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CSV 53F – A NEW SINGLE CUT FORAGE SORGHUM VARIETY FOR INDIA

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SUMMARY

An improved single-cut forage sorghum variety, "CSV 53F" was developed by pedigree method of breeding by Forage Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar. It was identified under AICRP on Sorghum and further released & notified for cultivation in *kharif* season for all sorghum growing states of the country *i.e.*, Haryana, Punjab, Rajasthan, Uttarakhand, Maharashtra, Tamil Nadu and Karnataka. CSV 53F (SPV 2705) produced 482.81 q/ha green fodder (average of three years in Coordinated trials) which showed 2.91 % and 1.18% superiority over the national check I CSV21F (468.29 q/ha) and the national check II CSV35F (467.44 q/ha), respectively at national level. CSV 53F (SPV 2705) produced 152.67 q/ha dry fodder (average of three years in Coordinated trials) which showed 5.57 % and 9.28% superiority over the national check I CSV21F (144.76 q/ha) and the national check II CSV35F (139.53 q/ha), respectively at national level. This variety gives good seed yield *i.e.*, 13.39 q/ha and highly responsive at F_1 fertility level *i.e.* 50% RDF. As far as quality is concerned it has high total soluble solids (TSS%) *i.e* 9.24 % which is at par with national check I CSV21F (9.41%) and 18.1% increase over the national Check II CSV35F (7.82%). It possesses 66.31 µg/g HCN (on fresh wt. basis) which is far less than permissible limit of 200 µg/g and has crude protein 6.92% and IVDMD 44.22% which shows 2.98 % and 1.88 % increase over the national check I CSV21F (Crude protein 6.78% and IVDMD 43.41%), respectively. It is also tolerant to shootfly and stem borer and resistant against grey leaf spot and sooty stripe. However, it is moderately resistant against anthracnose, leaf blight and zonate leaf spot foliar diseases.

Key Words: Forage, single-cut, green fodder, dry fodder, quality

Sorghum (*Sorghum bicolor* (L.) Moench) is a versatile crop with multiple uses like food, forage, fodder, biofuel and other industrial uses. It belongs to family Poaceae and its primary center of origin is Africa and distributed across different continents including North America, Africa, Asia, and Australia (Ostmeyer *et al*., 2022). It is grown worldwide in more than 86 countries on 38 million ha area approximately with annual production of 58 million tones (FAO, 2018). It is an important climate resilient crop and staple food for the majority of the population of semi-arid tropics due to its drought tolerant nature. In India it is used as food and fodder both due to its high grain yield and high green biomass yield with good nutritional composition of fodder. India is an agriculture based country and is the world's biggest livestock owner with 535.78 million livestock population (20th Livestock-Census). Livestock security mainly depends on the availability of quality green and dry fodder. Livestock sustainability is highly affected by the climate changes (Sejjan *et al*., 2015) globally resulting in decline in production and quality of food and forage, consequently leading to poor animal growth and milk production. India is already deficit in fodder *viz*. green fodder (11.24%) and dry fodder (23.4%) (Roy *et al.,* 2021). These shortages will further continue to exist because area under forage crops is stagnant and livestock population is increasing in country. The major constraint for low production and productivity of fodder in country is the non-availability of improved varieties of forage crops with good fodder yield and quality to the farmers. Absence of improved genotype, weed control, plant protection, fertilizer and irrigation resulted in 39, 33, 31, 30 and 22 per cent losses in the productivity of fodder sorghum as compared to full package of practices

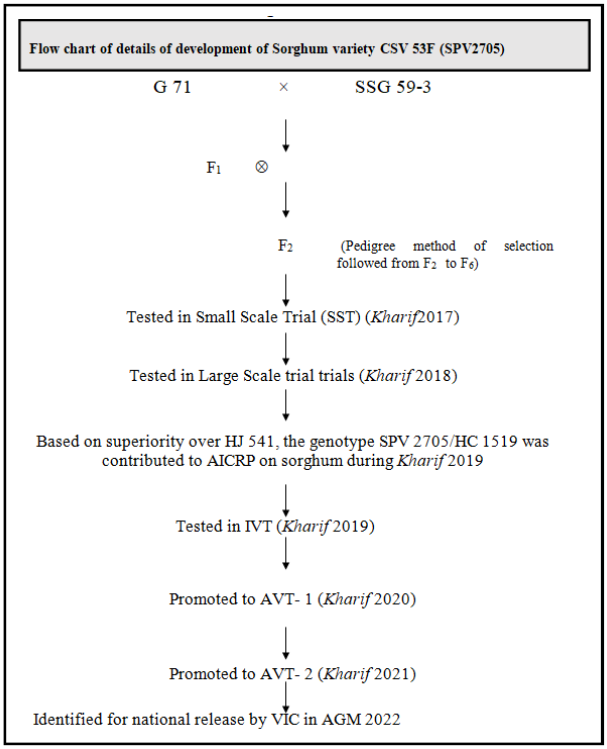

Fig. 1. Pedigree selection method used for development of CSV53F.

