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FODDER YIELD, QUALITY AND NUTRIENTS UPTAKE POTENTIAL OF DIFFERENT TYPES OF SORGHUM (*SORGHUM BICOLOR*) VARIETIES IN CENTRAL GUJARAT

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SUMMARY

A study was conducted for two years to evaluate 15 sorghum varieties belonging to sweet sorghum, dual purpose and forage types, for green fodder yield, chemical & nutrients composition and nutrient uptake potential under double cut system at 75 days interval. The highest green fodder yield (71.28 t/ha) was observed in sweet sorghum variety CSH 22 SS which was found at par with forage varieties HC 308 and CSV 21F. Among forage varieties, HJ 513 recorded higher green fodder yield (69.48 t/ha). All the sorghum varieties were found at par amongst themselves on the basis of dry matter and crude protein yields. Significant differences were observed in sorghum varieties green fodder for variation in crude protein (4.32-7.08%), ether extract (1.32-2.53%), crude fibre (22.71-31.69), silica (2.9-4.1%) and dry matter (25.91-33.11%) content. Differences for nutrients composition were recorded significant in green fodder of sorghum varieties for nitrogen, potash, calcium, magnesium, copper and manganese minerals. However, nutrient uptake (kg/ha) by sorghum varieties was found significant for calcium and magnesium minerals only.

Key words : Fodder sorghum, sweet sorghum, forage sorghum, fodder yield, quality parameters, nutrient uptake, mineral content

Sorghum (*Sorghum bicolor*) is the fourth major cereal crop of the world in production and fifth in acreage after wheat, rice, maize and barley. Sorghum plant is unique in stature and can grow in adverse environments and is well adapted to changing climatic conditions. In India during 2013-14, 5.72 million hectares land was under sorghum cultivation with grain production of 10.62 million tonnes (Zalkuwi *et al.*, 2014). The crop is well adapted to the semi-arid Tropics climatic regions and is one of the most efficient dry land crops to convert atmospheric CO_2 into sugar (Schaffert and Gourley, 1982). Sorghum is also a major cereal fodder crop grown in arid and semi-arid areas of India throughout the year in *zaid, kharif* and *rabi* seasons. Sorghum is successfully grown throughout India both under irrigated and rainfed conditions for grain, ethanol and fodder production. However, fodder sorghum cultivation is limited to an estimated area of 2.60 million hectares with average green fodder productivity ranging from 35 to 70 t/ha (ICAR, 2006). It meets over two-third of the total forage demand of **kharif** season in the states of western Uttar Pradesh, Haryana, Punjab, Gujarat, Rajasthan and Delhi (Gangaiah and Gautam, 2008). Sweet sorghum owing to its high fodder yielding ability coupled with sweet and juicy stalks is more often used as a fodder crop in India than for its intended use as a sugar or bio-energy crop (Nimbkar *et al*., 2010). Sorghum varieties with higher juice brix (sugar %) can easily be ensiled for silage production. Recently, Indian Council of Agricultural Research (ICAR) has developed and notified several new sorghum varieties and hybrids for fodder cultivation under All-India Coordinated Sorghum Improvement Programme (AICSIP). However, limited information is available on performance of these new sorghum varieties and hybrids under central Gujarat conditions for fodder cultivation purpose. Keeping this in view, the present study was conducted to evaluate different sorghum varieties for their fodder yields, quality, nutrient uptake and other associated characteristics.

