

4. Sweet Sorghum Breeding

AV Umakanth coordinating with scientists at several SAUs

Contents

Summary	1
Detailed report: 2008-2009	2
Morpho-phenological traits.....	2
Biomass traits	2
Quality traits.....	2
Components of total sugars	3
Resistance to biotic stresses.....	3
Table 1: Promising initial and advanced sweet sorghum varieties and hybrids for stalk yield, biomass, sugar content and bioethanol yields, Kharif 2008	4
Annexure I: Compliance report on receipt of data-Kharif -2008.....	6

-- ## --

Summary

Trial 1K. Evaluation of initial and advanced sweet sorghum varieties and hybrids (IASSVHT) for stalk yield, biomass, sugar content and bioethanol yields.

1. Eighteen entries comprising 8 varieties, and 6 hybrids along with 3 checks (SSV 84, CSV 19SS & CSH 22 SS) were evaluated at 11 locations during kharif 2008
2. None of the test hybrids were significantly superior for total fresh biomass and fresh stalk yields over the check CSH22 SS.
3. Among the varieties, SPSSV 27 (Rahuri) followed by SPSSV 35 (ICRISAT) recorded a numerical superiority of 17% and 13% for total fresh biomass and 19% and 13% for fresh stalk yields over SSV 84.
4. For grain yield, the test hybrids SPSSH 30 (ICRISAT), SPSSH 26 (NARIPhaltan) and SPSSH 29 (ICRISAT) were numerically superior to the check by 22%, 20% and 12%. Similarly the test variety SPSSV 36 (Rahuri) was numerically superior to the best check SSV 84 by 24%.
5. SPSSV 34 (ICRISAT) with a brix of 19.2% recorded significant superiority of 10% than the check SSV84.
6. For juice yield, the hybrids SPSSH 30 and SPSSH 28 (ICRISAT) recorded marginal superiority (4% and 3%) over CSH 22SS while the variety SPSSV 35 was superior to both the varietal checks SSV 84 and CSV 19SS by 21% and 4%.
7. None of the hybrids were superior to the check hybrid for calculated bioethanol yields. SPSSV 35 was superior to SSV 84 by 26% and CSV 19SS by 9%.
8. SPSSV 27 and SPSSV 34 were shootfly tolerant among varieties
9. SPSSH 30 recorded lower shootfly deadhearts (%) than check and had tolerance to multiple leaf diseases.

Detailed report: 2008-2009

Eighteen IASSVHT trial entries comprising 8 varieties, and 6 hybrids along with 3 checks (SSV 84, CSV 19SS & CSH 22 SS) were evaluated at 11 locations during kharif 2008. The promising entries for different traits in both hybrids and varieties are presented in the Table 1.

Morpho-phenological traits

Days to 50% flowering varied from 76-88 days. SPSSV 37 (76 days), SPSSV 36 (77) and SPSSV 27 (78) were the earliest ones to flower. Variation among locations revealed that average days to flowering was the lower at Coimbatore followed by Akola, Hyderabad and Anakapalle. In general, varieties were earlier to flower than hybrids.

Days to maturity of hybrids was on par to the check CSH 22SS (124 days). The varieties SPSSV 37 and SPSSV 36 were even earlier than the early check CSV 19SS (3 and 2 days).

Plant height ranged from 267cm (SPSSV 36) to 331cm (SPSSH 29) with a mean of 307cm.

Biomass traits

Total fresh biomass varied from 34 to 57 t/ha (mean of 46 t/ha). None of the test hybrids was significantly superior to the check CSH22 SS. Among the varieties, SPSSV 27 (Rahuri) followed by SPSSV 35 (ICRISAT) recorded a numerical superiority of 17% and 13% over SSV84. However, none of the varieties were superior over CSV 19SS.

Fresh stalk yield differed significantly across locations. Pantnagar recorded lowest mean stalk yield (13.1 t/ha) while Parbhani recorded highest mean stalk yields (53 t/ha). The stalk yield ranged from 25.6 to 42.9 t/ha with a mean of 34.6 t/ha. None of the test hybrids was superior to the check CSH 22SS. Among the varieties, the trend was similar to that of total fresh biomass and SPSSV 27 and SPSSV 35 were numerically superior to SSV 84 by 19% and 13%.

Per day stalk yield ranged from 218 to 351 kg/ha/day (average of 292). None of the hybrids was significantly superior to the check CSH 22SS while SPSSV 27 was 19% numerically superior to SSV 84.