Fig. 2. Field view of CSV53F.

(Satpal *et al*., 2021). This study reveals that an improved genotype plays a critical role in full package of practices.

For any dairy industry supply of nutritious fodder is a pre-requisite for its success. Forage sorghum is nutritive forage, more palatable having good regeneration capability with high dry fodder production and high dry matter digestibility as compared to other *kharif* and summer season fodder crops (Ghosh *et al.,* 2016). As area for fodder production is declining continuously over the decades, in such situation cultivation of high biomass yielding varieties with better availability of nutrients is the sole way to overcome this shortage specially for *kharif* season in India.

The improved single-cut forage sorghum variety, CSV 53F, was developed under AICRP on sorghum and released and notified vide Gazette Notification Ministry of Agriculture and Farmers Welfare under Department of Agriculture, Cooperation and Farmers Welfare, GOI, New Delhi, vide **S.O.E. No. 1056(E) dated 06.03.2023** for cultivation in all sorghum growing areas of country under timely sown, normal fertility and irrigated conditions in *kharif* season. The new variety was registered with NBPGR having IC No. 645447. The new variety CSV 53F was developed at Forage Section, Department of Genetics & Plant Breeding, CCS Haryana Agricultural University, Hisar by pedigree method of breeding from the cross G 71 × SSG 59-3 (Fig. 1).

Fodder yield performance of CSV 53F

Green fodder yield of this variety is 482.81 q/ha (average of three years in Coordinated trials) which is 2.91 % and 1.18% more than the national check I CSV21F (468.29 q/ha) and the national check II CSV35F (467.44 q/ha), respectively at national level (Table 1). Similarly, dry fodder yield was 152.67 q/ha (average of three years in Coordinated trials) which showed 5.57 % and 9.28% superiority over the national check I CSV21F (144.76 q/ha) and the national check II CSV35F (139.53 q/ha), respectively at national level (Table 2). It is also good seed yielder variety with seed yield of 13.39 q/ha which is 1.75% and 2.65% more than the national check I CSV21F (13.18 q/ha) and the national check II CSV35F (13.03 q/ha), respectively at national level (Table 3). Field view of CSV 53F is shown in Figure 2. For maximum fodder yield and better quality it should be harvested at the time of 50 percent flowering (approx. 85 days after sowing).

Quality attributes of CSV 53F

As far as fodder quality of CSV 53F is concerned it has high total soluble solids (TSS%) *i.e* 9.24% which is at par with national check I CSV21F (9.41%) and 18.1% increase over the national check II CSV35F(7.82%). HCN content of this variety is 66.31 µg/g HCN which is far less than permissible limit of 200 µg/g on fresh wt. basis. Crude protein

TABLE 1
Green fodder yield (q/ha) : Mean performance of CSV 53F at all India level

Green Fodder yield (q/ha)	Year of testing	No. of trials/locations	Proposed variety	Check I	Check II	Qualifying variety (SPV 2704)
			(CSV 53F/SPV 2705)	(CSV 21F)	(CSV 35F)	
	2019	11	580.91	538.70	562.08	555.94
	2020	13	413.56	428.97	421.79	416.48
	2021	15	470.89	450.73	460.99	417.26
Weighted Mean	-	482.81	468.29	476.44	456.11	

TABLE 2
Dry fodder yield (q/ha) : Mean performance of CSV 53F at all India level

Dry Fodder yield (q/ha)	Year of testing	No. of trials/locations	Proposed variety	Check I	Check II	Qualifying variety (SPV 2704)
			(CSV 53F/SPV 2705)	(CSV 21F)	(CSV 35F)	
	2019	11	167.88	152.33	149.32	166.62
	2020	14	128.81	127.26	126.99	134.14
	2021	15	153.61	145.90	134.76	140.13
Weighted Mean	-	152.67	144.76	139.53	149.04	

TABLE 3
Seed yield (q/ha): Mean performance of CSV 53F at all India level

Seed yield (q/ha)	Year of testing	No. of trials/locations	Proposed variety	Check I	Check II	Qualifying variety (SPV 2704)
			(CSV 53F/SPV 2705)	(CSV 21F)	(CSV 35F)	
	2020	5	12.56	12.11	12.42	12.18
	2021	5	14.21	14.24	13.64	13.92
Weighted Mean	-	13.39	13.18	13.03	13.05	

percent is 6.92 and IVDMD percent is 44.22 which shows increase of 2.98 % and 1.88 % respectively, over the national check I CSV21F (Table 4).

