5. Sorghum Agronomy

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Data tables in Book 2 of 3
Pages: 174-199

Contents

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Executive summary

In All India co-ordinated sorghum improvement project (AICSIP) Agronomic research was planned to conduct mandatory trials and location specific trials in kharif 2007. In mandatory trial, Advanced or prerelease genotypes of AVHT trials of breeding programme were evaluated for their yield potential at different sorghum zones of the country. The location specific research was conducted to improve productivity and profitability of sorghum and sweet sorghum *in situ* soil moisture conservation for higher WUE and INM in sorghum based cropping systems. The details of AICSIP Agronomy technical programme for kharif are presented in Table 1.

Table.1: - Details of AICSIP – Agronomy for kharif - 2007

S. No	Trial	Experiments	Test genotypes	Check genotype	Location	Promising entries / treatments
A.	**Mandatory Trial**					
1.	1(K)A	Evaluation of promising genotypes for their yield potential under rainfed condition in Zone - I	SPV-1733	SPV-1616, SPV-462, CSV-17 and Yellow Jona	Palem, Coimbatore	120 Kg N + 60 Kg P_2O_5 / ha gave 28% higher grain yield than 100% RDF; CSV 17 produced highest grain yield
2.	1(K)B	Evaluation of promising genotypes for their yield potential under rainfed conditions in Zone-II	SPH-1567, SPV-1746	SPV-1616, CSV-17. CSV-15	Akola, Indore, Surat, Dharwad, Parbhani	120 Kg N + 60 Kg P_2O_5 / ha was found optimum; SPH 1567 and SPV 1746 were superior to SPV 1616 & CSV 17
3.	1(K)C	Evaluation of promising genotypes for their potential under rainfed condition Zone-III	SPV-1730, SPV-1733	SPV-1616, SPV-462, CSV-17	Deesa, Udaipur, Pantnagar, Mauranipur	80 Kg N + 40 Kg P_2O_5 / ha was found optimum; SPV 1730 and SPV 1733 were superior to CSV 17 but on par with SPV 462
4	1(K)D	Evaluation of promising genotypes for their yield potential under rainfed condition late kharif early rabi zone	SPH-1577	SPV-1616, SPV-462, CSV-17	Kovilpatti	120 Kg N + 60 Kg P_2O_5 / ha revealed maximum grain yield; SPH 1577 was superior to CSV 17
5	1(K)E	Evaluation of promising genotypes (Dual purpose) for their yield potential under rainfed conditions	SPV-1750, SPV-1753, SPV-1754, CSV-15, SPH-1467	--	Palem, Udaipur, Pantnagar, Coimbatore	80 Kg N + 40 Kg P_2O_5 / ha was found optimum; SPH 1467 produced highest grain yield
B.	**Location specific trials**					
6.	1.1(A)	Maximization of sweet sorghum cane yield	SSV-84, CSV-19SS/ CSH-22SS	--	Akola, Coimbatore, Pantnagar, Solapur	Sweet sorghum genotypes CSH 22SS, SSV 84, CSV 19SS sown at row spacing 45 cm x 15 cm fertilized with 120 kg N / ha was promising
7.	1.1(B)	Evaluation of sweet sorghum genotypes for their yield potential at different fertility levels	SPSSV-11, SPSSV-15, SPSSV-20	SSV-84, CSV-19SS, CSH-22SS	Akola, Coimbatore, Indore, Pantnagar, Solapur	Sweet sorghum genotypes SPSSV 20 was high yielding. Response to 120 kg N / ha + 60 Kg P_2O_5 / ha was significant
8.	1.2	Integrated nutrient and moisture conservation in kharif sorghum	CSH-14	--	Parbhani, Akola, Dharwad, Udaipur	Opening furrow at 21 DAS along with 80 Kg N + 40 Kg P_2O_5 / ha was found optimum
9.	1.3	Studies on nutrient uptake grain and stover qualities of different sorghum genotypes	SPV-1616, CSV-15, CSH-16, SSV-84, HC-308 and SSG-59-3		Coimbatore, Parbhani, Dharwad, Indore, Udaipur, Deesa, Solapur Pantnagar	CSH 16 revealed highest DDM at crude protein yields
10.	2.1	Nutrient recycling in sorghum based double cropping system			Indore, Surat	Sorghum in Sorghum (K)-chickpea sequence responded significantly up to 80 Kg N + 40 Kg P_2O_5 / ha
11.	3.1	Effect soil moisture conservation practices on yield of sorghum			Indore	Moisture conservation through earthing up at 25 DAS and application of glycidia were promising
12.	3.2	Response of forage sorghum genotypes to different fertility level	UTFS- 43, HC-308, S -540 and S-541	--	Dharwad	Forage sorghum genotype UTFS 43 was highest yielding; Response to 30 Kg N / ha was significant

Mandatory trials

Trial 1 (K) A- Evaluation of promising genotypes for their yield potential under rainfed condition in Zone – I

Test genotype SPV-1733 along with SPV-1616, SPV-462 and CSV-17 were evaluated at three fertility level (50, 100 and 150% RDF). In zone-I at Palem 150% RDF (2942 kg/ha) revealed significantly higher grain yield with compared with 50 or 100% RDF. The response was 646 kg/ha over 100% RDF, which was 28.2 percent higher than 100% RDF (2294 kg/ha), similarly 150% RDF produced maximum stover yield (9.6 t/ha) and total biomass (12.5 k/ha). Genotype CSV-17 produced the highest grain yield (2914 kg/ha) followed by SPV-462 and SPV-1616 and Yellow sorghum. Test genotype SPV-1733 produced lowest yields grain, stover and total biomass (2041 kg/ha, 6.5 t/ha 8.5 t/ha respectively).

Trial 1 (K) B: Evaluation of promising genotypes for their yield potential under rainfed conditions in Zone-II

The experiment was conducted at Akola, Dharwad, Indore and Parbhani and Surat. Crop responded significantly upto 150% RDF at all locations. The increase in grain yield with 150% RDF was 38.5 and 11.3 percent compared to 50% and 100% RDF (3050 and 3794 kg/ha, respectively). The stover yield and total biomass yield were on par with 100% and 150% RDF. Genotypes, SPH-1567 and SPV-1746 (4016 and 4034 kg/ha) were on par with CSH-16 (4060 kg/ha) and CSV-15 (3684 kg/ha) however were significantly superior to SPV-1616 (3420 kg/ha) and CSV-17 (2924 kg/ha). Significant interaction between genotypes x fertility level at Dharwad and Indore for grain yield revealed the highest grain yield of 5247 kg/ha with combination SPH-1567 and 150% RDF at Dharwad and the highest grain yield of 7315 kg/ha with SPV-1746 at 100% RDF at Indore. Total biomass at Dharwad increased with increase in fertility levels up to 150% RDF with SPH-1567, SPV-1746 and CSV-17 genotypes, while the response was significant upto 100% RDF in SPV-1616 and CSV-15. At Indore, on the basis of total biomass genotypes, SPV-1616, SPH-1567 responded upto 150% RDF, while genotypes. CSV-15 and SPV-1746 and CSH-16 responded significantly upto 100% RDF.

Trial 1(K) C: Evaluation of promising genotypes for their yield potential under rainfed condition Zone-III

In zone III, in the mean data of Dessa, Udaipur and Pantnagar, the response to fertilizer was significant upto 100% RDF (80:40: kg NP per ha). The increase in fertility levels upto 150% RDF increased grain yield to 3569 kg/ha which was on par with 100% RDF (3441 kg/ha). Fertility level of 100 and 150% RDF increased grain yield by 21.7 and 26.3 percent respectively compared to 50% RDF (2826 kg/ha). The highest stover and total biomass was recorded with 150% RDF (17.5 and 21.1 t/ha respectively). Genotypes SPV-1730 and SPV-1733 (3217 and 34 94 kg/ha) was on par with SPV-1616 and SPV-462 (3524 and 3300 kg/ha) but significantly superior to CSV-17 (2856 kg/ha grain yield). SPV-1730 produced the highest stover yield (19.46 and total biomass (22.68 t/ha) were however recorded followed by SPV-1733 and SPV-1616, SPV-462, CSV-17. The harvest index of genotypes was 0.15-0.24 with 1000 seed of 25.96-31.42g, where SPV-1730 was bold seed (31.42g 1000 seed wt).

