kharif** season and evaluated for biomass along with quality parameters in subsequent generations thereafter at MPKV, Rahuri. It was evaluated in sweet sorghum station trial under the number RSSV 167 at Rahuri from 2006-07 to 2009-10. Considering its high biomass potential, it was sponsored to coordinated single cut forage sorghum trial from the year 2010-11 to 2012-13 under number SPV 2057 along with the checks CSV 21F, HC 308 and Local variety. It was evaluated at zone I and zone II for green and dry fodder yield and forage quality parameters from the year 2010-11 to 2012-13. The zone I comprising the states Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Haryana and Punjab and zone II comprising the states Maharashtra, Karnataka and Tamil Nadu of India.

The co-ordinated AVT single cut trials for green and dry fodder yield evaluation were conducted at Hisar, Karnal, Ludhiana, Pantnagar, Jhanshi, Meerut, Deesa, Surat and Udaipur in zone I and Akola, Rahuri, Parbhani, Solapur, Kovilpatti Coimbtore and Mandya in Zone II during the year 2010-11. During the year 2011-12, it was tested at Hisar, Karnal, Ludhiana, Pantnagar, Jhanshi, Deesa, Surat and Udaipur in zone I and Akola, Rahuri, Parbhani, Solapur, Kovilpatti, Coimbtore and Mandya in Zone II. In the year 2012-13, it was evaluated at Hissar, Karnal, Ludhiana, Pantnagar, Jhanshi, Meerut, Deesa and Surat in zone I and Akola, Parbhani, Solapur, Coimbtore and Mandya in Zone II.

Varietal trials were conducted as per the testing norms and recommended packages as prescribed in AICSIP (Anonymous, 2010). The data on green, dry fodder, shootfly, foliar diseases, forage quality parameters and ancillary data were recorded from the year 2010-11 to 2012-13. Statistical analysis was done as per the method of Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The genotype CSV 30F was evaluated for single cut forage sorghum trials with checks, CSV 21F, HC 308 and Local variety for green and dry fodder yield from the years 2010-11 to 2012-13 and the results are presented in Table 1 to 5. The green and dry fodder yield differences due to genotypes at all the locations and when data pooled were statistically significant in all the years (2010-11 to 2012-13). The co-ordinated trials AVT single cut were conducted at 16 locations viz., Hisar, Karnal, Ludhiana, Pantnagar, Jhanshi, Meerut, Deesa, Surat and Udaipur in zone I and Akola, Rahuri, Parbhani, Solapur, Kovilpatti Coimbtore and Mandya in Zone II during the year 2010-11. The genotype SPV 2057 was evaluated at 16 locations. The results (Table 1) revealed that the genotype SPV 2057 recorded 457.5 q/ha green fodder yield which

TABLE 1

Mean green and dry fodder yield (q/ha) of single cut forage sorghum variety CSV 30F in co-ordinated trials during 2010-11

States	No. of trials	Green forage yield (q/ha)					Dry fodder yield (q/ha)				
		SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%	SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%
Zone I	9	439.6	430.7	437.7	379.2	67.9	104.5	108.7	109.7	77.8	25.4
Zone II	7	480.5	416.7	434.0	440.3	58.2	163.5	134.5	137.2	129.6	36.0
India Average	16	457.5	424.6	436.1	405.9	45.9	129.8	119.7	121.5	100.0	21.9
Per cent increase			7.7	4.9	12.7	-		8.4	6.8	29.8	-

TABLE 2
Mean green and dry fodder yield (q/ha) of single cut forage sorghum variety CSV 30F in co-ordinated trials during 2011-12

States	No. of trials	Green forage yield (q/ha)					Dry fodder yield (q/ha)				
		SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%	SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%
Zone I	8	401.3	390.4	397.9	389.4	47.0	114.4	111.7	107.5	102.1	17.1
Zone II	7	473.1	385.1	372.9	346.5	59.2	183.4	147.4	146.8	146.1	29.9
India Average	15	434.8	387.9	386.2	371.0	38.8	144.0	127.1	124.3	119.0	16.7
Per cent increase			12.1	12.6	17.2	-	-	13.3	15.8	21.0	-

TABLE 3
Mean green and dry fodder yield (q/ha) of single cut forage sorghum variety CSV 30F in co-ordinated trials during 2012-13

States	No. of trials	Green forage yield (q/ha)					Dry fodder yield (q/ha)				
		SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%	SPV 2057	CSV 21 F	HC 308	Local variety	C. D. at 5%
Zone I	8	408.7	421.7	429.1	432.6	37.4	110.0	106.3	107.5	117.3	12.8
Zone II	5	479.5	446.6	435.0	423.6	50.8	195.4	163.4	165.8	189.3	36.9
India Average	13	435.9	430.5	431.4	429.4	32.4	148.0	131.7	133.4	148.2	15.5
Per cent increase			1.3	1.0	1.5	-	-	12.4	10.9	0.13	-

was more than CSV 21F (424.6 q/ha), HC 308 (436.1 q/ha) and Local variety (405.9 q/ha) in per cent. It was 7.7, 4.9 and 12.7 per cent higher than the checks, respectively. On the other hand, it yielded 8.4 per cent higher dry fodder yield (129.8 q/ha) over CSV 21F (119.7 q/ha), 6.8 per cent over HC 308 (121.5) and 29.8 per cent over Local variety (100.0 q/ha).