MATERIALS AND METHODS

The experiment was laid out in a randomized block design (RBD) with three replications consisting

of 15 sorghum varieties belonging to sweet sorghum, dual purpose and forage types at fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat) during **kharif** season in 2014 and 2015. In this trial, sweet sorghum varieties were CSV 19 SS, CSV 24 SS and CSH 22 SS; dual purpose varieties were : CSV 15, SPV 462, CSV 27 and Phule Revati and forage varieties were Pant Chari 6, CSH 24 MF, SSG 898, HJ 513, HJ 541, Pant Chari 5, CSV 21 F (State check) and HC 308 (National check) (Fig. 1 and Table 1). The soil of the experimental site was sandy loam type with EC 0.19, pH 7.7, total nitrogen (900 kg/ha), available P_2O_5 (13 kg/ha) and available K_2O (272 kg/ha). The soil contained DTPA-extractable Fe (5.2 ppm), Mn (4.3 ppm), Zn (1.8 ppm) and Cu (1.4 ppm). The crop was sown manually in the month of April during both the years. The total plot size was 6 x 4 m^2 with net plot area of 5 x 3 m^2 at harvest. The crop was sown at 45 cm row spacing with seed rate of 40 kg/ha. The crop was fertilized with 150 : 60 : 40 kg NPK/ha. Entire quantity of P and K was given as basal dose. Nitrogen fertiliser was divided into three equal doses and was applied as basal, 30 days after sowing and 20 days after first cut as top-dressing. After sowing pendimethalin @ 1.25 litre/ha and atrazine @ 1 kg/ha herbicides were applied as pre-emergence to control weeds. Two hand hoeing operations were done at 25 days after sowing and 15 days after first cut to control emerging weeds. Total 7 to 8 irrigations were applied during the crop growing period from April to October during both the years. The crop was harvested twice i. e. 75 and 150 days after sowing in both the years. After harvest, green fodder yields and yield parameters were recorded. Six plants were selected randomly from two rows for recording growth parameters. Total soluble sugar content (brix %) in stem was recorded using hand-refractometer. Half kg chopped mixed fodder samples 1 to 2 cm in size consisting of leaves and stem portion were dried in ovens separately at 70^0C to a constant weight for dry matter content. Dried samples were grinded for chemical analysis and the amount of N was found by using micro-Kjeldhal method

TABLE 1

Yield and yield parameters of different sorghum types as affected by varieties (Pooled analysis of two years).

Treatment	Yield (t/ha)			Yield parameters				
	Green fodder	Dry matter	Crude protein	Plant height (cm)	Plant population/ metre row length	Stem thickness (cm)	Dry matter accumulation/ tiller (g)	Leaf : Stem ratio
Sweet sorghum type								
CSV 19 SS	63.37	20.92	1.32	233.0	9.3	4.65	28.51	0.89
CSV24 SS	62.62	19.30	1.25	213.4	6.8	5.40	38.37	0.72
CSH 22 SS	71.28	20.18	1.28	247.4	6.7	5.25	32.67	0.81
Average	65.76	20.18	1.28	247.4	6.7	5.25	32.67	0.81
Dual purpose type								
CSV 15	57.51	19.03	1.27	194.5	5.7	4.92	34.24	0.97
SPV 462	54.76	19.16	1.43	188.8	6.8	5.22	38.65	0.79
CSV 27	55.49	17.46	1.05	213.3	8.9	4.80	20.63	0.38
Phule Revati	54.06	18.32	1.24	214.1	4.8	4.63	33.82	0.93
Average	55.46	18.49	1.25	202.7	6.6	4.89	31.84	0.77
Forage type								
Pant Chari 6	57.09	19.19	1.19	220.6	8.4	4.34	31.75	0.82
CSH 24 MF	60.52	19.59	1.14	232.2	6.0	4.91	30.94	0.78
SSG 898	45.38	16.75	1.04	243.1	7.1	4.40	33.69	1.16
HJ 513	69.48	23.41	1.40	252.6	6.5	5.97	34.85	0.92
HJ 541	65.48	23.33	1.51	232.7	10.2	4.13	30.39	0.67
Pant Chari 5	61.16	18.93	1.20	221.1	7.7	5.51	33.24	0.85
CSV 21 F (SC)	66.92	22.57	1.27	242.8	8.3	4.19	32.47	0.92
HC 308 (NC)	60.43	21.18	1.27	237.9	7.5	4.85	37.73	0.73
Average	60.81	20.62	1.25	235.4	7.7	4.79	33.13	0.86
S. Em±	4.00	1.76	0.10	7.35	1.2	0.28	1.92	0.09
C. D. (P=0.05)	11.58	NS	NS	21.20	NS	0.81	5.67	0.29

SC : State check and NC : National check. NS–Not Significant.

