

## GFS 8 (*BANAS CHARI*) – A NEW SINGLE CUT FORAGE SORGHUM VARIETY FOR SEMI-ARID REGION OF GUJARAT

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### SUMMARY

The new fodder sorghum variety GFS 8 (*Banas chari*) breed through pedigree selection method from the cross between NR 184 × UPMC 512 at Centre for Millets Research, Sardarkrushinagar Dantiwada Agricultural University, Deesa, Gujarat. The fodder sorghum variety GFS 8 (*Banas chari*) (DSF 168) was tested in a preliminary evaluation trial (PET) in *kharif* 2017. It was also tested in AICRP – Sorghum in IVHT-SC trials as a SPV 2879 in *kharif* 2021 in fourteen locations (Zone I and Zone II) nationwide. The fodder sorghum variety GFS 8 (*Banas chari*) was tested under 31 state trials against various check varieties *viz.*, GFS 5, GAFS 12, CSV 21 F, GFS 6 and CSV 46 F. The mean performance of GFS 8 (*Banas chari*) for green fodder yield over 31 locations, including the preliminary trial was 433.6 q/ha. In the case of dry fodder yield, the mean performance over 30 locations, including the preliminary trial was 139.7 q/ha. In Gujarat, based on 31 testing trials GFS 8 (*Banas chari*) exhibited high green fodder yield (433.6 q/ha) with an increment of 28.1, 24.2, 6.4 and 8.2 per cent, respectively and based on 30 location dry fodder (139.7 q/ha) with an increment of 26.6, 18.0, 6.8 and 1.8 per cent over the years and locations against checks GFS 5, GAFS 12, CSV 21 F and GFS 6 respectively. It medium may be flowers within 65-75 days, tall in nature, long & broad leaves and a thin stem diameter. It is moderately resistant to leaf blight and anthracnose diseases and exhibited lower infestation of shoot fly and stem borer. Besides the yield advantage, the variety has also recorded higher TSS (11.1% Brix) and crude protein (6.1%) as well as low HCN content (48.1 ppm).

**Key words:** Fodder Sorghum, green fodder, dry fodder and morphological attributes

Sorghum or Great millet [*Sorghum bicolor* (L.) Moench] is the most important grain and fodder crop of the semi-arid tropics. Sorghum grains are essential as food for human beings and livestock feed. The stem and foliage are used as green forage, hay, silage and pasture. The stems are also used as fuel. Though sorghum is known for its versatile use, hardiness, dependability, yield stability, and adaptability over a wide range of climates, the edapho-climatic conditions in the sorghum growing areas of the world limit crop production. For any dairy industry, a supply of nutritious fodder is a prerequisite for its success. Forage sorghum is nutritive forage, more palatable and has good regeneration capability with high dry fodder production and high dry matter digestibility compared to other *kharif* and summer season fodder crops (Ghosh *et al.*, 2016). In Gujarat, the dairy industry is developing very fast, and hence the demand for forage increasing day by day. Among the forage crops, quality fodder is available from sorghum

[*Sorghum bicolor* (L.) Moench] both green and dry fodder.

Sorghum is grown in almost all the districts of Gujarat to meet the fodder requirement for maintaining the milch animals. Due to the cultivation of cash crops in the *Kharif* season and the fast development of dairy industries, there is a forage shortage. The sorghum has potential for cultivation after cash crop because of the high value of fodder; the fodder sorghum cultivars can catch the demand of green forage and dry fodder. Farmers are growing improved varieties and local fodder cultivars to meet the requirements. However, the local cultivars have poor quality, late maturity and low green and dry fodder yields. 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 (Satpal *et al.*, 2021). Therefore, developing a variety with early maturity, high green and dry fodder

yield potential with suitable quality parameters is necessary along with the crop management practices. Cultivars viz., GFS 5, GAFS 12, CSV 21 F, GFS 6 and CSV 46F for fodder sorghum purpose are cultivating in Gujarat. The local varieties like malwan have demerits like a high infestation of pest, late maturity and poor yields both for grain and fodder. Therefore, it is a need to develop a variety that has high green and dry fodder yield potential with early to medium flowering. The released variety GFS 8 [*Banas chari*] was developed from cross NR 184 × UPMC 512 followed by continuous evaluation and selection.