During the year 2011-12, the genotype SPV 2057 was evaluated at 15 locations. The results (Table 2) revealed that the genotype SPV 2057 recorded 434.8 q/ha green fodder yield which was more than CSV 21F (387.9 q/ha), HC 308 (386.2 q/ha) and Local variety (371.0 q/ha) and in per cent, it was 12.1, 12.6 and 17.2

TABLE 4
Summary of green fodder yield (q/ha) data of CSV 30F

Year of trials	No. of trials	Green fodder yield (q/ha)				
		Proposed variety SPV 2057	Check varieties			C. D. at 5%
		CSV 21F	HC 308	Local variety		
2010-11	16	457.5	424.6	436.1	405.9	45.9
2011-12	15	434.8	387.9	386.2	371.0	38.8
2012-13	13	435.9	430.5	431.4	429.4	32.4
Mean	44	443.4	413.8	417.7	400.9	-
	-	-	7.2	6.2	10.6	-

TABLE 5
Summery of dry fodder (q/ha) data of CSV 30F

Year of trials	No. of trials	Dry fodder yield (q/ha)				
		Proposed variety SPV 2057	Check varieties			C. D. at 5%
		CSV 21F	HC 308	Local variety		
2010-11	14	129.8	119.7	121.5	100.0	21.9
2011-12	14	144.0	127.1	124.3	119.0	16.7
2012-13	9	148.0	131.7	133.4	148.2	15.5
Mean	37	139.6	125.3	125.4	118.9	21.9
	-	-	11.4	11.3	17.4	-

per cent higher than the checks, respectively. On the other hand, it yielded 13.3 per cent higher dry fodder yield (144.0 q/ha) over CSV 21F (127.1 q/ha), 15.8 per cent over HC 308 (124.3 q/ha) and 21 per cent over Local variety (119.0 q/ha).

During the year 2012-13, the genotype SPV 2057 was evaluated at 13 locations. The results (Table 3) revealed that the genotype SPV 2057 recorded 435.9 q/ha green fodder yield which was more than CSV 21F (430.5 q/ha), HC 308 (431.4 q/ha) and Local variety (429.4 q/ha) and in per cent it was 1.3, 1.0 and 1.5 per cent higher than the checks, respectively. On the other hand, it yielded 12.4 per cent higher dry fodder yield

(148.0 q/ha) over CSV 21F (131.7 q/ha), 10.9 per cent over HC 308 (133.4 q/ha) and 0.13 per cent over Local variety (148.2 q/ha).

Based on overall performance for three years i. e. from 2010-11 to 2012-13 averaged over 44 trials (Table 4), the SPV 2057 recorded higher mean green yield (443.4 q/ha) as against CSV 21F (413.8 q/ha), HC 308 (417.7 q/ha) and local variety (400.9 q/ha), which amounted to 7.2, 6.2 and 10.6 per cent increase over checks, respectively. It also yielded 11.4 per cent higher dry fodder yield (139.6 q/ha) over CSV 21F (125.3 q/ha), 11.3 per cent over HC 308 (125.4 q/ha) and 17.4 per cent over Local variety (118.9 q/ha) (Table 5).

The genotype SPV 2057 was screened for

shootfly from the year 2010-11 to 2012-13 at 15 locations. The data (Table 6) revealed that the genotype SPV 2057 had tolerance to shootfly dead heart (37.4% dead heart) as compared to CSV 21F (52.3%), HC 308 (48.7%) and Local variety (47.5%). Similarly, it was also screened for stem borer at 17 locations from 2010-11 to 2012-13. The results revealed that the genotype 2057 was found tolerant to stem borer (20.6% dead hearts) as compared to CSV 21F (21.6%), HC 308 (22.4%) and Local variety (17.7%).

The genotype SPV 2057 was screened for foliar diseases viz., Gray leaf spot, Leaf blight, Anthracnose, Zonate leaf spot, Targeted leaf spot, Sooty stripe, Rust and Downy Mildew at different locations during the years

TABLE 6
Incidence of shootfly and stem borer in the single cut forage sorghum variety CSV 30F and checks (Mean of three years)

S. No.	Traits	No. of trials	Proposed variety SPV 2057	Check varieties		
				CSV 21F	HC 308	Local variety
1.	Shootfly dead heart (%) : 28 DAE	15	37.4	52.3	48.7	47.5
2.	Stem borer dead heart (%) : 45 DAE	14	20.6	21.6	22.40	17.7

TABLE 7
Incidence of foliar diseases in the single cut forage sorghum variety CSV 30F and checks (Mean of three years)