(Jackson, 1973). Crude protein content was calculated multiplying N amount of each sample by 6.25. Quality analysis of fodder samples for nutritive value was carried out following the standard laboratory procedures recommended by (AOAC, 2005). Minerals content was determined according to Inductively Coupled Plasma-Optical Emission Spectroscopy, Perkin Elmer, OPTIMA-3300 RL (ICP-OES) test method. Oxalic acid content was determined by Titrimetric method. Total uptake of nutrients was calculated separately by the following formula :

Uptake of nutrient (kg/ha) = (Nutrient % x Dry matter yield (kg/ha)]/100

Whereas, nutrient uptake (kg/t of dry matter) = (Nutrient uptake)/(Dry matter yield).

Two years' data were pooled and analyzed statistically as per statistical analysis. The obtained data were done with the help of computer applying analysis of variance technique (Panse and Sukhatme, 1985). Overall differences were tested by 'F' test of significance. The critical differences were worked out at 5 per cent level of probability for comparing treatment means in case of significant 'F' test.

RESULTS AND DISCUSSION

Yield and Yield Parameters

Significant difference was observed in green fodder yields among sorghum varieties. In two cuts, sweet sorghum variety CSH 22 SS at par with other sweet sorghum varieties recorded significantly higher green fodder yield (71.28 t/ha) than forage varieties Pant Chari 6, SSG 898 and all dual purpose sorghum varieties (Table 2). The lowest green fodder yield (45.38 t/ha) was recorded in forage variety SSG 898. During rainy season, SSG 898 was observed to be highly infected with foliar diseases, which may be cause of low green fodder yield (Table 1). Differences were found at par among other forage varieties and sweet sorghum varieties for green fodder yield. Singh *et al.* (2015) observed in single cut green fodder yield of 34, 30 and 35 t/ha in sweet sorghum varieties CSV 19 SS, CSV 24 SS and CSH 24 SS, respectively in three years trial. Non-significant differences were found among sorghum varieties for dry matter and crude protein yield (Table 2). However, higher dry matter (23.41 t/ha) and crude protein yield (1.51 t/ha) were observed in composite forage varieties HJ 513 and HJ 541, respectively. Pahuja *et al.* (2012) reported average green fodder yield of 50.32 and 43.83 t/ha in HJ 541 and HC 308 varieties, respectively, in single cut.

Forage variety HJ 513 recorded significantly higher plant height (252.6 cm) than CSV 24 SS, Pant Chari 6, Pant Chari 5 and all dual purpose varieties (Table 2). SPV 462 at par with CSV 15 recorded lowest plant height (188 cm) than other varieties. Hussain *et al.* (2011) recorded plant height of 212 and 217 cm in SPV 462 and CSV 15 varieties, respectively, at grain maturity stage between 118 -125 days after sowing. Stem thickness differed significantly and HJ 513 at par with CSV 24 SS, CSH 22 SS, SPV 462 and Pant Chari 5 recorded significantly thickest stem (5.97 cm) than remaining sorghum varieties (Table 2). Dry matter accumulation per tiller was found significantly the highest in SPV 462 (38.65 g) and lowest in CSV 27 (20.63 g). Among forage varieties highest dry matter accumulation per tiller was recorded in HC 308 (37.73 g). Leaf : stem ratio differed significantly and the highest leaf: stem ratio was found in SSG 898 (1.16) which was at par with CSV 19 SS (0.89), CSV 15 (0.97), Phule Revati (0.93), HJ 513 (0.92) and CSV 21F (0.92) and the lowest leaf : stem ratio was observed in CSV 27 (0.38).