### MATERIALS AND METHODS

The new fodder sorghum variety GFS 8 [*Banas chari*] breed through pedigree selection method from cross NR 184 × UPMC 512 at Centre for Millets Research, Sardarkrushinagar Dantiwada Agricultural University, Deesa, Gujarat with the name of DSF 168. The cross was made in 2009-10 followed by pedigree selection was done from *kharif*, 2010 to 2016. This variety was advanced with main objectives of high green and dry fodder yield. The variety GFS 8 [*Banas chari*] was tested in a preliminary evaluation trial (PET) in *kharif*, 2017. It was found promising and further, it was tested in state multilocation trial from *kharif* 2018 to 2021. It was also tested under the AICRP sorghum- IVHT trial in *kharif* 2021 as SPV 2879 at fourteen locations (Zone-I and II) nationwide. The variety was also screened for disease and pest under field conditions in state and AICRP trials (Anonymous 2021-22). The DNA fingerprinting of GFS 8 (*Banas chari*) (DSF-168) along with four check varieties GAFS 12, GFS 6, CSV 21F and CSV 46F was performed using 11 SSR Markers (Table 1).

### RESULTS AND DISCUSSION

The forage sorghum variety GFS 8 [*Banas chari*] was evaluated in PET during *kharif* 2017 against various check varieties viz., GFS 5 and CSV 21 F. The tested entry exhibits a significantly high green forage yield (411.1 q/ha) with 17.5 and 2.8 per cent increments over checks GFS 5 and CSV 21 F, respectively (Table 2). Similarly, in the case of dry fodder yield, the variety GFS 8 (*Banas chari*) exhibited significantly high dry fodder yield (183.3 q/ha) with an increment of 17.8 per cent over check GFS 5 (Table 3). Further, it was tested under a total of 31 state trials against various check varieties viz., GFS 5, GAFS 12, CSV 21 F, GFS 6 and CSV 46 F. The mean performance of GFS 8 (*Banas chari*) for green fodder yield over 31 locations, including the preliminary trial was 433.6 q/ha. In the case of dry fodder yield, the mean performance over 30 locations, including the preliminary trial was 139.7 q/ha. In Gujarat, based on 31 testing trials GFS 8 (*Banas chari*) exhibited high green fodder yield (433.6 q/ha) with an increment of 28.1, 24.2, 6.4 and 8.2 per cent, respectively (Table 2) and based on 30 location dry fodder (139.7 q/ha) with an increment of 26.6, 18.0, 6.8 and 1.8 per cent over the years and locations against checks GFS 5, GAFS 12, CSV 21 F and GFS 6 respectively (Table 3). The variety was also tested in AICRP – Sorghum in IVHT-SC trials as a SPV 2879 in *kharif* 2021 in fourteen locations (Zone I and Zone II) nationwide. The Green fodder yield means the performance of GFS 8 (*Banas chari*) among fourteen location trials of IVHT-SC showed 9.2 and 3.07 per cent yield advancement against checks CSV 21 F and CSV 44 F, respectively in Zone I and II. Dry fodder yield

TABLE 1  
List of primers used in fingerprinting

S. No	Name of primer	Forward Primer	Reverse Primer
SSR1	msbCIR240	GTTCTTGGCCCTACTGAAT	TCACCTGTAACCCTGTCTTC
SSR2	msbCIR276	CCCCAATCTAACTATTTGGT	GAGGCTGAGATGCTCTGT
SSR3	msbCIR283	TCCCTTCTGAGCTTGTAAT	CAAGTCACTACCAAATGCAC
SSR4	msbCIR300	TTGAGAGCGGCGAGGTAA	AAAAGCCCAAGTCTCAGTGCTA
SSR5	msbCIR329	GCAGAACATCACTCAAAGAA	TACCTAAGGCAGGGATTG
SSR6	Xcup14	TACATCACAGCAGGGACAGG	CTGGAAAGCCGAGCAGTATG
SSR7	Xcup53	GCAGGAGTATAGGCAGAGGC	CGACATGACAAGCTCAAACG
SSR8	Xtxp12	AGATCTGGCCGGCAACG	AGTCACCCATCGATCATC
SSR9	Xtxp67	CCTGACGCTCGTGGCTACC	TCCACACAAGATTCAGGCTCC
SSR10	Xtxp265	GTCTACAGGCGTGCAAATAAAA	TTACCATGCTACCCCTAAAAGTGG
SSR11	Xtxp283	CGCCCGAACTCTTTAAATCT	ATTATGCCCTAACTGCCTTTGA

TABLE 2  
Green forage yield performance of proposed sorghum entry GFS 8 (*Banas chari*) (DSF 168) in comparison with check varieties in the Gujarat state