Trial 1 (K) D: Evaluation of promising genotypes for their yield potential under rainfed condition: Late kharif early rabi zone

Fertility level of 150% RDF produced maximum grain yield (2261 kg/ha) which was significantly superior to 50% RDF (1978 kg/ha) and 100% RDF (2117 kg/ha). Similarly 150% RDF produced maximum stover yield (5.6 t/ha) as well as the total biomass (8.3 t/ha). SPH-1577, produced significantly higher grain yield (2293 kg/ha) compared to SPV-1616, SPV- 462 and CSV-17 (1861, 2109 and 2212 kg/ha). CSV-17, SPV-1616 responded significantly upto 150% RDF.

Trial 1(K) E: Evaluation of promising genotypes (Dual purpose) for their yield potential under rainfed conditions

The response to fertility level in terms of grain yield was significant at Palem and non significant at Udaipur. Total biomass increased significantly upto 150% RDF at Palem (12.2 t/ha). Stover yields at Palem, Udaipur and Pantnagar increased significantly upto 100% RDF compared to 50% RDF. In mean data of Palem and Udaipur, genotypes did not vary significantly for grain, stover and total biomass. The highest grain yield was recorded with SPH1467 (3590 kg/ha) followed by, CSV15 (3588 kg/ha), SPV1753 (3547 kg/ha) and SPV-1754 (2926 kg/ha).

Location specific trials

Trial 1.1 A: Maximization of sweet sorghum cane yield

The optimum row spacing and nitrogen fertilization was found out for sweet sorghum genotypes at Akola, Coimbatore, Indore, Solapur and Pantnagar. The cane yield production potential of sweet sorghum was 36.7, 36.8, 24 and 29 tones per ha at Akola, Coimbatore, Solapur and Pantnagar respectively with brix value of upto 11.5 – 18.3 percent and juice yield 10891 – 12659 liters per ha. CSH-22SS had maximum cane yield potential (38 t/ha) followed by SSV-84 (30.7 t/ha) and CSV-19SS (26.8 t/ha). Row spacing of 45cm × 15cm revealed the maximum cane yield (34 t/ha) as well as juice yield (10020 liters/ha) compared to 60cm × 15cm (29.1 t/ha cane yield and 8800 liter/ha juice yield). An application of 120 kg N/ha produced highest cane yield (35.2 t/ha) which was 23.5 percent higher than 30 kg N/ha (28.5 t/ha).

Trial 1.1 B: Evaluation of sweet sorghum genotypes for their yield potential at different fertility levels

Six genotypes of sweet sorghum viz SPSSV-11, SPSSV-15, SPSSV-20, SSV-84, CSV-19SS and CSH-22SS were evaluated for their yield potential and fertility response (50, 100 and 150% RDF) at Akola, Coimbatore, Indore and Solapur. The response to 150% RDF was significant at Akola while at Solapur and Coimbatore response to fertilizer application was absent. Sweet sorghum genotype SPSSV-20 produced the maximum cane yield (36.5 t/ha), SPSSV-11 (34.1 t/ha) and SPSSV-15 (32.7 t/ha) compared to SSV-84 (28.0 t/ha).

Trial 1.2: Integrated nutrient and moisture conservation in kharif sorghum
Suitable land layout for soil moisture conservation and fertilizer application for kharif sorghum were found out at Parbhani, Akola, Dharwad and Udaipur. The moisture conservation through opening of furrow at 3 week stage in 45cm row spaced or paired planted (30:60:30) kharif sorghum revealed the higher grain yield (4782 and 4512 kg/ha respectively) compared to flat bed at 45 row spacing (3832 kg/ha). Application of 100% RDF (80:40:40 kg NPK/ha) or 50% RDF + 25 t/ha FYM (4135 and 3871 kg/ha respectively) were significantly superior to organic nutrient viz 5 t/ha FYM + Azospirillum + PSB (3492 kg/ha).

Trial 1.3: Studies on nutrient uptake grain and stover qualities of different sorghum genotypes
In kharif – 2006, various forage quality parameters viz content of dry matter, nitrogen and crude protein, metaboligable energy and IVDMD were determined in different sorghum genotypes. The content of dry matter of different sorghum genotypes varied significantly. N uptake was maximum in NSSH-104 (121.8 kg/ha) followed by CSH-16 (120.5 kg/ha) and HC-308 (119.2 kg/ha). SSV-84 had lowest N uptake (95.6 kg/ha). Similarly NSSH-104 produced their highest crude protein yield (760.5 kg/ha) followed by CSH-16 and HC-308. With regards to digestible dry matter yield, CSH-16 registered highest DMD yield (8185 kg/ha) followed by SPV-1616 (8102 kg/ha) and NSSH-104 (7998 kg/ha). SSV-84 registered lowest crude protein yield (658 kg/ha) and SSG 59-3 registered lowest DMD yield (6467 kg/ha). In kharif – 2007, six sorghum genotypes comprising three grain types (CSV-15, SPV-1616 and CSH-16), two forage type (HC-308 and SSG 59-3) and one sweet sorghum (SSV-84) were evaluated for their yield and nutrient uptake and stover quality at location viz Coimbatore, Dessa, Dharwad, Indore, Parbhani, Solapur, Surat and.

Trial 2.1: Nutrient recycling in sorghum based double cropping system
Effect of application of inorganic fertilizer (100% RDF) or vermicompost @ 2 t/ha + 50% RDF was found out in kharif sorghum based double cropping sequence viz Sorghum – chickpea / field pea / lentil at Indore or Sorghum - chickpea / Indian bean / green gram at Surat. At Indore, RDF revealed the highest grain yield of sorghum (6020 kg/ha), whereas, INM of vermicompos t @ 2 t/ha + 50% RDF was better at Surat (2325 kg/ha) grain yield.

Trial 3.1: Effect soil moisture conservation practices on yield of sorghum
Ridges and furrow layout or earthing up at 25 DAS, increased grain yield by 14.5 and 13.5 percent compared to flat bed layout (6524 kg/ha) (Table 3.1). Among organic amendments, the incorpation of green biomass or glyricidia @ 6 t/ha were promising and increased grain yield by 46 percent over FYM or straw mulch (7068 and 6903 kg/ha).

Trial 3.2: Response of forage sorghum genotypes to different fertility level
The highest dry matter yield was recorded with genotype UTFS- 43 (16.65 t/ha) and the forage sorghum responded significantly up to 30 kg N/ha for grain yield. The interaction between G × N indicated that for grain yield UTFS- 43 and HC-308 responded significant up to 30 kg N/ha. In S-541 response was significant up to 50 kg N/ha.

Experimental results

Mandatory Trials

Trial 1 (K) A: Evaluation of promising sorghum genotypes for their yield potential under rainfed condition in (Zonel Palem and Coimbatore)
In this mandatory trial, the test genotypes SPV-1733 along with checks viz CSV-17, SPV-1616 and SPV- 462 were evaluated at three fertility levels of 50, 100 and 150% RDF (RDF 80:40:40 kg NPK per ha). The trial was conducted at Palem and Coimbatore. Data from Palem in Zone-I have been presented Table 1 (K) A

Yields of grain, stover and total biomass were not varied significantly due to levels of fertility and genotypes at Palem (Table 1 (K) A) except grain yield. Which was significantly superior with 150% RDF (2942 kg/ha) compared to 50% RDF (1953 kg/ha). The higher fertility level of 150% RDF, increased grain yield, stover yield and total biomass by 28.2, 19.6 and 22 percent respectively compared to 100% RDF (2294, 7757 and 10050 kg/ha of grain, stover and total biomass respectively). However, variation in yield with 100% RDF and 150% RDF was not significant. The 150% RDF revealed significantly tallest (249 cm) compared to 50 and 100% RDF.