Chemical Composition

In different varieties of sorghum chemical composition was analyzed and significant differences were noticed for crude protein, ether extract, crude fibre, silica and dry matter content (Table 3). Differences were found to be non-significant for brix in sorghum juice. The highest crude protein percentage was observed in SPV 462 (7.08%) which was found at par with Phule Revati, CSV 19 SS, Pant Chari 5 and CSV 15 varieties while lowest crude protein was recorded in CSV 27 (4.32%). Ether extract was recorded significantly highest in CSV 27 (2.53%) as compared to other varieties, while lowest in CSV 19 SS (1.32%). Highest crude fibre percentage was found in HJ 513 (33.11%), while the lowest crude fibre percentage was observed in CSV 27 (22.71). Silica content was found highest (4.1 %) in SPV 462 and SSG 898 and lowest in CSH 24 MF (2.9%). Sweet sorghum type varieties were significantly lower in dry matter percentage, while the forage type varieties were significantly higher, highest dry matter percentage was found in SSG 898 (33.11), while lowest dry matter was observed in CSH 22 SS (25.91 %). Lower dry matter content in sweet sorghum varieties may be due to high juice content.

TABLE 2
Chemical composition (%) of different sorghum types as affected by varieties (Pooled analysis of two years)

Treatments	Crude protein	Ether extract	Crude fibre	Silica	Dry matter	Brix
Sweet sorghum type						
CSV 19 SS	6.35	1.32	29.89	3.6	29.24	10.23
CSV24 SS	6.17	1.53	30.83	3.6	27.54	11.88
CSH 22 SS	6.17	1.51	30.17	3.7	25.91	10.12
Average	6.23	1.45	30.30	3.6	27.56	10.74
Dual purpose type						
CSV 15	6.32	1.66	31.03	3.6	29.63	12.23
SPV 462	7.08	1.46	30.29	4.1	31.01	10.47
CSV 27	4.32	2.53	22.71	2.9	27.66	10.51
PhuleRevati	6.57	1.35	27.77	3.3	31.33	10.57
Average	6.07	1.75	27.95	3.5	29.91	10.95
Forage type						
Pant Chari 6	6.02	1.43	30.99	3.3	31.77	11.04
CSH 24 MF	5.60	1.48	31.46	2.9	28.71	11.60
SSG 898	6.24	1.54	29.81	4.1	33.11	10.77
HJ 513	5.89	1.54	33.11	3.5	30.18	9.90
HJ 541	6.16	1.43	31.64	3.3	30.66	10.28
Pant Chari 5	6.34	1.58	28.67	3.5	28.03	10.87
CSV 21 F (SC)	5.49	1.77	31.69	3.6	30.16	11.67
HC 308 (NC)	5.92	1.54	31.16	3.4	31.36	11.45
Average	5.96	1.54	31.07	3.5	30.50	10.95
S. Em±	0.27	0.15	0.85	0.2	1.54	0.63
C. D. (P=0.05)	0.79	0.44	2.46	0.6	4.47	NS

SC : State check and NC : National check. NS–Not Significant.

Nutrient Composition

Primary, secondary and micro-nutrients contents were analyzed during the experiment. Among primary nutrients nitrogen (N) and potassium (K), secondary nutrients calcium (Ca) and magnesium (Mg) and micro-nutrients copper and manganese differed significantly (Table 4). The highest nitrogen percentage was observed in SPV 462 (1.13), while lowest nitrogen percentage was observed in CSV 27 (0.85). Potassium was recorded highest in SSG 898 (0.89%), while CSV 27 and CSH 24 MF (0.57%) were the lowest in potassium percentage. Highest calcium percentage was recorded in CSV 21 F (0.34%) and CSV 27 (0.22%) was lowest in calcium percentage. Sweet sorghum variety CSV 24 SS (0.61%) was found significantly higher in magnesium percentage, while dual purpose variety CSV 27 (0.37 %) was the lowest in magnesium percentage. Among micro-nutrients copper and manganese differed significantly. The highest copper and manganese percentages were observed in SPV 462 (4.99 and 37.49 ppm) and lowest in CSV 27 (3.13 and 22.92 ppm). Zinc and iron content differences were found non-significant but varied from 13.59 to 18.86 and 280.17 to 434.17 ppm, respectively, in sorghum varieties (Table 3).