Grain yield ranged from 1251 to 2541 kg/ha with a mean of 1882 kg/ha. None of the test hybrids were significantly superior to the check hybrid CSH 22SS. However, it is worth noting that the test hybrids SPSSH 30 (ICRISAT) SPSSH 26 (NARI-Phaltan) and SPSSH 29 (ICRISAT) were numerically superior to the check by 22%, 20% and 12%. Similarly the test variety SPSSV 36 (Rahuri) was numerically superior to the best check SSV 84 by 24%.

Quality traits

Juice brix at physiological maturity varied between 15.8 and 19.2 % (mean of 17.2%). Among hybrids, SPSSH 26 recorded 4% numerical superiority over CSH 22SS while among test varieties, SPSSV 34 (ICRISAT) with a brix of 19.2% recorded significant superiority of 10% than the check SSV84.

Juice extraction ranged from 30.1 to 40.5% (mean of 36.4%). Among the test hybrids, SPSSH 28 (ICRISAT) recorded 10% higher extraction rate over check CSH22 SS though it produced less stalk

yield than the check hybrid. Among the test varieties, SPSSV 35 (ICRISAT) recorded 4% and 12% higher extraction than the checks SSV84 and CSV 19SS. Lower mean values were recorded at Rahuri followed by Akola for this character.

Juice Yield: Hybrids SPSSH 30 and SPSSH 28 recorded marginal superiority (4% and 3%) over CSH 22SS. However, the variety SPSSV 35 was superior to both the varietal checks SSV 84 and CSV 19SS by 21% and 4%.

Components of total sugars

Total soluble sugars (TSS) ranged from 12.6 to 15% with an average of 13.5%. None of the test hybrids were superior to the check hybrid CSH 22SS. SPSSV 34 (ICRISAT) was significantly superior to checks SSV84 and CSV 19SS by 14% and 19% while SPSSV 31(NRCS) was 15% significantly superior over CSV 19SS.

The range of **reducing sugars** was 1.6 to 2.06% while the range of non-reducing sugars was 8.1 to 14.5%.

In case of **sucrose**, SPSSV 34 (23% and 26%) followed by SPSSV 31 (18% and 22%) were significantly superior to the checks SSV 84 and CSV 19SS.

The CCS (%) and CCS (t/ha) ranged from 7.63-9.48% and 2.36-5.03 t/ha.

Total sugar yields: Sugar yields ranged from 0.89 to 2.01 t/ha with a mean of 1.5 t/ha. None of the test hybrids were superior to the check CSH22 SS. Among the varieties, SPSSV 35 was superior to both the varietal checks SSV 84 and CSV 19SS (26% and 9%) while SPSSV 27 (11%) and SPSSV 34 (8%) were superior to SSV 84 alone.

Ethanol yield: Calculated bioethanol yields ranged from 475 to 1070 L/ha with mean of 799 L/ha. None of the hybrids were superior to the check hybrid. In general, the hybrids (961) recorded more bio ethanol yields than varieties (670). Among the test varieties, SPSSV 35 was superior to SSV 84 by 26% and CSV 19SS by 9% while SPSSV 37 (11%) and SPSSV 34 (8%) were superior to SSV 84 alone.

Per-day bioethanol yields: Per day bioethanol yields varied from 3.9 to 9.3 L/ha/day with a mean of 6.9L. SPSSH 31 (JK seeds) has shown numerical superiority of 7% over CSH22 SS. Among varieties the trend for this trait was similar to ethanol yields.

Resistance to biotic stresses

Shoot fly: The data from 3 locations viz., Rahuri, Akola and Surat indicated that SPSSV 27 (34.4) and SPSSV 34 (36.3%) recorded least deadheart formation among varieties while all the hybrids were equally susceptible as the check hybrid CSH 22SS.

Stem borer: Data from Rahuri alone indicated inadequate infestation of stem borer. However, the entries SPSSV 27 and SPSSV 36 recorded lowest deadheart formation while among the hybrids the check hybrid showed least deadheart percentage.

Diseases: Among the test hybrids, SPSSH 30 showed multiple resistance to leaf blight, zonate leaf spot and Anthracnose. SPSSV 33 among varieties was promising for anthracnose resistance.