Year/ Season	Name of Trial	Locations	Green forage Yield (q/ha)					S. Em. ±	C. D. @ 5%	CV%	
			GFS 8 ( <i>Banas chari</i> )	(LC)	(LC)	(NC)	(LC)				(NC)
			GFS 5 (a)	GAFS 12 (b)	CSV 21F (c)	GFS 6 (d)	CSV 46F (e)				
Kharif-2017	PET	Deesa	411.1 <sup>a</sup>	350.0		400.0		19.3	55.2	9.9	
		% IOC		17.5		2.8					
Kharif-2018	SSVT	Deesa	862.9 <sup>ac</sup>	715.1	762.4	697.9		40.4	119.1	10.0	
		Mangrol	576.8 <sup>abc</sup>	463.4	437.4	478.3		22.1	65.3	8.0	
		Surat	338.1 <sup>abc</sup>	174.9	225.2	222.2		8.5	25.2	6.7	
		Dhari	144.7 <sup>a</sup>	118.1	133.8	133.9		5.1	15.0	6.5	
		Mean (4)	480.6	367.9	389.7	383.1					
		% IOC		30.6	23.3	25.5					
Kharif-2019	LSVT	Deesa	677.7 <sup>bd</sup>		475.2	641.8	530.3	25.6	75.0	7.7	
		SKNagar (PRS)	551.2 <sup>bd</sup>		461.0	526.4	482.7	19.5	57.2	7.4	
		Ladol	535.9 <sup>bed</sup>		429.5	449.2	441.3	23.9	70.0	8.7	
		Mangrol	306.1		281.7	311.3	347.5	16.3	47.7	8.9	
		Surat	389.0 <sup>bc</sup>		278.3	328.1	397.2	13.8	40.4	6.2	
		Dhari	212.2 <sup>b</sup>		165.3	184.2	177.0	13.7	40.3	13.4	
		Kothara	288.3		224.6	331.4	271.3	24.6	72.2	15.8	
		Viramgam	643.7 <sup>bd</sup>		420.7	574.7	472.0	45.6	133.8	14.6	
		Anand	250.0		229.7	259.3	248.3	20.9	61.3	14.3	
		Achhaliya	385.3		390.9	362.5	407.0	24.5	71.8	10.4	
		Mean (10)	423.9		335.7	396.9	377.5				
		% IOC		26.3	6.8	12.3					
Kharif-2020	LSVT	Deesa	388.7 <sup>b</sup>		284.8	357.5	352.5	20.6	59.9	10.5	
		Mangrol	207.3		197.5	221.9	219.4	16.5	48.0	13.0	
		Dhari	322.7		304.6	406.7	339.3	31.8	92.4	15.6	
		Kothara	361.3		321.3	319.3	337.2	20.7	60.3	11.2	
		Viramgam	620.3		541.0	574.7	628.0	37.3	108.4	12.3	
		Anand	490.9		521.6	566.9	624.2	27.4	79.6	9.5	
		Ladol	450.3 <sup>bed</sup>		354.6	386.5	372.3	21.1	61.4	9.5	
		Achhaliya	328.7 <sup>b</sup>		220.6	312.3	308.2	20.9	60.7	12.0	
		Mean (8)	396.3		343.3	393.2	397.6				
				% IOC		15.4	0.8	-			
Kharif-2021	LSVT	Deesa	573.3 <sup>b</sup>		442.2	500.0	526.7	533.3	32.6	97.0	11.6
		Surat	440.4 <sup>b</sup>		326.2	561.0	482.6	635.8	19.7	58.4	7.0
		Dhari	365.2		333.3	319.1	372.3	425.5	25.8	76.7	12.7
		Kothara	169.0 <sup>bd</sup>		109.3	157.8	127.7	160.6	11.5	34.1	15.3
		Viramgam	272.2		255.6	258.3	269.4	258.3	13.2	39.1	8.8
		Anand	659.0 <sup>b</sup>		455.3	688.2	590.1	838.6	24.1	71.5	7.0
		Ladol	599.9 <sup>bed</sup>		440.3	502.4	508.3	591.0	28.5	84.6	10.1
		Achhaliya	618.8 <sup>bd</sup>		468.1	597.9	430.5	623.4	38.8	115.5	11.9
		Mean (8)	462.2		353.8	448.1	413.5	508.3			
				% IOC		30.7	3.2	11.8	-		
Overall Mean			433.6	-	-	-	-				
		Overall Mean (5)	466.7	364.3							
		Overall Mean (30)	434.3		349.7						
		Overall Mean (31)	433.6			407.5					
		Overall Mean (26)	427.2				394.7				
		Overall Mean (8)	462.2					508.3			
Overall % increase over the checks			28.1	24.2	6.4	8.2	-				
Frequency of top non-significant groups			9/31	-	1/30	4/31	1/26	3/8			

TABLE 3  
Dry fodder yield performance of proposed sorghum entry GFS 8 (*Banas chari*) (DSF 168) in comparison with check varieties in the Gujarat state