Nutrient Uptake

Primary, secondary and micro-nutrient uptake was recorded on the basis of per hectare and per tonne of dry matter produced. On per hectare basis, only two secondary nutrients calcium (Ca) and magnesium (Mg) uptake differed significantly, while the difference in primary nutrients (N, P_2O_5 and K_2O), micro-nutrients (Cu, Mn, Zn and Fe) and sulphur was found non-significant (Table 4). CSV 21 F at par with HJ 541, HJ 513, HC 308, Phule Revati and CSV 19 recorded the significantly highest calcium uptake (76.56 kg/ha) over remaining varieties. Lowest calcium uptake was found in CSV 15 (52.19 kg/ha). HJ 513 at par with HJ 541, CSV 21 F and all sweet sorghum varieties recorded the highest magnesium uptake (132.57 kg/ha) than remaining sorghum varieties. SSG 898 (82.8 kg/ha) was the lowest in magnesium uptake. N uptake was found the highest in SPV 462 (11.32 kg/t dry matter production) as compared to all forage varieties except HC 308 but at par with CSV 19 SS, CSV 15 and Phule Revati (Table 5). Significant differences were recorded among varieties for Ca, Mg and Mn

TABLE 3
Nutrients composition (%) of different sorghum types as affected by varieties (Pooled analysis of two years)

Treatments	Primary nutrients (%)			Secondary nutrients (%)			Micro-nutrients (ppm)			
	N	P_2O_5	K_2O	Ca	Mg	S	Cu	Mn	Zn	Fe
Sweet Sorghum Type										
CSV 19 SS	1.02	0.20	0.64	0.30	0.55	0.26	4.39	32.02	17.84	384.50
CSV 24 SS	0.99	0.20	0.66	0.33	0.61	0.28	4.60	35.71	15.99	337.42
CSH 22 SS	0.99	0.21	0.72	0.31	0.58	0.28	4.77	35.42	17.88	365.75
Average	1.00	0.20	0.67	0.31	0.58	0.27	4.59	34.38	17.24	362.56
Dual Purpose Type										
CSV 15	1.01	0.20	0.62	0.28	0.52	0.31	4.87	33.65	18.86	375.08
SPV 462	1.13	0.20	0.76	0.29	0.51	0.33	4.99	37.47	16.90	382.58
CSV 27	0.85	0.22	0.57	0.22	0.37	0.32	3.13	22.92	15.09	323.75
Phule Revati	1.05	0.19	0.71	0.33	0.56	0.31	4.61	30.80	17.08	422.25
Average	1.01	0.20	0.67	0.28	0.49	0.32	4.40	31.21	16.98	375.92
Forage Type										
Pant Chari 6	0.96	0.16	0.64	0.30	0.50	0.29	4.21	30.88	13.59	402.56
CSH 24 MF	0.90	0.18	0.57	0.29	0.53	0.31	4.48	32.25	14.58	371.83
SSG 898	1.00	0.19	0.89	0.31	0.50	0.29	4.81	30.86	16.18	321.83
HJ 513	0.94	0.20	0.64	0.31	0.57	0.28	4.76	27.21	16.78	280.17
HJ 541	0.99	0.18	0.68	0.33	0.52	0.28	4.95	30.86	15.31	360.17
Pant Chari 5	1.01	0.18	0.65	0.30	0.52	0.28	4.15	31.73	16.34	416.42
CSV 21 F (SC)	0.88	0.19	0.59	0.34	0.57	0.26	3.97	28.78	14.23	434.17
HC 308 (NC)	0.95	0.20	0.63	0.33	0.51	0.27	4.75	30.38	17.02	351.17
Average	0.95	0.19	0.66	0.31	0.53	0.28	4.51	30.37	15.50	367.29
S. Em±	0.04	0.01	0.06	0.01	0.02	1.23	0.24	1.51	1.54	38.03
C, D. (P=0.05)	0.13	NS	0.17	0.04	0.06	NS	0.71	4.40	NS	NS

