

## EVALUATION OF SWEET STEMMED SORGHUM CULTIVARS FOR THE PRODUCTION OF GREEN STALK, JUICE AND GRAIN YIELD AND RATOONING ABILITY

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### ABSTRACT

Fifteen cultivars of sweet stemmed sorghum were evaluated for green stalk, juice and grain yield in addition to ratooning ability. The characters in the first crop, eleven characters in the ratoon crop and the total yield over two cuts were studied. The cultivar HES 4 showed significant and highest extractable juice yield of 13327 l per ha from our of 35.5 t/ha of millable greenstalk and 721 kg/ha of jaggery was obtained in addition to 2369 kg/ha of grain yield in the first crop. In ratoon crop, the cultivar SSV 714 showed significant *per se* performance for green stalk (32.9 t/ha), juice (4338 l/ha), jaggery (262 kg/ha) and grain yield (987 kg/ha). Based on the total yield over two cuts, HES 4, SSV 714 and IS 6962 appeared promising in respect of green stalk, juice, jaggery and grain yield and also showed ratooning ability.

**KEY WORDS :** Sweet Stemmed Sorghum, Evaluation, Juice, Grain, Jaggery Yield, Ratooning Ability

Sorghum is cultivated in an area of 7.0 lakh ha in Tamil Nadu. Considerable attempts have been made to develop high yielding varieties/hybrids for grain and fodder purposes. However, very little attention has been paid in developing suitable cultivars for different industrial purposes. The sucrose content in the stalks of sweet stemmed sorghum can be increased to such a level that it can be utilised for extraction of juice from which syrup and jaggery can be made. Sweet stemmed sorghum may be grown in areas where sugarcane processing units are well established. This will help to run the sugar industries for a longer period, creating additional employment, Bapat *et al.* (1987) reported that under Rahuri condition, better quality of jaggery as well as syrup (with TSS % of 90.5) were obtained and the colour of the jaggery was quite appealing and keeping quality was extremely good and for more than one year, it retained its colour and texture. Studies on important traits will help in selecting the cultivars for intensive cultivation of sweet stemmed sorghum. A number of sweet stemmed sorghum cultivars are available including the one (SSV 84) already released by the All India Co-ordinated Sorghum Improvement Project. Ten traits in the first crop and eleven traits in the ratoon crop were studied for selection of sweet stemmed sorghum cultivars. The traits and varietal behaviours and ratooning ability are discussed in this paper.

### MATERIALS AND METHODS

Fifteen cultivars including the check variety (SSV 84) were selected and the trial was laid in a comparative yield trial during summer 1991 at the Agricultural Research Station, Vellore under irrigated condition. The cultivars were sown in plots of 3 x 2.7m, at 45 x 15 cm spacing in a randomized block design with three replications. Fertiliser was applied at the rate of 40 : 40 : 40 NPK kg/ha as basal and N at 40 kg/ha as top dressing on 25th day after sowing.

Observations of five plants at random in a replication on plant height, stem girth, number of internodes per plant, length of 4th internode from the top, total soluble solids and days to maturity were taken at the time of maturity. The crop was harvested and the green stalk yield was recorded after removing the leaves and earheads. The juice yield was recorded by crushing in the mini sugarcane crusher (electrically operated). The grain yield was recorded separately. The jaggery was prepared by local method.

The main crop was left for ratooning after harvest. On tenth day, all side shoots excepting one per plant were removed and nitrogen applied at 40 kg/ha and irrigated. Observations were recorded as was done for the main crop and number of side shoots per plant was made. Using the mean values,

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Table 1. Mean performance of sweet stemmed sorghum cultivars : main crop 1991-1992.

Entries	Plant height (cm)	Stem girth (cm)	No. of internodes / plant	Length of 4th internodes from top (cm)	Days to maturity	Total soluble solids (%) (Brix value)	Green stalk yield (t/ha)	Extractable juice yield (lit/ha)	Jaggery yield (kg/ha)	Grain yield (kg/ha)
SSV 53	302	1.82	16.6	18.33*	102	19.38	53.3*	5923	299	694
SSV 74	335*	2.53*	18.6*	16.66*	102	21.73	28.8	11568*	512	975
SSV 84(C)	308	1.63	15.3	14.00	95	23.92	34.2	8391	368	925
SSV 714	233	2.20*	15.6	16.00	102	23.65	48.9*	10266*	450*	1258*
SSV 715	219	1.91	12.6	18.66*	100	23.02	47.5*	8144	362	586
SSV 1333	294	2.35*	17.6*	13.00	105	20.48	39.6*	7959	352	555
SSV 2525	334*	2.30*	19.6*	16.00	104	25.71*	49.5*	3295	148	1493*
SSV 7073	237	2.77*	19.0*	9.33	106	18.99	32.9	10365*	457*	2098*
SSV 12611	245	2.89*	20.0*	5.66	103	20.04	43.9*	8440	374	938
IS 6962	274	1.62	17.0	19.33*	95	24.31	67.5*	14191	623*	975
IS 49171	190	1.64	14.3	16.00	92*	23.06	29.9	4812	228	1728*
IS 20503	180	2.47*	19.6*	11.66	92*	25.85*	20.3	8884	388	1388*
HES 4	235	2.32*	20.0*	10.0	105	25.18*	35.5	13327*	721*	2369*
PR 4579	185	1.07	15.0	6.66	100	25.25*	29.8	3332	148	753
CO 25	271	2.09	15.6	13.0	112	18.72	49.6*	6108	272	1974*
SE	5.8	0.09	0.55	0.72	0.19	0.34	0.95	172	9.8	30
C.D. (P=0.01)	20.7	0.33	2.01	2.63	0.69	1.24	3.5	629	35.8	109