Table 1: Promising initial and advanced sweet sorghum varieties and hybrids for stalk yield, biomass, sugar content and bioethanol yields, Kharif 2008

S. No	Trait	Mean	Min	Max	Range	C D (0.05)	Var. check-SSV 84	Var. check-CVS19SS	Hyb. check-CSH22SS	Promising hybrids and varieties superior to checks
1	Time to 50% flowering (d)	82.0	76.0	88.0	12.0	4.0	86	80	85	Hybrids: None Varieties: SPSSV 37 (76), SPSSV 36 (77) and SPSSV 27 (78) were early to flower
2	Time to maturity (d)	121	115	127	12	4.0	125	118	124	Hybrids: None Varieties: SPSSV 37 and SPSSV 36 were early by 3 and 2 days compared to CSV 19SS.
3	Plant height (cm)	307	267	331	64	20	276	308	327	Hybrids: SPSSH 29 Varieties: SPSSV 32 and SPSSV 27 were taller than checks.
4	Fresh biomass (t ha ¹)	45.8	33.6	56.9	23.3	8.7	41.5	48	56.9	Hybrids: Test hybrids were not superior. Varieties: SPSSV 27 (17%) and SPSSV 35 (13%) recorded numerical superiority over SSV 84.
5	Fresh stalk yield (t ha ⁻¹)	34.6	25.6	42.9	17.3	6.5	31.4	36.6	42.9	Hybrids: None Varieties: SPSSV 27 (19%) and SPSSV 35 (13%) were numerically superior to SSV 84.
6	Grain yield (Kg ha ⁻¹)	1882	1251	2541	1290	525	1750	1659	2074	Hybrids: SPSSH 30 (22%), SPSSH 26 (20%) and SPSSH 29 (12%) were numerically superior to CSH 22SS. Varieties: SPSSV 36 (24%) was numerically superior to SSV 84.
7	Juice brix %	17.2	15.8	19.2	3.4	1.4	17.5	17.2	17.5	Hybrids: SPSSH 26 (4%) was numerically superior to CSH 22SS. Varieties: SPSSV 34 recorded 10% significant superiority than SSV84.
8	Juice yield (L ha ¹)	13948	9783	17677	7894	3646	12606	14750	17064	Hybrids: SPSSH 30 (4%) and SPSSH 28 (3%) were numerically superior over CSH 22SS. Varieties: SPSSV 35

S. No	Trait	Mean	Min	Max	Range	C D (0.05)	Var. check-SSV 84	Var. check-CVS19SS	Hyb. check-CSH22SS	Promising hybrids and varieties superior to checks
										was superior SSV 84 and CSV 19SS (21% and 4%).
9	Juice extraction (%)	36.4	30.1	40.5	10.4	3.6	37.4	34.9	36.9	Hybrids: SPSSH 28 recorded 10% higher extraction rate over check Varieties: SPSSV 35 was promising over SSV84 and CSV 19SS (4% and 12%)
10	Total soluble sugars (%)	13.5	12.6	15	2.4	1.6	13.2	12.6	14.2	Hybrids: None Varieties: SPSSV 34 was significantly superior to checks SSV84 and CSV 19SS (14% and 19%). SPSSV 31 was significantly superior (15%) over CSV 19SS.
11	Sucrose (%)	12.1	11.1	14	2.9	1.9	11.4	11.1	13.1	Hybrids: None Varieties: SPSSV 34 (23% and 26%) followed by SPSSV 31 (18% and 22%) were significantly superior to SSV 84 and CSV 19SS
12	Sugar yield (t ha ⁻¹)	1.5	0.89	2.01	1.12	0.62	1.3	1.5	1.98	Hybrids: None Varieties: SPSSV 35 was superior to both the varietal checks SSV 84 and CSV 19SS (26% and 9%). SPSSV 27 (11%) and SPSSV 34 (8%) were superior to SSV 84 alone
13	Bioethanol yield (L ha ⁻¹)	799	475	1090	615	329	693	798	1057	Hybrids: None Varieties: SPSSV 35 was superior to the SSV 84 by 26% and CSV 19SS by 9% while SPSSV 37 (11%) and SPSSV 34 (8%) were superior to SSV 84 alone.

NB: Values in the parentheses indicate the percent superiority over checks.

Annexure I: Compliance report on receipt of data- Kharif -2008

S.No	Locations	Date of sowing	Dead line of data receipt (Date)	Data received on
1	Parbhani*	25-Jun	30-Nov	24-Nov
2	Rahuri*	24-Jun	30-Nov	20-Nov
3	Akola	7-Jul	30-Nov	16-Dec
4	NARI-Phaltan*	9-Jun	30-Nov	26-Nov
5	Anakapalle	22-Jul	30-Nov	15-Dec
6	Perumallapalle	5-Jun	30-Nov	2-Dec
7	Somaiah Institute	13-Jun	30-Nov	12-Jan
8	Almel-Bijapur	Not sown	30-Nov	-
9	Coimbatore*	16-Jun	30-Nov	27-Nov
10	Pantnagar*	27-Jun	30-Nov	26-Nov
11	Ludhiana	3-Jul	30-Nov	25-Dec
12	Surat	8-Jul	30-Nov	18-Dec
13	NRCS *	22-Jun	30-Nov	30-Nov

** Submitted data within deadline*