SC : State check and NC : National check. NS–Not Significant.

nutrients on per tonne dry matter production basis (Table 5). Average calcium uptake per tonne dry matter production was found more in fodder sorghum, whereas magnesium and manganese were found more in sweet sorghum. Average primary nutrient uptake ($N+P_2O_5+K_2O$) was found equal @ 22.7 kg/t dry matter production in case of sweet sorghum and dual purpose sorghum types. Whereas, secondary nutrient uptake (Ca+Mg+S) was found better in case of sweet sorghum type @ 9.85 kg/t dry matter production. However, dual purpose sorghum type recorded more micro-nutrient uptake @ 429.5 g/t dry matter production than sweet sorghum (419.2 g/t dry matter production) and fodder sorghum (408.4 g/t dry matter production) types (Table 5). Primary nutrients uptake was found twice more than secondary nutrients uptake in sorghum crop on per tonne dry matter production basis Vasanthi and Kumaraswamy (2000) reported $N+P_2O_5+K_2O$ uptake in fodder sorghum at the rate of 30.7 kg/t dry matter production. At Jhansi in Uttar Pradesh, fodder sorghum absorbed 40.4 kg $N+P_2O_5+K_2O$ per tonne dry matter production (Kumar *et al.*, 2005). Micronutrient uptake by sorghum fodder/ tonne dry matter was 11.0 g Zn, 8.0 g Cu, 21.0 g Fe and 43.5 g Mn (Hazra and Tripathi, 1998).

CONCLUSION

Trials conducted for two years indicated that given the conditions of central district in Gujarat, sweet sorghum type varieties had equal potential to provide green fodder yield in comparison to forage type varieties but better than dual purpose type sorghum varieties. Green fodder of dual purpose and sweet sorghum type varieties was found as nutritious as forage sorghum type varieties. Among sweet sorghum CSH 22 SS and CSV 19 SS, dual purpose sorghum SPV 462 and forage sorghum HJ 513, HJ 541, Pant Chari 5 and CSV 21 F varieties were found to be more suitable for green fodder cultivation and hence may be recommended for fodder cultivation. On the basis of dry matter and brix content at 75 days stage of harvest, different types of sorghum varieties were found suitable for green feeding as well as ensiling purpose.