\* - Significant at 1 per cent level (C) - Check variety

ANOVA was worked out for the main crop and ratoon crop separately.

## RESULTS AND DISCUSSION

The *per se* performance of the sweet stemmed sorghum cultivars for the main crop is given in the Table 1. The analysis of variance showed significant difference for all the characters. The cultivars HES 4 showed significant and highest extractable juice of 13327 litres/hectare and 721 kg/ha of jaggery in addition to 2369 kg/ha of grain yield. However, it recorded 35.5 t/ha of green fodder yield which was lower than the check SSV 84 (34.2 t/ha). The cultivar HES 4 also was significantly superior in the total soluble solids, stem girth and number of internodes per plant when compared to the check. Another cultivar SSV 2525 produced a green stalk of 49.5 t/ha and grain yield of 1493 kg/ha. Though the total soluble solids, plant height, stem girth and a number of internodes were significantly superior, it had a low juice yield of 3295 l/ha and 148 kg/ha of jaggery yield, IS 6962 recorded the highest green stalk yield (67.5 t/ha) and juice yield (14191 lit/ha) and 623 kg/ha of jaggery yield but the grain yield was not significant (975 kg/ha). Among the three cultivars discussed

above, the cultivar, IS 6962 was early maturing (95 days) while the duration of other cultivars was 104 (SSV 2525) and 105 (HES 4) days respectively (Table 1). These studies are in conformity with the findings of Selvi and Palanisamy (1990).

The *per se* performance of cultivars in the ratoon crop are presented in Table 2. Significant differences were observed for all the eleven characters. The cultivar SSV 714 showed significant *per se* performance for four traits *viz.*, green stalk yield (32.9 t/ha), juice yield (4338 lit/ha), jaggery yield (262 kg/ha) and grain yield (987 kg/ha). Similarly it showed significant performance in total soluble solid (27.42%), plant height (185 cm), stem girth (1.45 cm) and the length of 4th internode from the top (11.0 cm). This cultivar matured in 79.6 days. Though it showed a non-significant green stalk yield, it recorded significant juice yield of 4146 lit/ha, 220 kg/ha of jaggery in addition to 678 kg/ha of grain yield. HES 4, SSV 12611 and SSV 74 were similar in performance to SSV 714. As regard to side shoots per plant none of the cultivars was significantly superior to the check SSV 84. However, SSV 7073 recorded highest number of side shoots (6/plant).

TABLE 2. Mean performance of sweet stemmed sorghum entries : ratoon crop 1991-1992.

Entries	No. of side shoots / plant	Plant height	Stem girth (cm)	No. of internodes / plant	Length of 4th internodes from top (cm)	Days to maturity	Total soluble solids (%) (Brix value)	Green stalk yield (t/ha)	Extractable juice yield (lit/ha)	Jaggery yield (kg/ha)	Grain yield (kg/ha)
SSV 53	4.6	189*	1.38*	11.33*	13.0	81.6	26.26	34.9*	6251*	264*	296
SSV 74	3.6	162*	0.99	8.0	10.0*	80.3	25.17	21.9	4252*	238*	765*
SSV 84(C)	5.6	155	1.19	10.33	8.0	71.6	25.82	20.1	2899	135	555
SSV 714	4.3	185*	1.45*	10.33	11.0*	79.6	27.42*	32.9*	4338*	262*	987*
SSV 715	5.0	165*	1.44*	9.33	10.33*	69.3*	26.68	30.9*	4499*	259*	370
SSV 1333	3.3	190*	1.28*	10.33	8.66	85.0	22.10	21.9	22.08	98	346
SSV 2525	4.3	2.35*	1.94*	13.0*	9.66*	84.0	23.58	35.1*	1501	77	675*
SSV 7073	6.0	230*	1.88*	12.0*	6.66	85.6	27.63*	27.9*	389	28	687*
SSV 12611	5.0	184*	1.24	10.0	4.33	83.0	26.06	22.9	7498*	376*	863*
IS 6962	3.3	250*	1.50*	12.33*	13.0*	75.0	24.86	22.5	4146*	220*	678*
IS 49171	3.3	177*	1.53*	11.0	10.0*	72.0	25.39	24.9*	5091*	287*	678*
IS 20503	3.6	115	1.10	10.6	8.0	84.6	27.41*	12.2	1419	90	463
HES 4	4.0	186*	1.92*	11.3*	8.0	85.0	24.65	19.9	5849*	290*	1259*
PR 4579	4.6	160	0.92	8.33	4.33	68.3*	24.65	12.1	999	62	642
CO 25	3.0	140	1.46*	10.66	7.66	84.0	24.18	26.9*	3850*	178*	284
SE	0.21	1.76	0.021	0.24	0.38	0.13	0.38	0.78	112	6.4	23
C.D. (P=0.01)	0.77	6.42	0.077	0.88	1.39	0.47	1.38	2.84	409	23.3	85

\* - Significant at 1 per cent level (C) - Check variety

Four cultivars viz., SSV 714, SSV 12611, IS 6962 and SSV 74 were better in performance for most of the traits, and these could be considered suitable for ratoon cropping.