Table: 1 (K) A: Growth and yield of kharif sorghum genotypes at different fertility level (Zone-I Palem)

Treatments	Grain yield (kg/ha)	Stover yield (kg/ha)	1000 seed wt (g)	HI	Plant height (cm)	Total Biomass (t/ha)
Fertility levels						
50% RDF	1953	6220	21.38	0.24	205	8.17
100% RDF	2294	7757	19.06	0.23	232	10.05
150% RDF	2942	9284	21.83	0.24	249	12.26
CD (0.05)	919	NS	2.67	0.03	16.0	NS
Genotypes						
SPV-1733	2041	6482	17.41	0.24	236	8.52
SPV-1616	2258	7492	20.71	0.23	211	9.75
SPV-462	2515	7678	23.33	0.25	228	10.19
Y.J.	2253	7501	22.51	0.23	334	9.75
CSV-17	2914	9616	19.82	0.24	133	12.53
CD (0.05)	NS	NS	4.42	0.02	19	NS

The yields of grain, stover and total biomass of genotypes not varied significantly. CSV-17 registered maximum yields of grain, stover and total biomass (2914, 9616 and 12530 kg/ha respectively). Whereas, test genotype SPV-1733 produced lowest yields of grain, stover and total biomass (2041, 6482 and 8520 kg/ha respectively). SPV-462 was significantly tallest (334 cm) compared to the other genotypes, while CSV-17 had lowest plant height (133 cm). The plant height of genotypes SPV-1733, SPV-462 and SPV-1616 were on par (236,228 and 211 cm respectively). The interaction between fertility levels and genotype was not significant.

Trial 1 (K) B: Evaluation of promising genotypes for their yield potential under rainfed condition in (Zone-II Akola, Dharwad, Indore, Parbhani and Surat)

In this a field experiment, two test genotypes of SPH-1567 and SPV-1746 along with checks of SPV-1616, CSV-17, CSV-15 were evaluated at three fertility level of 50, 100 and 150% RDF (RDF 80:40:40 kg NPK per ha). The experiment was conducted in Zone-II comprising the AICSIP centers viz Akola, Dharwad, Indore, Parbhani and Surat. The data from Akola, Dharwad, Indore, and Parbhani have been presented (Table: 1 (K) B1). In mean data 150% RDF revealed significantly highest grain yield (4224 kg/ha), stover yield (11.24 t/ha) and total biomass (15.5 t/ha).

Table: 1 (K) B.1: Evaluation of promising sorghum genotypes for their yield potential and fertility response in Zone – II (Mean of Akola, Dharwad, Indore and Parbhani)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (t/ha)	HI	1000 seed wt (g)	Total Biomass (t/ha)	Plant stand 000/ha
Fertility levels								
50% RDF	74	209	3056	8.67	0.25	25.1	11.72	199
100% RDF	73	225	3794	10.43	0.26	25.3	14.22	204
150% RDF	75	230	4224	11.24	0.27	26.0	15.47	201
CD (0.05)	–	13	424	1.19	NS	1.0	1.53	8.2
Genotypes								
SPH-1567	78	244	4016	10.72	0.27	23.7	14.74	199
SPV-1746	77	222	4034	11.30	0.25	25.0	15.33	200
SPV-1616	75	273	3420	11.28	0.22	26.7	14.70	201
CSV-17	62	126	2924	6.64	0.29	23.0	9.56	200
CSV-15	75	268	3684	11.4	0.23	26.6	15.08	203
CSH-16	71	195	4060	9.34	0.29	28.8	13.41	204
CD (0.05)	–	25.0	441.0	1.75	0.03	1.87	1.877	8.0

At Indore 100% RDF produced significantly higher grain yield than 50% RDF. Genotypes varied significantly for growth and yields of grain, stover and biomass (Table 1 (K) B.1). Significantly tallest (273 cm) than SPV-1616, SPV-1746 and SPH-1567 than all genotypes but was on par CSV-15. Similarly SPH-1567 was significantly taller than CSH-16. Grain yields of SPH-1567 produced significantly higher grain yield compared to SPV-1616 and CSV-17 but was on par with CSV-15. Stover yields of SPH-1567 was on par with CSH-16. Similarly stover yield of SPV-1746 was on par with CSV-15, and SPV-1616 but significantly superior to CSV-17 (664 t/ha). SPH-1567 had significantly lowest 1000 seed wt (23.78) compared to CSH-16 (28.8). SPV-1746 had higher 1000 seed wt than CSV-17 but had almost similar 1000 seed

wt compared to SPV-1616 and CSV-15. The interaction between fertility levels and genotypes was significant for total biomass at Dharwad and Indore (Table 1 (K) B.2).

Table 1 (K) B.2: Total biomass (t/ha) as influenced by fertility level and genotype interaction at Dharwad and Indore

Center	Dharwad				Indore			
Fertility	F 1	F 2	F 3	Mean	F 1	F 2	F 3	Mean
SPH-1567	13.6	16.0	17.5	15.6	14.9	21.8	25.3	20.7
SPV-1746	13.8	15.4	17.0	15.4	15.5	21.0	19.9	18.8
SPV-1616	12.6	13.7	14.8	13.7	18.2	22.7	24.8	21.9
CSV-17	9.4	10.8	13.1	11.1	8.5	9.9	11.7	10.0
CSV-15	11.3	14.7	15.0	13.7	18.3	24.6	23.5	22.1
CSH-16	11.8	16.9	17.8	13.5	14.7	17.2	17.7	16.5
Mean	12.1	14.5	15.8		15.0	19.5	20.5	

Table 1 (K) B.3: Grain and stover yields as influenced by interaction of fertility and genotype at Surat

	Grain yield (kg/ha)				Stover yield (t/ha)			
Genotypes	F 1	F 2	F 3	Mean	F 1	F 2	F 3	Mean
SPH-1567	1165	1711	1906	1594	7.17	7.51	7.86	7.52
SPV-1746	716	1068	1761	1182	4.52	7.50	7.27	6.40
SPV-1616	1159	1986	2299	1815	7.06	7.60	7.58	7.41
CSV-17	1123	2063	2449	1878	6.85	7.72	7.49	7.52
CSV-15	738	992	1142	957	4.67	7.52	5.38	5.86
CSH-16	1088	1751	1900	1580	6.96	6.74	7.48	7.06
CD (0.05)	171.2	--	--		6.21	7.43	7.25	

At Dharwad, response to fertility was significant upto 150% RDF over 50 and 100 RDF in SPH-1567, SPV-1746 and CSV-17 compared whereas SPV-1616 CSV-15 and CSH-16 responded significantly upto 100% RDF. SPH-1567 and SPV-1746 were more response to higher fertility which recorded higher biomass yields (17.5, 17.8 17.0 t/ha) compared to CSV-17, SPV-1616 and CSV-15 (13.1, 15.0 and 14.8 t/ha) at 150% RDF (Table 1 (K) B.2). At Indore, response upto 150% RDF was significant in SPH-1567 and SPV-1616 while, significant increase in total biomass was upto 100% RDF in SPV-1746, CSV-15 and CSH-16. SPH-1567 (25.3), SPV-1616 (24.8 t/ha) were superior to other genotypes at 150% RDF.

Trial 1 (K) C: Evaluation of promising sorghum genotypes to their yield potential at different fertility levels under rainfed condition s (ZoneIII Dessa, Pantnagar, Udaipur and Mauranipur)

A field experiment comprised of treatments combinations of 3 fertility levels (50, 100 and 150% RDF) and 5 genotypes (SPV-1730, SPV-1733 as test genotypes, CSV-17, SPV-1616 and SPV-462 as check) was conducted at Dessa, Pantnagar and Udaipur in Kharif -2007.