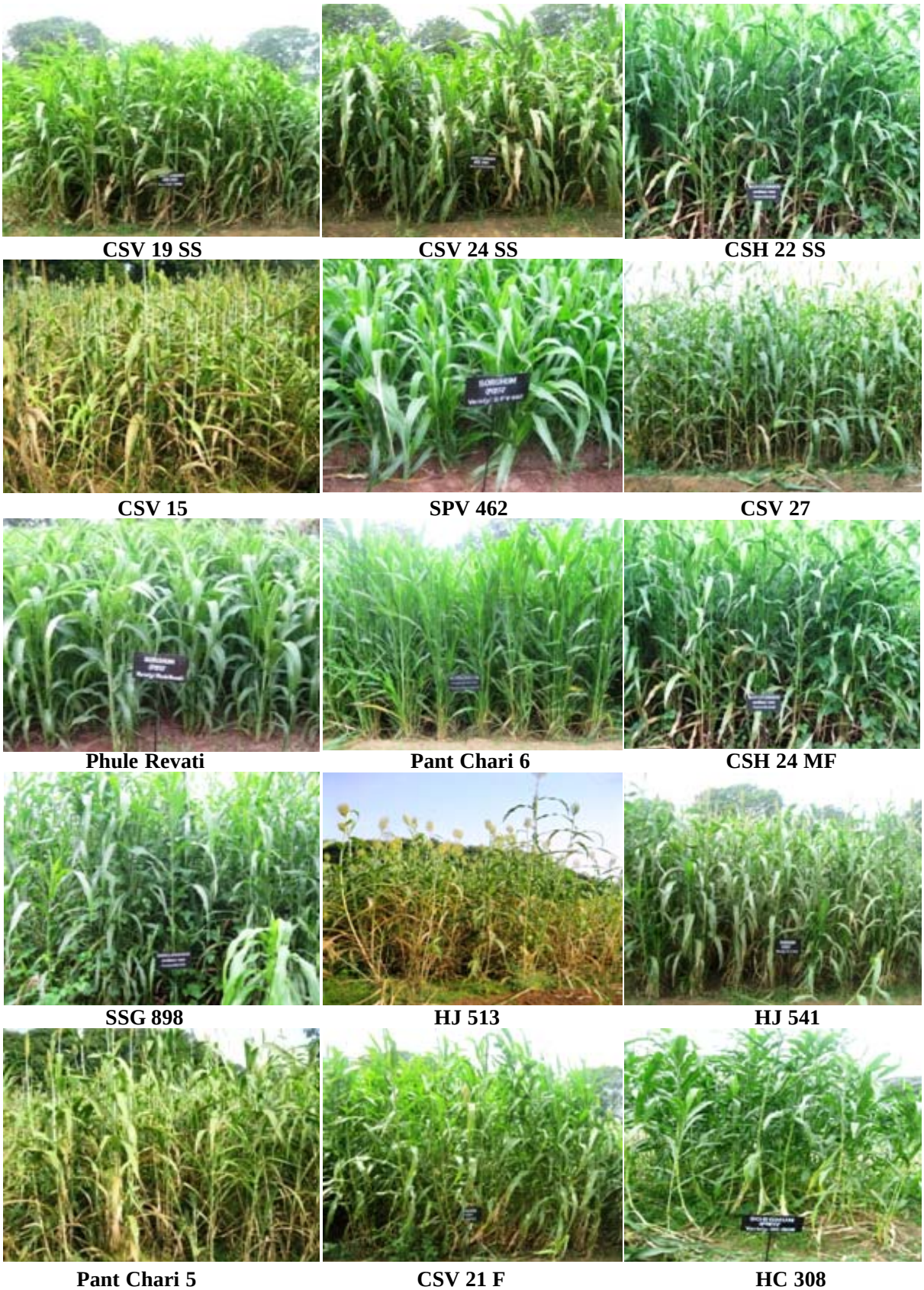

Fig. 1. Different varieties of sorghum used in trial.

TABLE 4
Nutrients uptake of different sorghum types as affected by varieties (Pooled analysis of two years)

Treatments	Primary nutrients uptake (kg/ha)			Secondary nutrients (kg/ha)			Micro-nutrients (kg/ha)			
	N	P_2O_5	K_2O	Ca	Mg	S	Cu	Mn	Zn	Fe
Sweet sorghum type										
CSV 19 SS	212.00	96.06	162.42	63.53	114.73	18.15	92.17	666.86	369.82	7924.6
CSV 24 SS	189.56	87.77	153.62	62.43	118.57	18.03	88.60	680.03	310.61	6481.4
CSH 22 SS	199.08	95.19	175.44	62.62	117.81	18.92	96.55	712.03	360.68	7320.7
Average	200.21	93.01	163.83	62.86	117.04	18.37	92.44	686.31	347.04	7242.2
Dual purpose type										
CSV 15	190.64	86.40	138.65	52.19	99.02	19.45	92.33	640.58	358.65	7149.7
SPV 462	216.52	90.51	175.91	54.25	96.26	20.70	96.12	712.75	331.85	7362.9
CSV 27	170.74	99.82	136.59	56.00	97.07	20.86	78.51	606.05	424.02	7993.9
Phule Revati	193.16	78.26	159.79	66.23	101.88	18.72	84.63	568.57	303.61	6284.7
Average	192.77	88.75	152.74	57.17	98.56	19.93	87.90	631.99	354.53	7197.8
Forage type										
Pant Chari 6	184.46	69.23	147.13	57.50	95.90	18.25	80.87	590.90	260.19	7697.2
CSH 24 MF	175.36	81.56	132.88	57.73	103.81	19.84	87.19	629.40	286.83	7234.1
SSG 898	167.20	74.40	178.63	52.20	82.80	15.89	80.34	517.24	271.39	5380.2
HJ 513	218.59	106.55	175.33	72.88	132.57	21.82	110.13	636.58	387.46	6575.0
HJ 541	226.63	98.33	191.04	75.35	119.49	21.40	114.89	716.09	357.58	8349.0
Pant Chari 5	184.78	79.67	146.21	55.43	97.42	17.06	77.80	593.52	308.84	7959.0
CSV 21 F	198.95	100.16	159.26	76.56	127.20	19.12	89.20	649.62	321.50	9783.7
HC 308	199.74	95.21	157.17	68.93	108.19	19.28	101.08	647.22	356.68	7428.2
Average	194.46	88.14	160.96	64.57	108.42	19.08	92.69	622.57	318.81	7550.8
S. Em±	15.80	8.29	20.24	4.65	8.35	1.62	7.91	54.30	38.49	1030.7
C. D. (P=0.05)	NS	NS	NS	13.48	24.19	NS	NS	NS	NS	NS