Year/ Season	Name of Trial	Locations	Dry forage Yield (q/ha)					S. Em. ±	C. D. @ 5%	CV%
			GFS 8 ( <i>Banas chari</i> )		(LC)		(NC)			
			GFS 5 (a)	GAFS 12 (b)	CSV 21F (c)	GFS 6 (d)	CSV 46F (e)			
Kharif-2017	PET	Deesa	183.3	155.6	17.8	188.9		12.6	36.2	14.3
		% IOC				-				
Kharif-2018	SSVT	Deesa	313.2 <sup>ac</sup>	271.9	283.7	256.3		13.6	40.0	10.0
		Mangrol	183.8 <sup>b</sup>	165.5	159.6	168.3		8.0	23.7	8.3
		Surat	182.0 <sup>abc</sup>	86.9	118.2	113.3		6.2	18.4	9.5
		Dhari	57.9 <sup>a</sup>	47.2	53.5	54.3		2.3	6.6	7.2
		Mean (4)	184.2	142.9	153.8	148.1				
		% IOC		28.9	19.8	24.4				
Kharif-2019	LSVT	Deesa	214.7 <sup>bd</sup>	153.7	199.8	175.3		11.6	34.0	11.1
		SKNagar	168.2 <sup>b</sup>	148.5	166.3	155.6		6.4	18.9	7.9
		Ladol	213.6 <sup>bcd</sup>	162.7	164.3	165.1		9.0	26.5	8.8
		Mangrol	96.7	78.4	101.7	112.8		10.9	31.9	18.7
		Surat	83.9 <sup>bc</sup>	71.3	62.7	87.5		4.1	12.1	8.4
		Dhari	73.2	75.5	82.6	79.8		9.8	28.8	21.8
		Kothara	74.2	56.7	83.5	68.7		6.4	18.7	15.9
		Virangam	186.3 <sup>bcd</sup>	147.7	149.3	134.3		12.4	36.5	12.5
		Anand	59.9	63.1	67.9	57.9		6.0	17.7	16.6
		Achhaliya	59.9	176.2	147.8	158.8		15.7	45.9	17.3
		Mean (10)	123.1	113.4	122.6	119.6				
		% IOC		8.6	0.4	2.9				
Kharif-2020	LSVT	Deesa	135.9 <sup>b</sup>	105.9	116.6	120.9		10.2	29.8	16.4
		Mangrol	64.9	62.9	73.0	83.3		7.0	20.5	15.6
		Dhari	214.2	148.9	204.3	229.4		27.9	81.2	25.2
		Kothara	111.7 <sup>c</sup>	95.9	90.2	85.2		5.5	16.1	10.9
		Virangam	198.7 <sup>bc</sup>	101.3	154.0	184.3		15.1	44.0	14.9
		Anand	104.3	114.4	131.8	176.0		8.4	24.4	12.1
		Ladol	172.3 <sup>e</sup>	157.8	140.8	156.0		9.1	26.4	10.4
		Achhaliya	74.2	58.5	84.1	80.0		6.5	18.9	13.4
		Mean (8)	134.5	105.7	124.3	139.4				
		% IOC		27.3	8.2	-				
Kharif-2021	LSVT	Deesa	199.3 <sup>b</sup>	158.2	171.1	182.4	174.4	13.5	40.1	14.2
		Surat	170.6 <sup>b</sup>	111.7	213.5	164.2	199.6	7.2	21.4	7.8
		Dhari	148.9	191.5	163.1	198.6	283.7	20.8	61.7	18.2
		Kothara	46.7 <sup>b</sup>	38.2	57.3	45.5	47.6	2.7	8.1	11.1
		Virangam	76.7	61.4	61.9	80.6	60.8	8.0	23.6	19.9
		Anand	130.7 <sup>b</sup>	106.5	150.3	120.6	208.6	6.3	18.6	8.2
		Ladol	154.9 <sup>e</sup>	139.2	119.4	128.5	152.8	9.1	27.0	11.8
		Achhaliya	175.1 <sup>bed</sup>	113.6	114.6	118.7	143.2	15.4	45.6	18.8
		Mean (8)	137.9	115.0	131.4	129.9	158.8			
		% IOC		19.8	4.9	6.1	-			
Overall Mean	139.7	-	-	-	-	-	-			
	Overall Mean (5)		184.0	145.4						
	Overall Mean (29)		138.2		117.2					
	Overall Mean (30)		139.1			130.7				
	Overall Mean (25)		131.1				128.8			
	Overall Mean (08)		137.9					158.8		
Overall % increase over the checks				26.6	18.0	6.8	1.8	-		
Frequency of top non-significant groups			6/30	-	-	3/30	1/25	3/7		

a, b, c, d and e = Significantly superior than GFS 5, GAFS12, CSV 21F, GFS 6 and CSV 46F, respectively.