Fertility level of 150% RDF revealed maximum plant height (233 cm), and yield of grain (3569 kg/ha), stover (17.56 t/ha) and biomass (21.13 t/ha) which was significantly superior compared to 50% RDF. The variation due to 100% RDF and 150% RDF was not significant (Table 1 (K) C.1). The crop reached 50% flowering by 74-75 days at different fertility levels. Grain yield was 21.7 and 27.2 percent higher with 100 and 150% RDF compared to 50% RDF (2826 kg/ha). Similarly total biomass was 14.2 and 24 percent higher with 100 and 150% RDF compared to 50% RDF (17.02 t/ha).Genotypes differed significantly for days to50% flower, plant height and yield of grain, stover and total biomass and 1000 seed weight.

Test genotypes SPV-1730 and 1733 were late in 50% flowering (79, 80 days) compared to check CSV-17 (57 days). Grain yield of SPV-1730 sand SPV-1733 (3217 and 3494 kg/ha) were on par with check genotypes viz SPV-1616 and SPV-462 (3524 and 3300 kg/ha) but significantly superior to CSV-17 (2856 kg/ha). The similar trend was noticed for stover yield and total biomass (Table 1 (K) C). SPV-1730 and SPV-1733 had lower HI than CSV-17 (0.24) but were on par with SPV-462 and SPV-1616.

Table: Trial 1 (K) C.1: Growth and yield of kharif sorghum genotypes at different fertility level Zone – III (Mean of Dessa, Udaipur and Pantnagar)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (t/ha)	Total biomass (t/ha)	HI	1000 seed wt (g)
Fertility levels							
50% RDF	75	216	2826	14.2	17.02	0.17	28.6
100% RDF	74	229	3441	16.0	19.44	0.18	29.5
150% RDF	74	233	3569	17.56	21.13	0.18	29.9
CD (0.05)	NS	10.0	531	2.038	2.364	NS	NS
Genotypes							
SPV-1730	79	286	3217	19.46	22.68	0.15	31.4
SPV-1733	80	216	3194	17.83	21.33	0.17	28.9
CSV-17	57	129	2856	9.23	12.09	0.24	26.0
SPV-1616	78	253	3524	17.05	20.57	0.18	30.5
SPV- 462	77	245	3300	16.02	19.32	0.17	29.9
CD (0.05)	4.6	35.0	405	3.092	3.344	0.03	3.01

Table: Trial 1 (K) C.2: Total biomass (t/ha) as influenced by fertility level and genotypes in zone – III

Genotypes	F 1	F 2	F 3	Mean
SPV-1730	9.7	10.4	12.3	10.8
SPV-1733	10.6	13.0	14.8	12.8
CSV-17	5.7	6.3	7.2	6.4
SPV-1616	7.7	9.7	11.8	9.7
SPV- 462	9.6	12.3	14.6	12.1
Mean	8.6	10.3	12.1	

CD for main plot at different sub plot – 609; CD for sub plot at different main plot – 592

Trial 1 (K) D: Evaluation of promising sorghum genotypes for their yield potential under rainfed conditions. (Zone – Late Kharif early Rabi – Kovilpatti)

Four sorghum genotypes viz SPH-1577, CSV-17, SPV-1616 and SPV-462 were evaluated at 3 fertility levels of 50, 100 and 150% RDF (RDF 80:40:40 kg NPK/ka) at Kovilpatti in Late Kharif-2007. Days to 50% flowering and yields of grain, stover and total biomass were affected significantly due to fertility levels 150% RDF hastened flowering to (66 days compared to 50% RDF (68 days to 50% flowering). Harvest index was on par with different fertility levels. Fertility level of 150% RDF produced the high grain yield (2261 kg/ha) which was significantly superior to 50% RDF (1978 kg/ha) and 100% RDF (2117 kg/ha) (Table 1 (K) D.1). Stover yield and total biomass with 100% RDF (4891 and 5269 kg/ha respectively) (Table 1 (K) D.1). The similar trend was seen with total biomass.

Table: 1 (K) D.1: Growth and yield of sorghum genotypes at different fertility level in Late Kharif (Kovilpatti)

Treatments	Days to 50% flowering	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (t/ha)	HI	Plant stand (000/ha)
Fertility levels						
50% RDF	68	1978	4891	6869	0.29	70.05
100% RDF	67	2117	5269	7385	0.30	69.68
150% RDF	66	2261	5623	7884	0.29	69.91
CD (0.05)	–	71	465	417	NS	0.25
Genotypes						
CSV-17	57	2212	3713	5925	0.37	69.63
SPV-1616	70	1861	6108	7969	0.23	70.12
SPV-462	70	2109	6191	8300	0.25	69.69
SPH-1577	69	2293	5031	7323	0.32	70.06
CD (0.05)	–	73	260	269	0.01	0.44

Table: 1 (K) D.2: Grain yield (kg/ha) as influenced by fertility and genotype interaction in late kharif sorghum

Genotypes	F 1	F 2	F 3	Mean
CSV-17	2070	2194	2370	2212
SPV-1616	1676	1778	2130	1861
SPV-462	1930	2187	2209	2109
SPH-1577	2235	2307	2335	2293
Mean	1978	2117	2261	2119

CD for Fertility level -127; CD for genotypes at different fertility level-130

Genotypes varied significantly for growth and yields of grain, stover and total biomass (Table 1 (K) D.1). CSV-17 flowering in 57 days was early compared to the SPV-1616, SPV-462 and SPH-1577 (70, 70 and 69 days to 50% flowering). CSV-17 had highest HI (0.37) followed by SPH-1577, SPV-462 and SPV-1616. SPH-1577 produced significantly higher grain yield (2293 kg/ha) compared to SPV-1616, SPV-462 and CSV-17 (1861, 2109 and 2212 kg/ha respectively). SPV-462 produced highest stover and total biomass (6191 and 8300 kg/ha respectively) followed by SPV-1616. CSV-17 produced the lowest stover (3713 kg/ha), total biomass (5925 kg/ha). The significant interaction between fertility levels and genotypes for grain yield indicated significant response upto 150% RDF in CSV-17 and SPV-1616 (2370 and 2130 kg/ha) compared to 50 and 100% RDF whereas the variation in grain yield due to 100 and 150% RDF was not significant in SPV-462 and SPH-1577 (Table 1 (K) D.2).

Trial 1 (K) E: Evaluation of promising sorghum genotypes (Dual purpose) for their yield potential and fertilizer response under rainfed conditions.

This was the first year of experimentation. Dual purpose test genotypes SPV-1750, SPV-1753, SPV-1754 and SPH-1467 and CSV-15 as check were evaluated at 3 fertility levels of 50, 100 and 150% RDF. The Experiment was conducted in spilt plot design with fertility levels as main plots and genotypes as sub plot treatment with 3 replication at Palem, Udaipur and Pantnagar during Kharif – 2007. Fertility level of 100% RDF resulted in significantly taller plants (246 cm plant height) compared to 50% RDF (229 cm) (Table 1 (K) E1). Grain and stover yields did not vary significantly due to fertility levels, however, 150% RDF registered 36.4 and 21.1 percent higher grain and stover yields compared to 50% RDF (2430 kg/ha grain and 10.89 t/ha stover yield).

Genotypes varied significantly with respect to plant height and grain yields. SPV-1753 and SPV-1754 flowered in 75 and 76 days were early compared to SPV-1750 (80 days) and CSV-15 (79 days). SPH-1467 flowered in 67 days. SPV-1754 and SPH-1467 (250 and 254 cm plant height) were significantly taller than SPV-1750, SPV-1753 and CSV-15 (234, 235 and 231 cm plant height). At Palem SPV-1750 produced significantly lowest grain yield (1882 kg/ha) whereas CSV-15 produced the maximum grain yield (3008 kg/ha). In mean data, SPV-1753 (3547 kg/ha) was on par with CSV-15 and SPH-1467 (3590 and 3588 kg/ha). At Surat, dual purpose sorghum responded similarly to 100% RDF compared to 50% RDF and variation in grain yield with 100% and 150% RDF was not significant (Table 1 (K) E.2). Stover yield were not varied significantly due to fertility level. Genotypes SPV-1750 and SPV-1753 (1962 and 1915 kg/ha respectively) were on par to each other but both were significantly superior to SPV-1754 (1316 kg/ha) and CSV-15 (702 kg/ha) (Table 1 (K) E.2). Similar trend was noted in stover yields. The interaction between fertility level and genotypes revealed significant response upto 150% RDF in SPV-1750 and SPV1754, while it was upto 100% RDF in SPV-1754.