SC : State check and NC : National check. NS–Not Significant.

TABLE 5
Nutrients uptake on dry matter basis by different sorghum types as affected by varieties (Pooled analysis of two years)

Treatments	Primary nutrients uptake (kg/t of dry matter)			Secondary nutrients (kg/t of dry matter)			Micro-nutrients (g/t of dry matter)			
	N	P_2O_5	K_2O	Ca	Mg	S	Cu	Mn	Zn	Fe
Sweet sorghum type										
CSV 19 SS	10.16	4.58	7.72	3.04	5.48	0.87	4.4	32.0	17.8	385
CSV 24 SS	9.87	4.52	7.97	3.25	6.13	0.93	4.6	35.7	16.0	337
CSH 22 SS	9.88	4.72	8.69	3.10	5.83	0.93	4.8	35.4	17.9	366
Average	9.97	4.61	8.13	3.13	5.81	0.91	4.59	34.38	17.23	363
Dual purpose type										
CSV 15	10.10	4.56	7.43	2.75	5.18	1.02	4.9	33.7	18.9	375
SPV 462	11.32	4.68	9.06	2.85	5.05	1.08	5.0	37.5	16.9	383
CSV 27	8.51	4.98	6.81	2.80	4.78	1.05	3.9	30.6	22.0	396
Phule Revati	10.52	4.27	8.56	3.63	5.61	1.02	4.6	30.8	17.1	339
Average	10.11	4.62	7.97	3.01	5.15	1.04	4.60	33.14	18.71	373
Forage type										
Pant Chari 6	9.63	3.60	7.66	3.00	5.00	0.95	4.2	30.9	13.6	403
CSH 24 MF	8.97	4.16	6.83	2.94	5.30	1.02	4.5	32.2	14.6	372
SSG 898	9.98	4.45	10.62	3.13	4.96	0.95	4.8	30.9	16.2	322
HJ 513	9.47	4.50	7.54	3.25	5.08	0.90	4.7	30.4	17.0	351
HJ 541	9.42	4.58	7.64	3.11	5.66	0.93	4.8	27.2	16.8	280
Pant Chari 5	9.86	4.24	8.15	3.26	5.17	0.93	4.9	30.9	15.3	360
CSV 21 F	8.79	4.47	7.06	3.40	5.65	0.85	4.0	28.8	14.2	434
HC 308	10.52	4.27	8.56	3.63	5.61	1.02	4.6	30.8	17.1	339
Average	9.58	4.28	8.01	3.21	5.30	0.94	4.57	30.25	15.60	358
S. Em±	0.44	0.22	0.71	0.14	0.20	0.06	0.3	1.6	1.5	38
C. D. (P=0.05)	1.27	NS	NS	0.41	0.58	NS	NS	4.4	NS	NS

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