S. No.	Traits	No. of trials	Proposed variety SPV 2057	Check varieties		
				CSV 21F	HC 308	Local variety
1.	Grey leaf spot (1-9)	10	4.20	2.40	2.85	3.66
2.	Leaf blight (1-9)	10	4.55	3.36	3.81	5.67
3.	Anthracnose (1-9)	12	3.90	3.18	3.01	3.90
4.	Zonate leaf spot (1-9)	18	3.30	3.60	3.29	3.60
5.	Target leaf spot (1-9)	6	1.57	1.67	1.35	3.10
6.	Sooty Stripe (1-9)	6	2.19	3.59	3.45	2.05
7.	Rust (1-9 Scale)	2	3.0	2.0	1.50	5.10
8.	Downy Mildew (%)	2	13.85	45.15	22.35	13.70

TABLE 8
Forage quality parameters of single cut forage sorghum variety SPV 2057 (RSSV 167) and checks (Mean of three years)

S. No.	Traits	No. of trials	Proposed variety SPV 2057	Check varieties		
				CSV 21F	HC 308	Local variety
1.	TSS (%)	24	8.86	8.62	9.46	8.93
2.	Protein (%)	21	8.07	8.20	8.13	8.13
3.	Protein yield (q/ha)	17	9.67	8.87	8.60	8.11
4.	IVDMD (%)	17	50.2	50.2	50.7	50.5
5.	HCN (ppm)	6	56.5	64.5	68.2	62.0
6.	DDM (q/ha)	13	57.6	54.6	52.8	49.1

TABLE 9
Morphological data of single cut forage sorghum variety SPV 2057 (RSSV 167) and checks (Mean of three years)

S. No.	Traits	No. of trials	Proposed variety SPV 2057	Check varieties		
				CSV 21F	HC 308	Local variety
1.	Early vigour	24	3.30	3.28	3.32	3.26
2.	Days to harvesting	46	81.0	79.0	80.0	81.0
3.	Days to 50% flowering	43	76.0	74.0	75.0	72.0
4.	Plant height (cm)	48	267.0	261.0	259.0	253.0
5.	Number of leaves	47	12.0	12.0	12.0	11.0
6.	Leaf length (cm)	47	78.4	77.7	74.3	77.6
7.	Leaf breadth (cm)	47	7.16	6.35	6.61	6.62
8.	Stem girth (cm)	43	2.94	2.72	2.83	2.99
9.	Leaf : stem ratio	26	0.36	0.35	0.35	0.39
10.	1000-seed wt. (g)	1	25.1	20.7	21.8	-
11.	Seed yield (q/ha)	4	16.7	17.8	18.9	-

2010-11 to 2012-13 (Table 7). The data indicated that the genotype SPV 2057 had moderately tolerance as compared to the checks.

Forage quality parameters viz., TSS, protein per cent, IVDMD, HCN and DDM of SPV 2057 with the checks CSV 21 F, HC 308 and Local variety were analyzed at different locations during the year from 2010-11 to 2012-13. The results (Table 8) revealed that the genotype recorded higher TSS (8.86 %), protein (8.07%), protein yield (9.67 q/ha), IVDMD (50.2%), DDM (57.6%) and low HCN (56.5 ppm) as compared to the checks (Annenymous, 2013).

Due to distinct superiority over to CSV 21F, HC 308 and Local variety for green and dry fodder yield, tolerance to shootfly, stem borer and foliar diseases, with better forage quality parameters over the checks, the single cut forage sorghum variety SPV 2057 was recommended by the 43rd Annual Sorghum Group Meeting, held at DSR, Hyderabad (A. P.) during the year 2012-13 under the name SPV 2057 for **kharif** growing areas of zone I (Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Haryana and Punjab) and zone II (Maharashtra, Karnataka and Tamil Nadu) of India (Table 9).

ACKNOWLEDGEMENT

The authors are thankful to all the concerned scientists and technical staff who helped in evaluation of CSV 30F in various trials at various locations in zones I and II of India.

REFERENCES

- Anonymous. 2010 : *Guidelines for Conduct of Co-ordinated Trials*. Directorate of Sorghum Research, Hyderabad. pp. 3-4.
- Anonymous. 2013 : Release proposal of single cut forage sorghum variety SPV 2057. Proposal submitted to the 43rd Annual Sorghum Group Meeting, DSR, Hyderabad. pp. 1-65.
- Gowda, C. L. L. 2004 : Objectives of the expert meeting on alternative uses of sorghum and pearl millet in Asia. In : *Alternative uses of sorghum and pearl millet in Asia* : Proc. Expert Meeting, ICRISAT, Patancheru, Andhra Pradesh, India, 1-4 July 2003. CFC Technical Paper No. 34 PO Box No. 74656,1070 BR Amsterdam, The Netherlands : Common Funds for Commodities and Patancheru, A. P., India. pp. 10.
- Panse, V. G., and P. V. Sukhatme. 1985 : *Statistical Methods for Agricultural Workers*, 2nd edn. ICAR, New Delhi.