Table: 1 (K) E1: Growth and yield of sorghum genotypes (Dual purpose) at different fertility levels (Mean of Palem, Udaipur and Pantnagar)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg /ha)	Stover yield (t/ha)	HI	1000 seed wt (g)
Fertility levels						
50% RDF	69	229	2430	10.89	0.21	20.9
100% RDF	67	246	3010	12.52	0.23	21.9
150% RDF	61	247	3315	13.19	0.23	21.6
CD (0.05)	1.0	10.0	NS	NS	--	NS
Genotypes						
SPV-1750	80	234	1882	11.74	0.23	21.3
SPV-1753	75	235	3547	13.68	0.24	23.5
SPV-1754	76	250	2926	13.67	0.23	24.2
SPH-1567	67	254	3590	13.79	0.26	25.5
CSV-15	79	231	3588	12.01	0.29	23.6
CD (0.05)	NS	12.0	806	NS	NS	NS

Table: 1 (K) E.2: Effect of fertility level and genotype interaction on grain and stover yield of sorghum

	Grain yield (kg/ha)				Stover yield (t/ha)			
Genotype	**F 1**	**F 2**	**F 3**	**Mean**	**F 1**	**F 2**	**F 3**	**Mean**
SPV-1750	1665	1998	2223	1962	7.53	7.72	6.38	7.21
SPV-1753	1597	1890	2259	1915	7.44	7.69	8.62	7.92
SPV-1754	949	1626	1371	1316	6.62	6.42	6.29	6.33
CSV-15	722	762	622	702	6.06	5.75	5.95	5.92
Mean	1233	1569	1619	--	6.82	6.89	6.81	--
CD (0.05)	153.7				0.89			

Location specific trials

Trial 1.1 (A): Maximization of sweet sorghum cane yield

This was the second year of experimentation. Treatments comprised of combinations of two row spacing (45×15 and 60×15 cm), two genotypes of sweet sorghum (SSV-84 and CSV-19SS / CSH-22SS) and four levels of nitrogen (30,60,90 and 120 kg N/ha). An experiment was conducted at Akola, Coimbatore, Pantnagar and Solapur.

The cane yield of sweet sorghum was 36.7, 36.8, 24 and 29 t/ha at Akola, Coimbatore, Solapur and Pantnagar respectively (Table 1.1 (A.1)) Row spacing of 45×15 revealed significantly higher green cane yield of sweet sorghum (34.1 t/ha) compared to 60×15 row spacing (Table: 1.1 (A)). At Solapur however cane yield was maximum with wider row spacing (25.0 t/ha) than narrow row spacing (22 t/ha). The juice yield did not vary significantly due to row spacing, and 45×15 spacing revealed 10020 liter/ha juice yield compared to 8800 kiloliters per ha with 60×15 cm. Wider row spacing had higher brix value (16.8%) than 45×15 row spacing (15.3%). Juice extraction with different spacing was 37-39%. Narrow row spacing had taller plants compared to wider row spacing (Table 1.1 A.2).

Performance of genotypes: The green cane yield of sweet sorghum genotypes varied significantly at Akola, Coimbatore and Solapur and not significantly at Pantnagar (Table 1.1A). CSH-22SS (NSSH-104) produced the maximum cane yield (38.1 t/ha) followed by SSV-84 (30.7 t/ha) or CSV-19SS (26.8 t/ha). At Akola and Coimbatore CSH-22SS, (38.7 and 37.5 t/ha) was significantly superior to SSV-84 (34.8 and 36 t/ha), CSV-19SS (24.5 t/ha) was superior to SSV-84 (22.1 t/ha) at Solapur. Juice yield of Genotypes varied 5938-9780 liter/ha at Akola and 10893-11030 liter/ha at Pantnagar (Table 1.1 A.1). SSV-84 had higher brix value (17.0%) followed by CSV-19SS (15.6%) and CSH-22SS (15.3%). The plant height of CSH-22SS was significantly higher than SSV-84 at Akola and Pantnagar Table (1.1 (A).2). At Solapur CSV-19SS was significantly taller than SSV-84. In mean data CSV-19SS (302 cm) was tallest followed by CSH-22SS (292 cm) and SSV-84 (242 cm).

Effect of Nitrogen level: Sweet sorghum responded significantly upto 120 kg N/ha in terms of plant height and yield of green cane, juice and grain (Table 1.1(A)1 and Table 1.1(A).2). The maximum plant height was recorded at 120 kg N/ha (264 cm) compared to 30 kg N/ha (239 cm) The maximum green cane yield was recorded at 120 kg N/ha Akola, Coimbatore, Pantnagar and Solapur (43.2, 37.9, 33.5 and 26.0 t/ha respectively) compared to 30, 60 and 90 kg N/ha. Similarly juice yield increased with increase in N levels upto 120 kg N/ha at Akola (10891 liter/ha) and upto 90 kg N/ha at Pantnagar (11895 liter/ha). The grain yield of sweet sorghum genotypes increased significantly upto 120 kg N/ha (1745 and 3167 kg/ha at Akola and Coimbatore respectively).

Table 1.1A1: Green Cane and Juice yield of sweet genotypes at different row spacing and levels of nitrogen

Treatments	**Green Cane Yield (t/ha)**					**Juice Yield (liter/ha)**			**Brix value (%)**			
	Akola	*Coim*	*Pant*	*Solapur*	*Mean*	*Akola*	*Pant*	*Mean*	*Akola*	*Coim*	*Pant*	*Mean*
Row spacing												
45 x 15	44.5	39.0	31.0	21.9	34.1	8663	11377	10020	16.8	12.3	15.3	14.8
60 x 15	29.1	34.5	27.4	25.2	29.1	7054	10545	8800	16.3	11.4	16.8	14.8
CD (0.05)	2.58	0.69	NS	NS	--	556	NS	--	--	-	NS	--
Genotypes												
SSV-84	348	36.0	29.9	22.1	30.7	5938	11030	8484	17.8	16.7	16.5	17.0
CSV-19SS	--	--	28.6	24.9	26.8	--	10893	10893	--	--	15.6	15.6
CSH-22SS	38.7	37.5	--	--	38.1	9780	--	9780	15.3	7.0	--	15.3
CD (0.05)	2.58	0.69	NS	1.65	--	556	NS	--	--	--	NS	--
Level of Nitrogen (Kg N/ha)												
30	31.1	35.8	25.6	21.4	28.5	5580	8705	7143	15.2	12.3	17.7	15.1
60	34.3	36.4	27.3	22.8	30.2	6690	10586	8638	16.0	12.1	15.7	14.6

Treatments	Green Cane Yield (t/ha)					Juice Yield (liter/ha)			Brix value (%)			
	Akola	*Coim*	*Pant*	*Solapur*	*Mean*	*Akola*	*Pant*	*Mean*	*Akola*	*Coim*	*Pant*	*Mean*
90	38.5	36.9	30.4	23.9	32.4	7945	11895	9920	16.6	11.5	16.3	14.8
120	43.2	37.9	33.5	26.0	35.2	10891	12659	11775	18.3	11.5	14.5	14.7
C.D. (0.05)	2.96	0.55	3.07	3.06	--	528	1122.9	--	--	--	NS	--

Table 1.1A.2: Plant height, grain yield total biomass of sweet sorghum genotypes at different row spacing and levels of nitrogen