The total yield over two cuts for green stalk, extractable juice, jaggery and grain yield revealed that the analysis of variance was significant for all the characters (Table 3). IS 6962 and HES 4 showed significant increase over the check for all

Table 3. Total yield over two cuts for green stalk, extractable juice, jaggery and grain yield (sum of 2 crops).

Entries	Green stalk yield (t/ha)	Extractable juice yield (lit/ha)	Jaggery yield (kg/ha)	Grain yield (kg/ha)
SSV 53	88.2*	12174	663	990
SSV 74	50.7	15820	750	1740
SSV 84(C)	54.3	11290	503	1480
SSV 714	81.8*	14604	712	2245*
SSV 715	78.4	12643	621	956
SSV 1333	61.5	10167	450	901
SSV 2525	84.6*	3295	225	2168*
SSV 7073	60.8	10754	485	2785*
SSV 12611	66.8	15938	750	1801
IS 6962	90.0*	18337*	843*	1653
IS 49171	54.8	9903	515	2406*
IS 20503	32.5	10303	478	1851
HES 4	55.4	19176*	1011*	3628*
PR 4579	41.8	4331	210	1395
CO 25	76.5	9958	450	2258*
SE	4.8	0.96	0.06	0.12
C.D. (P=0.01)	20.21	4.04	0.26	0.48

\* - Significant at 1 per cent level (C) - Check variety



the traits. SSV 714 recorded significant for green stalk yield 81.8 t/ha and grain yield 2245 kg/ha but non significant for extractable juice yield (14604 lit/ha) and jaggery yield (712 kg/ha). The total duration of the cultivar *viz.*, IS 6962, HES 4 and SSV 714 ranged from 170 to 190 days.

Based on the total yield over two cuts the performance of IS 6962, HES 4 and SSV 714 appeared promising since these cultivars showed good performance in respect of green stalk yield (55.4 to 90.0 t/ha), juice yield (14604 to 19176 lit/ha), jaggery yield (712 to 1011 kg/ha) and grain yield (1653 to 3628 kg/ha). Bapat *et al.* (1984) reported that above traits are helpful in identifying and in the selection of promising sweet stemmed sorghum varieties.

In the major sorghum growing districts of Tamil Nadu, it will be possible to divert 50 per cent Madras Agric. J., 82(3): 160-162 March, 1995

of irrigated sorghum area for raising sweet stemmed sorghum and establish small processing units having crushing capacity of 500 to 1000 t/day in rural areas. The syrup and jaggery can also be marketed locally. The grains of sweet stemmed sorghum cultivars are mostly pearly white, medium bold and fit for household consumption and will fetch additional income to the growers.

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## CORRELATION AND PATH-COEFFICIENT ANALYSIS IN GREEN GRAM (*Vigna radiata*).

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#### ABSTRACT

An experiment with 16 green gram genotypes was conducted to study the association and path coefficients of different characters with seed yield. Pods per plant and 100 seed weight had significant and positive correlation with seed yield. Positive direct effects were observed for pods per plant, plant height and 100 seed weight, hence selection based on these characters would bring improvement in seed yield in green gram.

Seed yield is a complex character, highly influenced by environment. Selection based on yield is not effective, hence selection on yield components, which are less prone to environmental influences is very valuable (Ramana and Singh 1987). The present study was conducted to identify different yield components through which seed yield can be increased in green gram.

#### MATERIALS AND METHODS

Sixteen genotypes of green gram were sown in randomised block design with three replications during *kharif* 1989 at the Regional Agricultural Research Station, Jagtial. Each genotype was sown in 6 rows of 5m length with a row to row spacing of 30cm and plants spaced at 10cm apart within the row. All package of practices were followed as per

recommendations. Data on seven characters *viz.*, days to flowering, days to maturity, pods per plant, plant height, pod length, 100 seed weight and seed yield per plant were recorded and genotypic and phenotypic correlations were estimated (Robinson *et al.*, 1951). The direct and indirect effects of components of six characters on seed yield were estimated by path coefficient analysis following the method of Dewey and Lu (1959).

#### RESULTS AND DISCUSSION

In general, the genotypic correlations were greater than the corresponding phenotypic correlations, indicating the preponderance of genetic variance in expression of different characters (Table 1) (Malik *et al* 1981). Positive and significant association of seed yield was