Note: The trial of Surat during Kharif 2020 and Mangrol during Kharif 2021 were vitiated due to heavy rainfall.

TABLE 4  
Yield performance (q/ha/day) of proposed sorghum entry GFS 8 (*Banas Chari*) (DSF 168) in the Initial Varietal Hybrid Trial (IVHT) in the *Kharif* 2021 at different Zones of India

Year/Season	Zone	Locations	Green forage Yield (q/ha/day)			S. Em. ±	C. D. @ 5%	CV%
			SPV 2879 (DSF 168)	CSV 21F (a)	CSV 44F (b)			
Kharif-2021	Zone-I	Deesa	9.09	8.26	7.44	0.97	1.95	15.6
		Hissar	5.39	5.54	7.13	0.97	1.95	18.8
		Jhansi	0.58	0.82	0.83	0.16	0.33	22.3
		Ludhiana	6.13	6.89	6.69	0.35	0.71	6.3
		Pantnagar	7.49 <sup>a</sup>	5.63	7.63	0.71	1.44	12.7
		Surat	5.78	6.61	5.47	0.51	1.03	10.4
		Udaipur	14.31	12.59	13.01	1.33	2.68	12.2
		Mean	7.0	6.6	6.9			
		% inc. over the checks		5.2	1.2			
Kharif-2021	Zone II	Akola	4.12	2.94	5.95	0.77	1.56	15.3
		Chamrajnagar	7.64 <sup>a</sup>	6.36	6.91	0.53	1.07	9.8
		Coimbatore	5.72	5.47	5.20	0.85	1.71	17.2
		Parbhani	3.35	3.83	3.25	0.59	1.19	22.2
		Rahuri	3.63	3.36	3.77	0.71	1.44	22.5
		Solapur	6.03	4.76	4.40	0.40	0.82	8.9
		Urlikanchan	7.75	6.62	6.74	1.00	2.03	18.4
		Mean	5.46	4.76	5.17			
		% inc. over the checks		14.7	5.6			
Overall Mean			6.22	5.69	6.03			
Overall % increase over the checks				9.20	3.07			

Year/Season	Zone	Locations	Dry Fodder Yield (q/ha/day)			S. Em. ±	C. D. @ 5%	CV%
			SPV 2879 (DSF 168)	CSV 21F (a)	CSV 44F (b)			
Kharif-2021	Zone-I	Deesa	2.96 <sup>b</sup>	2.48	2.09	0.24	0.49	15.73
		Hissar	1.20	1.26	1.63	0.22	0.44	18.27
		Jhansi	0.20	0.29	0.29	0.06	0.12	23.39
		Ludhiana	1.16	1.38	1.31	0.13	0.27	11.85
		Pantnagar	1.70 <sup>a</sup>	1.26	1.73	0.17	0.35	13.62
		Surat	1.16	2.12	1.17	0.24	0.48	19.24
		Udaipur	4.36	4.28	4.75	0.51	1.03	15.29
		Mean	1.82	1.87	1.85			
		% inc. over the checks		-	-			
Kharif-2021	Zone II	Akola	1.88	1.36	3.32	0.57	1.15	21.27
		Chamrajnagar	2.28 <sup>a</sup>	1.91	2.07	0.15	0.31	9.53
		Coimbatore	1.84	1.79	1.66	0.26	0.53	16.39
		Parbhani	2.14	2.09	1.94	0.42	0.86	27.46
		Rahuri	0.75	0.80	0.81	0.21	0.43	29.41
		Solapur	1.69	1.49	1.24	0.13	0.26	10.16
		Urlikanchan	1.60	1.48	1.63	0.21	0.43	17.32
		Mean	1.74	1.56	1.81			
		% inc. over the checks		11.5	-			
Overall Mean			1.78	1.71	1.83			
Overall % increase over the checks				3.9	-			

Where; a and b = Significantly superior than CSV 21F and CSV 44F, respectively.

showed 3.9 percent yield advancement against checks CSV 21 F in Zones I and II, respectively (Table 4). The dairy industry is developing very fast, and hence the demand for forage is increasing day by day. Forage Yield with quality is also of prime importance as sorghum is being used as fodder purpose. The GFS 8 (*Banas chari*) has a 6.10 percent crude protein, which is comparable to that of check cultivars. It has high TSS (% Brix content) 11.1% against check cultivars viz., GAFS 12 (9.2%), GFS 6 (10.2%) and CSV 21 F (8.7 %). On the other hand, the released cultivar GFS 8 has a low HCN content (48.1 ppm) compared to check varieties viz., GAFS 12 (48.8 ppm) and GFS 6 (57.3 ppm) (Table 5).