Treatments	Plant height (cm)					Grain yield (kg/ha) (cm)			Stem girth (cm)			
	Akola	*Coim*	*Pant*	*Solapur*	*Mean*	*Akola*	*Coim*	*Mean*	*Coim*	*Pant*	*Solapur*	*Mean*
Row spacing												
45 x 15	281	175	272	288	254	2277	1779	2028	5.9	2.57	4.24	4.24
60 x 15	271	176	271.6	290	252	2818	1439	2129	6.2	2.36	4.75	4.50
CD (0.05)	2.72	NS	NS	NS	--	246	82.6	--	--	NS	--	--
Genotypes												
CSV-19SS	261	181	239	288	242	2172	1311	1742	6.2	2.67	3.87	4.66
SSV-84	--	--	304	300	302	2924	1907*	2924	5.9	2.25	5.12	4.00
CSH-22SS	292	1.69*	--	–	292	--	--	1907	--	--	--	--
CD (0.05)	2.72	3.66	6.63	NS	--	246	82.6	--	--	NS		
Level of Nitrogen (Kg N/ha)												
30	262	172	244	279	239	1872	1480	1676	5.9	2.01	4.26	4.06
60	274	178	267	287	252	2282	1559	1921	6.1	3.05	4.53	4.56
90	281	174	281	294	258	2750	1653	2202	5.8	2.35	4.72	4.29
120	288	177	294	295	264	3167	1745	2456	6.2	2.45	4.71	4.45
C.D. (0.05)	4.5	2.6	8.3	9.7	--	365	31.7	--	--	NS	--	--

Trial 1.1 (B): Evaluation of sweet sorghum genotypes for their yield potential at different fertility levels

This experiment was initiated in Kharif – 2007. Treatment comprised of 3 fertility levels (50,100 and 150% RDF). RDF 80:40:40 kg NPK per ha and 6 genotypes SPSSV-11, SPSSV-15 and SPSSV-20 as test genotypes and SSV-84, CSV-19SS and CSH-22SS as check. The experiment was conducted in spilt plot design with fertility levels as main plot treatments and sweet sorghum genotypes at sub plot treatments at Akola, Coimbatore, Indore and Solapur. Cane yield varied significantly due to fertility levels at Akola and non significant at Coimbatore and Solapur (Table 1.1 (B)1). 150% RDF revealed significantly highest green cane yield (43.7 t/ha) compared to 50 and 100% RDF (22.8 and 35.5 t/ha respectively) at Akola. Similarly 150% RDF significantly increased plant height (333 cm) and juice yield (6312 liters per ha) compared to 50 and 100 % RDF at Akola.

Sweet sorghum genotypes varied significantly for plant height, cane yield, juice yield. SPSSV-15 and CSV-19SS 297 cm and were on par 335 cm plant height and significantly taller than SSV-84 (271 cm) (Table 1.B.1). Cane yield of SPSSV-20 was significantly to SSV-84 at Coimbatore and Akola. Similarly at Akola CSV-19SS and CSH-22SS were significantly superior to SPSSV-11 and SPSSV-15 (1466 and 4331 t/ha respectively), with recorded to juice yield at Akola. SPSSV-20 and CSV-19SS were on par (5164 and 5627 l/ha) were on par and produced significant higher juice compared to SSV-84 and SPSSV-15 (Table 1.1 B.2). Grain yield of sweet sorghum genotypes varied significantly. SPSSV-11 produced the significantly highest grain yield (3508 and 3599 kg/ha at Akola and Indore respectively) compared to other genotypes viz SPSSV-15, SPSSV-20, SSV-84 and CSV-19SS.

Table 1.1B1: Plant height, Cane yield and Brix value of sweet sorghum genotypes at different fertility levels

Treatment	Plant height (cm)					Cane yield (t/ha)				Brix value		
	Akola	Coim	Indore	Solapur	Mean	Akola	Coim	Solpur	Mean	Akola	Coim	Mean
Fertility levels												
50% RDF	292	202	324	294	278	22.8	38.6	26.0	29.1	15.0	17.6	16.3
100% RDF	317	203	336	293	287	35.5	40.5	28.0	34.6	14.9	17.6	16.3
150% RDF	333	208	335	294	293	43.7	40.7	29.1	37.8	15.5	17.6	16.6
CD (0.05)	10.2	NS	--	NS	--	3.18	NS	NS	--	--	--	--
Genotypes												
SPSSV-11	302	200	328	285	279	30.8	44.9	26.6	34.1	12.4	17.6	15.0
SPSSV-15	326	209	343	308	296	33.8	36.6	27.7	32.7	16.8	18.1	17.5
SPSSV-20	319	223	334	281	289	33.8	50.0	25.7	36.5	17.1	16.1	16.6
SSV-84	294	184	318	289	271	30.1	28.2	25.9	28.0	15.8	18.7	17.3
CSV-19SS	330	--	339	303	324	36.2	--	32.6	34.4	14.8	--	14.8
CSH-22SS	311	--	328	--	320	35.2	--	--	35.2	14.1	--	14.1
C.D.(0.05)	9.2	6.9	--	11.7	--	1.94	2.61	2.31	--	--	--	--

Table 1.1B.2: Juice and Grain yield of sweet sorghum genotypes at different fertility levels

Treatments	Juice yield (Liter/ha)	Grain Yield (Kg/ha)			
	Akola	*Akola*	*Indore*	*Solapur*	*Mean*
Fertility levels					
50% RDF	15.0	1745	2065	998	1602
100% RDF	14.9	1641	2701	1393	1912
150% RDF	15.5	1811	2796	1404	2004
CD (0.05)	--	NS	--	–	--
Genotypes					
SPSSV-11	12.4	3508	3598	2648	3251
SPSSV-15	16.8	2814	2403	1212	2143
SPSSV-20	17.1	545	2191	1049	1262
SSV-84	15.8	875	2185	609	1223
CSV-19SS	14.8	1317	2037	801	1385
CSH-22SS	14.1	1276	2819	–	2048
C.D.(0.05)	--	241	--	–	--

Trial 1.2: Integrated nutrient and moisture conservation in kharif sorghum

This was second year of experimentation. Combinations of four moisture conservations through land treatment viz flat bed crop sown in 45 rows, sowing in 45cm rows and opening furrows at 3 weeks after sowing, paired planting at 30:60:30 opening furrows in inter pairs and paired planting 30:60:30 with 1 row of green gram / cowpea in inter pairs and three INM viz RDF (80:40:40 kg NPK per ha), FYM @ 5 t/ha + Azospirillum + PSB were evaluated in factorial RBD. The experiment was conducted at Akola, Dharwad, Udaipur and Parbhani. Days to 50% flower and plant height remain unalteded due to moisture conservation practices (Table 1.2.1). Paired planting in 30:60:30 and making furrow in inter pair space at 3 weeks or growing single row of green gram significantly decreased grain yield compared to sowing in 45 rows and making furrow at 3 weeks in the mean data (3960 to 3668 kg/ha). Stover yield was not varied significantly due to moisture conservation practices in the mean data of 4 centers. In mean data however, opening furrows at 3 weeks after sowing in crops sown at 45 rows or paired planting (30:60:30) produced significantly higher stover yield (9.35 and 9.25 t/ha respectively) compared to flat bed (8.65 t/ha) and paired planting + one row of green gram (8.85 t/ha).

Nutrient management of FYM @ 5 t/ha + Azospirillum + PSB significantly delayed 50% flowering by 4-6 days compared to 100% RDF and INM (50% RDF + FYM @ 2.5 t/ha + Azospirillum + PSB) at Akola and Dharwad (Table 1.2.1). Grain yield with (100% RDF and 50% RDF + FYM @ 2.5 t/ha + Azospirillum + PSB) (4135 and 3871 kg/ha) were on par and significantly superior to (FYM @ 5 t/ha + Azospirillum + PSB) (3492 kg/ha). The decrease in grain yield due to organic nutrients (FYM @ 5 t/ha + Azospirillum + PSB) was 20.7, 14.4, 9.7 and 7.7 percent compared to 100% RDF at Dharwad, Akola, Udaipur and Parbhani (4679, 4868, 4579 and 2592 kg/ha) respectively. The similarly stover yields decreased significantly due to organic nutrients by 10.4 and 7.6 percent compared to 100% RDF and INM (50% RDF + FYM @ 2.5 t/ha + Azospirillum + PSB) responded.