TABLE 4
Mean of three years of CSV 53F (SPV 2705) for quality parameters, insect pest incidence and foliar disease (*kharif* 2019, 2020 and 2021)

Trait	Proposed variety CSV 53F (SPV 2705)	National Check (CSV21F)	National Check (CSV35F)	Qualifying Variety
HCN	66.31	59.55	64.82	68.82
TSS%	9.24	9.41	7.82	9.62
CP%	6.92	6.78	6.81	7.13
IVDMD%	44.22	43.41	44.94	43.35
Shoot fly dead hearts (%)	33.9	33.7	35.7	36.3
Stem borer dead hearts (%)	14.3	13.0	16.0	15.4
Leaf blight	3.8	2.8	2.4	4.2
Anthracnose	3.1	3.1	3.1	2.9
Zonate Leaf Spot	3.2	3.3	3.3	3.0
Grey Leaf Spot	2.8	3.2	3.0	1.9

Performance against major foliar diseases and insect pests

It is tolerant to shoot fly and stem borer with 33.9% and 14.3% dead hearts respectively, which is at par with national check CSV21F (33.7 % shootfly deadhearts and 13.0% stem borer deadhearts). It is resistant against grey leaf spot and sooty stripe however it is moderately resistant against anthracnose, leaf blight and zonate leaf spot foliar diseases (Table 4).

Agronomy and Economics

The single-cut forage sorghum variety, CSV 53F released and notified for cultivation in all sorghum growing areas of country including Gujarat, Rajasthan, Punjab, Haryana, Uttarakhand, Maharashtra, Karnataka & Tamil Nadu under timely sown, normal

TABLE 5
Adaptability to Agronomic Variables for green fodder yield during *Kharif* 2021

Nature of Experiment	Fertilizer levels		Proposed variety CSV 53F	Check 1 CSV 21F	Check 2 CSV 30F
Fertilizer experiment	Green fodder yield (q/ha) at 50% RDF *i.e* F_1		536.18	507.90	388.97
	Green fodder yield (q/ha) at 100% RDF *i.e* F_2		588.05	606.07	456.55
	Green fodder yield (q/ha) at 150% RDF *i.e* F_3		622.54	639.94	488.46
	Percentage gain or loss under other doses	i) F_1	-	5.57	37.85
		ii) F_2	-	-2.97	28.80
		iii) F_3	-	-2.72	27.45

TABLE 6
Economics of CSV 53F at different fertility levels

Treatment	Net Return (Rs./ha)	B : C ratio	Net Return (Rs./ha)	B : C ratio	Net Return (Rs./ha)	B : C ratio
	50% RDF		100% RDF		150% RDF	
SPV 2705	80161	3.04	89263	3.25	94904	3.22
CSV 21F	74513	2.83	92869	3.28	96584	3.22
CSV 30F	50715	1.97	62968	2.40	68088	2.43

fertility level and irrigated conditions in *kharif* season. Data presented in Table 5 and 6 reveal that CSV 53F (SPV 2705) has shown 5.6% and 37.9% increase for green fodder yield over CSV 21F and CSV 30F, respectively at F_1 fertility level *i.e*. 50% RDF. CSV 53F (SPV 2705) has given BC ratio of 54, 35 and 33% higher over CSV30F at 50, 100 and 150% RDF, respectively. Among genotypes, maximum BC ratio (3.05) fetched with CSV 53F (SPV 2705) was 2.7 and 39.9 per cent higher over CSV 21F and CSV 30F, respectively.

CONCLUSION

The new variety CSV 53F exhibited 5.57 % and 9.28% superiority over CSV 21F (Single cut forage sorghum variety cultivated at national level) for dry fodder yield at national level. CSV 53F is single cut forage sorghum variety having high green and dry fodder yield with low HCN and high TSS % and IVDMD percent having tolerance against stem borer and foliar diseases.

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