The released cultivar GFS 8 (*Banas chari*) has medium in flowering, tall plant height, yellow coloration of flag leaf midrib, broad leaf and greyed orange glume colour. It has semi loose panicle with absent of lemma arista formation and yellow orange colour caryopsis after threshing with absent of lemma arista formation (Table 6).

During sorghum cultivation crop infested by many insects and diseases. In case of diseases anthracnose and leaf blight is considered as devastating

disease of forage sorghum (Gami *et al.*, 2021). Sorghum shoot fly is considered as one of the most important and causes more damage in early seedling stage. While stem borer also negative impact on sorghum production. The released cultivar tested in various locations in AICRP trials as well as an in-state trial for evaluating reaction toward major diseases and pests. Under field condition, the cultivar GFS 8 (*Banas chari*) moderately resisted anthracnose and leaf blight diseases in state trial. While in AICRP trial it gives resistant and moderately resistant reaction against anthracnose and leaf blight diseases, respectively (Table 7 & 8). It exhibited lesser infestation of shoot fly (25.90%) and stem borer dead heart (30.80 %) in state trials (Table 9). While in the case of AICRP trial Stem borer dead heart % (17.9 %) was observed (Table 9).

The DNA fingerprinting of GFS 8 (*Banas chari*) along with four check varieties GAFS 12, GFS 6, CSV 21F and CSV 46F was performed using 11 SSR Markers. All the markers amplified properly across the genotypes except one (SSR11). All amplified primers were found polymorphic and produced 2 to 3 alleles. Alleles were demonstrated using arrow symbol in Fig. 1.

TABLE 5  
Biochemical parameters of proposed entry GFS 8 (*Banas chari*) (DSF 168) along with checks in fodder (State trial)

Quality parameters	GFS 8 (DSF 168)	GAFS 12 (LC)	GFS 6 (LC)	CSV 21 F (NC)
Crude protein (%)	6.1	5.7	6.7	6.9
TSS (% Brix content)	11.1	9.2	10.2	8.7
NDFD % (Neutral Detergent fibre digestibility)	67.3	72.3	71.0	68.2
HCN content (ppm)	48.1	48.8	57.3	40.0

TABLE 6  
Distinguished Morphological characters of proposed entry GFS 8 (*Banas chari*) (DSF 168) along with checks as per DUS guidelines

S. No.	Characters	GFS 8 (DSF 168)	GFS 6 (LC)	CSV 21F (NC)
1.	Plant : Time of panicle emergence (50% of plant with 50% of anthesis)	Medium	Medium to late	Late
2.	Plant : Natural height of plant up to base of flag leaf	Tall	Tall	Tall
3.	Flag leaf : Yellow colouration of midrib	Present	Absent	Present
4.	Leaf : Width of blade (cm)	Broad	Broad	Medium
5.	Lemma : Arista formation	Absent	Absent	Present
6.	Glum colour	Greyed-orange	Grayed Yellow	Greyed-orange
7.	Panicle : density	Semi-Loose	Loose	Loose
8.	Neck of panicle : Visible length above sheath	Short	Medium	Medium
9.	Grain shape Dorsal view	Circular	Circular	Circular
	Profile view	Elliptic	Elliptic	Elliptic
10.	Caryopsis color after threshing	Yellow orange	Yellow white	Yellow orange

TABLE 7  
Reaction to major disease at Surat and Deesa centre in LSVT trial

Variety	Year	Anthracnose disease Grade (1-9)			Leaf blight disease Grade (1-9)		
		Surat	Deesa	Range	Surat	Deesa	Range
DSF 168	Kharif-2019	4.7	-	4.7	5.0	-	5.0
	Kharif-2020	4.9	4.0	4.0-4.9	4.8	4.1	4.1-4.8
	Kharif-2021	5.1	4.4	4.0-4.9	4.7	4.0	4.0-4.7
				4.0-5.1 [MR]			4.0-5.0 [MR]
Bulky Y (SC)	Kharif-2019	6.3	-	6.3	6.7	-	6.7
	Kharif-2020	6.0	5.0	5.0-6.0	6.3	4.7	4.7-6.3
	Kharif-2021	6.1	6.1	6.1	6.1	6.6	6.1-6.6
				5.0-6.3 [S]			4.7-6.6 [S]
B-58586 (RC)	Kharif-2019	4.7	-	4.7	4.7	-	4.7
	Kharif-2020	3.0	4.0	3.0-4.0	4.1	4.0	4.0-4.1
	Kharif-2021	4.1	3.8	4.0	4.2	3.1	3.1-4.2
				3.0-4.0 [MR]			4.0-4.7 [MR]
GFS 6	Kharif-2019	4.3	-	4.3	5.0	-	5.0
	Kharif-2020	4.4	4.1	4.1-4.4	4.7	4.2	4.2-4.7
	Kharif-2021	4.9	6.1	4.9-6.1	4.6	4.0	4.0-4.6
				4.5	5.1	4.1- 6.1[MR]	4.0 - 5.0[MR]
GAFS 12	Kharif-2019	6.3	-	6.3	6.0	-	6.0
	Kharif-2020	5.5	4.3	4.3-5.5	5.1	4.1	4.1-5.1
	Kharif-2021	5.7	6.1	5.7-6.1	5.2	6.4	5.2-6.4
				5.8	5.2	4.3-6.3 [S]	4.1-6.4 [S]
CSV 21F	Kharif-2019	4.7	-	4.7	5.0	-	5.0
	Kharif-2020	4.4	4.1	4.1-4.4	4.6	4.4	4.4-4.6
	Kharif-2021	4.7	3.8	3.8-4.7	4.6	3.8	3.8-4.6
		4.4-4.7	3.8-4.1	3.8-4.7 [MR]	4.7	4.1	3.8-5.0[MR]