Table: 1.2.1: Integrated nutrient and moisture conservation in kharif sorghum

Treatments	Days to 50% flowering		Plant Height (cm)		1000 seed wt (g)	
	Akola	*Dharwad*	*Akola*	*Dharwad*	*Akola*	*Dharwad*
Land Treatments						
L 1	60	64	161	132	29.7	26.7
L 2	59	64	165	134	31.1	27.1
L 3	61	64	150	137	29.6	27.4
L 4	90	64	157	139	29.2	26.3
CD (0.05)	--	NS	--	4.4	--	0.40
Integrated nutrient management						
F 1	58	63	170	134	30.9	27.1
F 2	64	67	146	130	29.0	26.4
F 3	58	63	165	143	29.9	27.2
CD (0.05)	--	0.40	--	3.8	--	0.35

Table: 1.2.2: Integrated nutrient and moisture conservation in kharif sorghum (grain and stover yield Kg/ha)

Treatment	Grain yield (kg/ha)					Stover yield (kg/ha)				
	Parbhani	*Akola*	*Dharwad*	*Udaipur*	*Mean*	*Parbhani*	*Akola*	*Dharwad*	*Udaipur*	*Mean*
Land Treatments										
L 1	2252	4362	4513	3832	3740	9304	8814	7385	9133	8659
L 2	2445	4424	4191	4782	3960	10027	8984	7617	10788	9354
L 3	2383	4191	4760	4512	3961	9757	8366	8125	10753	9250
L 4	2766	4129	3642	4136	3668	10093	8200	7025	10099	8854
CD (0.05)	356	313	262	155	328	464	786	404	228	515
Integrated nutrient management										
F 1	2592	4686	4681	4579	4135	9789	9635	7966	10431	9456
F 2	2391	3735	3709	4134	3492	9802	7278	6967	9828	8469
F 3	2402	4408	4439	4233	3871	9794	8859	7681	10320	9164
CD (0.05)	308	271	227	135	284	402	681	350	197	446

Table 1.2.3: Grain yield as influenced by the interaction between fertility level and moisture conservation practices at Udaipur

Moisture conservation	**F 1**	**F 2**	**F 3**	**Mean**
Flat bed	4129	3508	3856	3832
Sowing at 45 cm and opening furrow at 21 DAS.	5086	4696	4564	4782
Paired planting 30:60:30 and opening furrow at 21 DAS	4590	4590	4356	4512
Paired planting one row green gram	4511	3744	4154	4136
Mean	4579	4134	4233	

The crop sown at 45 row spacing and opened furrow at 21 DAS, produced the highest grain yield at 100% RDF (5086 kg/ha) compared to organic and INM treatments. The similar trend was noted in flat bed sown crop. The response to fertility level was absent in crop sown in paired planting + opened furrow at 21 DAS.

Trial 1.3: Studies on nutrients uptake, grain and stover qualities of different sorghum genotypes

Six sorghum genotypes comprising three grain types (CSV-15, SPV-1616 and CSH-16), two forage type (HC-308 and SSG 59-3) and one sweet sorghum (SSV-84) were evaluated for their yield and nutrient uptake and stover quality at location viz Coimbatore, Dessa, Dharwad, Indore, Parbhani, Solapur, Surat and Udaipur in Kharif-2007. Data on grain and stover yield have been presented in Table 1.3.1a and Table 1.3.1b. Among the grain sorghum genotypes CSH-16 produced maximum grain yield (2945 kg/ha) followed by CSV-15 (2931 kg/ha) and SPV-1616 (2918 ka/ha). Among forage types HC-308 produced 1626 kg/ha followed by SSG 59-3 (835 kg/ha). Sweet sorghum SSV-84 produced the highest stover yield (17.032 t/ha) followed by SPV-1616 (13.57 kg/ha), CSV-15 (12.8 kg/ha) and SSG 59-3 (12.7 t/ha). The lowest stover yield was recorded in CSH-16 (11.0 t/ha). The highest grain yield was recorded with CSH-16 at Indore (5252 kg/ha) followed by CSV-15 at Solapur (4870 kg/ha) and Indore (4662 kg/ha) and SPV-1616 at Solapur (4536 kg/ha) and Udaipur (4308 kg/ha). The maximum stover yield was recorded with SSV-84 at Solapur (24.9 t/ha), Dharwad (24.7 t/ha, Indore (24.3 t/ha) and Pantnagar (22.2 t/ha)) followed by SPV-1616 at Dharwad (21.0 t/ha) and CSV-15 at Pantnagar (19.8 t/ha). The data on Nutrient uptake, CP, DMY, DMD and Dry matter digestible yields recorded in kharif-2006 highlighted in Table 1.3. 2 and 1.3. 3. In kharif 2006, 8 different types of sorghum genotypes were evaluated at Coimbatore, Solapur, Dharwad, Indore and Udaipur. The content of dry matter (92.2 – 93.6 %), crude protein (3.76 – 4.83 %), N content (0.601 – 0.774%) and vitro dry matter digestibility (44.1 to 47.7 %) of different sorghum genotypes not varied significantly (Table 1.3.2). HC-308 had highest CP (4.83 %) and IVDMD (47.7%). N uptake, crude protein and digestible dry matter of different sorghum genotypes varied significantly (Table 1.3.3). N uptake was maximum in NSSH-104 (121.8 kg/ha) followed by CSH-16 (120.5 kg/ha) and HC-308 (119.2 kg/ha). SSV-84 had lowest N uptake (95.6 kg/ha). Similarly NSSH-104 produced their highest crude protein yield (760.5 kg/ha) followed by CSH-16 and HC-308, with regards to digestible dry matter yield. CSH-16 registered highest DMD yield (8185 kg/ha) followed by SPV-1616 (8102 kg/ha) and NSSH-104 (7998 kg/ha). SSV-84 registered lowest crude protein yield (658 kg/ha) and SSG 59-3 registered lowest DMD yield (6467 kg/ha).

Table 1.3.1a: Grain yield (Kg/ha) of different sorghum genotypes

Genotypes	Dessa	Udaipur	Indore	Dharwad	Parbhani	Coimbatore	Solapur	Surat
SPV-1616	1553	4308	3914	4056	1268	796	4536	--
CSV-15	1266	4076	4662	3861	1285	499	4870	435
CSH-16	1993	4510	5252	3944	1458	694	2987	2728
SSV-84	1164	472	2127	2028	66	621	7657	1156
HC-308	935	2968	1903	2361	454	666	2096	540
SSG 59-3	715	757	873	1208	317	754	1221	640
CD (5%)	139	408	469	522	137	61	2213	249.1

Table 1.3.1b: Stover yield (Kg/ha) of different sorghum genotypes

Genotypes	Dessa	Pantnagar	Udaipur	Indore	Dharwad	Parbhani	Coimbatore	Surat	Solapur
SPV-1616	9514	19528	13222	17130	21090	6466	6808	--	14809
CSV-15	7106	19806	12722	14352	19009	7330	6665	3765	15502
CSH-16	7662	15972	10493	11111	17621	7500	6978	8565	10798
SSV-84	5856	22222	15500	24306	24698	9452	9235	7938	24990
HC-308	6319	16861	15382	13426	17483	7022	7890	4938	14198
SSG 59-3	6493	19694	15174	10185	21923	7122	9078	6529	11914
CD (5%)	307	3431	943	3057	2636	445	532	2555	3083

Table 1.3.2: Contents of Dry matter (DM), Nitrogen (N), Crude protein (CP) in vitro dry matter Digestibility (IV DMD) and Metaboligable energy (Me) of sorghum genotypes (Kharif-2006)
(All India average mean of Coimbatore, Solapur, Dharwad, Indore and Udaipur)

Genotypes	Dry matter (%)	Crude protein (%)	Ash (%)	IV DMD (%)	Metaboligable Energy	N content (%)
CSH-16	93.6	4.05	9.49	44.1	6.36	0.649
CSV-15	92.5	3.94	7.98	47.2	6.90	0.630
SPV-1616	92.7	4.03	7.53	45.9	6.71	0.645
SSV-84	93.1	3.76	8.03	46.4	6.77	0.601
NSSH-104	92.2	4.45	9.29	46.8	6.79	0.713
CSH-20 MF	92.9	4.49	8.29	45.5	6.59	0.719
HC-308	92.5	4.83	8.55	47.7	6.95	0.774
SSG 59-3	92.7	4.41	8.67	44.8	6.49	0.706
CD (0.05)	NS	NS	NS	NS	NS	NS

Table 1.3.3: Uptake of N and yield of stover, crude protein and digestible dry matter of sorghum genotypes (Kharif-2006)

Genotypes	Total biomass	N uptake (kg/ha)	CD yield (kg/ha)	Digestible Dry matter yield (kg/ha)
CSH-16	18561	120.5	751.7	8185
CSV-15	16187	102.0	637.7	7640
SPV-1616	17651	113.8	711.0	8102
SSV-84	15919	95.67	598.5	7386
NSSH-104	17691	121.8	760.5	7998
CSH-20 MF	14673	105.5	658.8	6676
HC-308	15402	119.2	743.9	7346
SSG 59-3	14437	101.9	636.6	6467
CD (0.05)	4253	7.74	51.03	119.08

Trial 2.1: Nutrient recycling in sorghum based double cropping system (Indore and Surat)

The effect of inorganic fertilizer RDF (80:40:40 NPK/ha) and INM (50% RDF + Vermicompost @ 2 t/ha) was found out in kharif sorghum grown in sequence cropping with sorghum (K) – chickpea, sorghum (K) – field peas and sorghum (K) – lentil at Indore or sorghum (K) – chickpea, sorghum (K) – Indian bean and sorghum (K) – green gram (Rabi) at Surat in Kharif – 2007 and Rabi 2007-08. Data on kharif sorghum are presented in Table 2.1.1. At Indore, sorghum (kharif) – chickpea registered the highest grain yield (5714 kg/ha) and stover yield (10.6 t/ha) compared to its sequence with field peas or lentil 5185 and 5388 kg/ha grain yield sorghum (K) – field peas (5185 kg/ha) decreased stover yield significantly compared to sorghum (K) – chickpea. The similar trend was noted at Surat. At Indore, RDF (80:40:40 NPK/ha) revealed the highest grain yield (6026 kg/ha) which was 24.7 percent compared to INM of Vermicompost (@ 2 t/ha) + 50% RDF (4832 kg/ha). On the contrary INM (2325 kg/ha) produced higher grain yield than 100% RDF at Surat.

Table 2.1: Growth and yield of kharif sorghum in double cropping system

Treatments	Grain yield (kg/ha)		Stover yield (t/ha	
	Indore	*Surat*	*Indore*	*Surat*
Sorghum (Kharif) - Chick pea	5714	2566	10.6	7.77
Sorghum (Kharif) – Field pea	5185	–	9.9	–
Sorghum (Kharif) – Lentil	5388	–	10.1	–
Sorghum (Kharif) – Indian bean (in rabi)	--	2095	--	7.46
Sorghum (Kharif) – Green gram (in rabi)	--	2045	--	7.37
CD (0.05)	643	1.63	1.33	NS

Treatments	Grain yield (kg/ha)		Stover yield (t/ha	
	Indore	*Surat*	*Indore*	*Surat*
Integrated Nutrient Management				
Inorganic (80:40:40)	6026	2145	11.2	7.41
Vermicompost (@ 2 t/ha) + 50% RDF	4832	2325	9.2	7.61
CD (0.05)	525	340	1.09	NS

Trial 3.1: Effect soil moisture conservation practices on yield of sorghum

At Indore station trial entitled effect of soil moisture conservation practices on yield of sorghum was conducted in Kharif-2007. Treatments were moisture conservation through 3 land treatment viz flat bed, ridges and furrow system and earthing up at 25DAS and four organic amendments (@ 6 t/ha) viz straw mulch, FYM, green biomass and glyricidia. Ridges and furrow layout or earthing up at 25 DAS, increased grain yield by 14.5 and 13.5 percent compared to flat bed layout (6524 kg/ha) (Table 3.1). Among organic amendments, the incorpation of green biomass or glyricidia @ 6 t/ha were promising and increased grain yield by 46 percent over FYM or straw mulch (7068 and 6903 kg/ha).

Table 3.1: Growth and yield of kharif sorghum at different soil moisture conservation practices

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg /ha)	Stover yield (t/ha)	Grain wt per ear head (g)	1000 seed wt (g)
Land Layout Treatment						
Flat bed	69	286	6524	18.7	53.2	21.2
Ridges and furrow	69	293	7472	19.6	52.8	26.3
Earthing up	69	288	7405	20.2	53.3	26.3
CD (0.05)	–	–	--	--	–	--
Organic amendments (@ 6 t/ha)						
Straw mulch	68	293	6903	19.1	48.4	25.3
FYM	68	293	7068	19.5	51.5	25.3
Green biomass	70	282	7351	19.1	57.7	25.9
Glyricidia	69	288	7213	20.3	54.8	25.2
CD (0.05)	–	–	--	--	–	--

Trial 3.2: Response of forage sorghum genotypes to different fertility level

The experiment was conducted at Dharwad in Kharif – 2007. Treatments comprised the combinations of four genotypes of forage sorghum viz UTFS-43, HC-308, S-540 and S-541 and four levels of nitrogen (0, 50, 75 and 100 kg/ha). The experiment was conducted in factorial randomized block design with 3 replications. The initial nutrient status of soil was 155 kg/ha available nitrogen, 25kg P_2O_5/ha and 308 kg K_2O/ha with organic carbon of 0.056 with soil pH of 8.0. UTFS-43 and S -541 were early flower (64 days), compared to HC-308 (76 days) and S-540 (78 days). Genotype, HC-308 and S-540 (233 and 230 cm) significantly taller than UTFS-43 (216 cm), S -541 was taller than UTFS-43 but had lower plant height compared to HC-308 and S-540. LAI of genotypes (42-48) was not varied significantly. Dry matter yield of genotype UTFS-43 (16.5 t/ha) significantly higher than HC-308, S-540 and S-541 (14.9, 14.2 and 14.9 t/ha respectively). UTFS-43 significantly highest grain yield (2421 kg/ha) followed by HC-308 (1514 kg/ha) and S-541 (1003 kg/ha). S-540 was shy seeder and produced lowest grain yield (876 kg/ha). Forage sorghum responded significantly to nitrogen fertilization upto 75 kg N/ha interims of plant height (251 cm) and dry matter yield (16.65 t/ha) and upto 30 kg N/ha for grain yield. The interaction indicated that between G × N for grain yield UTFS-43 and HC-308 responded significant upto 30 kg N/ha. In S-541 response was significant upto 50 kg N/ha.

Table 3.2: Growth, grain and dry matter yield of sorghum genotypes at influenced by nitrogen level

Treatments	Days to 50% flowering	Plant height (cm)	LAI	Dry matter yield (t/ha)	Grain yield (kg/ha)	1000 seed wt (g)	Plant stand (000/ha)
Genotypes							
UTFS – 43	64	217	4.27	16.51	2421	19.6	251
HC – 308	75	233	4.36	14.92	1514	19.0	245
S – 540	78	230	4.21	14.28	876	19.1	250
S – 541	64	224	3.81	14.95	1003	19.2	244
CD (0.05)	0.48	6.4	NS	0.84	217.1	NS	NS
Level of nitrogen (kg N/ha)							
0	74	177	3.78	13.59	787	18.0	246
25	70	236	4.11	14.71	1624	19.2	245
50	69.5	239	4.30	15.61	1625	19.7	250
100	69	251	4.45	16.74	1779	20.0	251
CD (0.05)	0.48	6.4	0.45	0.84	217.1	0.52	NS