Grade classification :

0.0 - 1.0 = Highly Resistant (HR); 1.1 - 3.0 = Resistant (R); 3.1 - 5.0 = Moderately Resistant (MR); 5.1 - 7.0 = Susceptible (S); 7.1 - 9.0 = Highly Susceptible (HS).

TABLE 8  
Disease reaction and Pest incidence of proposed entry GFS 8 (*Banas chari*) [SPV 2879 (DSF 168)] along with checks in (AICRP TRIALS) All India Mean

S. No.	Particulars	SPV 2879 (DSF 168)	CSV 21F	CSV44F	Susceptible check (SC)	Resistant check (RC)
1.	Anthracnose disease Grade (1-9)	2.9	3.1	3.1	4.3	2.8
2.	Leaf blight disease Grade (1-9)	4.2	4.8	4.7	4.5	3.5
3.	SFDH % (28 DAE)	41.1	35.8	30.0	58.0	21.3
4.	SBDH % (45 DAE)	17.9	16.4	15.0	21.7	12.5

Grade classification: 0.0 - 1.0 = Highly Resistant (HR); 1.1 - 3.0 = Resistant (R); 3.1 - 5.0 = Moderately Resistant (MR); 5.1 - 7.0 = susceptible (S); 7.1 - 9.0 = Highly susceptible (HS).

SFDH = Shoot fly dead heart and SBDH = Stem borer dead heart.

### CONCLUSION

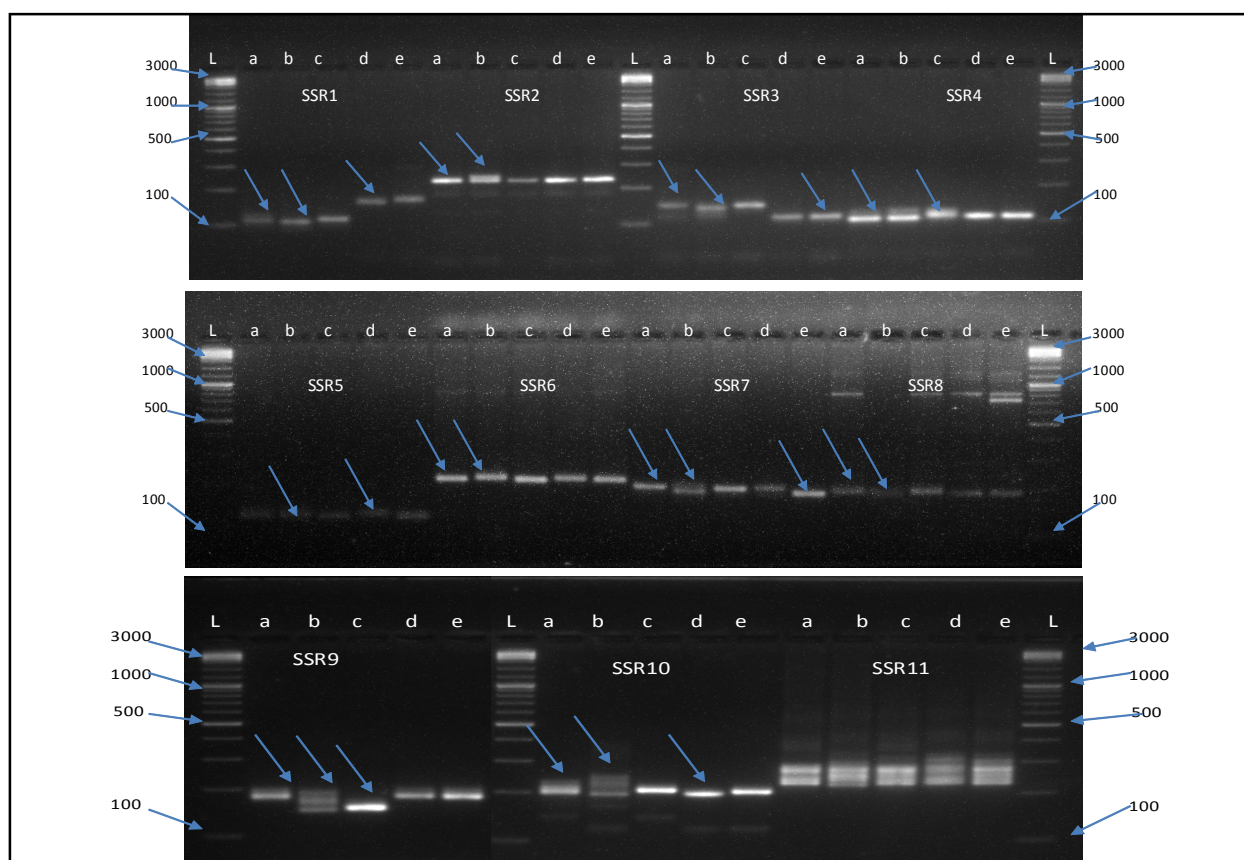
The variety GFS 8 (*Banas chari*) was found superior for green fodder yield against checks GFS 5, GAFS 12, CSV 21 F, GFS 6 with an average increment of 28.1, 24.2, 6.4, and 8.2 per cent, respectively, over the years and location. It was also found superior for

dry fodder yield against respective checks with an average increment of 26.6, 18.0, 6.8, and 1.8 per cent, respectively, over the years and location. The genotypes have desirable forage traits like tall plant height and broad leaf. It has semi-loose panicle, yellow-orange caryopsis after threshing with the absence of lemma arista formation. It was moderately resistant

TABLE 9  
Reaction to major pest at Surat and Deesa centre in LSVT trial

Variety	Year	SFDH % (28 DAE)			SBDH % (45 DAE)		
		Surat	Deesa	Average	Surat	Deesa	Average
DSF 168	Kharif-2019	33.1	-	33.1	41.9	-	41.9
	Kharif-2020	34.0	12.1	23.1	39.1	13.4	26.3
	Kharif-2021	34.4	23.7	29.1	39.9	29.2	34.5
	Year Average	33.8	17.9	25.9	40.3	21.3	30.8
Sawarna (SC)	Kharif-2019	60.7	-	60.7	72.2	-	72.2
	Kharif-2020	63.8	27.1	45.4	66.3	34.2	50.2
	Kharif-2021	51.5	40.0	45.7	54.0	43.3	48.7
	Average	58.7	33.5	46.1	64.2	38.7	51.4
IS-2205/18551 (RC)	Kharif-2019	18.9	-	18.9	17.7	-	17.7
	Kharif-2020	20.5	7.4	13.9	23.1	8.5	15.8
	Kharif-2021	21.9	6.4	14.1	23.7	8.1	15.9
	Average	20.4	6.9	13.6	21.5	8.3	14.9
GFS 6	Kharif-2019	21.4	-	21.4	22.8	-	22.8
	Kharif-2020	24.7	19.4	22.1	27.9	17.3	22.6
	Kharif-2021	27.2	13.8	20.5	29.1	13.5	21.3
	Average	24.4	16.6	20.5	26.6	15.4	21.0
GAFS 12	Kharif-2019	33.9	-	33.9	40.1	-	40.1
	Kharif-2020	35.6	20.8	28.2	43.6	21.1	32.4
	Kharif-2021	37.7	26.9	32.3	44.5	33.6	39.0
	Average	35.7	23.9	29.8	42.7	27.4	35.0
CSV 21F	Kharif-2019	33.3	-	33.3	38.6	-	38.6
	Kharif-2020	33.6	17.0	25.3	37.7	22.1	29.9
	Kharif-2021	32.2	16.6	24.4	37.1	19.8	28.5
	Average	33.0	16.8	24.9	37.8	21.0	29.4

Where: SFDH = Shoot fly dead heart and SBDH = Stem borer dead heart.



Where: L: Ladder; a: GFS 8 (DSF-168), b: GAFS 12, c: GFS 6, d: CSV 21F, e: CSV 46 SSR number representing to serial number of markers.  
Fig. 1. DNA profiling of Sorghum genotypes.



to diseases like anthracnose and leaf blight. It has high TSS (% Brix content) and low HCN content as compared to checks.

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