AICSIP Agronomy- Kharif 2006

Executive Summary

The highlights of result of the experiments conducted at different centers of All India coordinated sorghum improvement project on agronomic aspects of sorghum in Kharif-2006 and Rabi 2006-07 are presented in following text. The details of experiments conducted at different AICSIP centers are presented in following Table

Table 1: Center wise details of AICSIP Agronomic experiments-Kharif 2006

Trial No.	Experiment Title	Zone / Centers
1 (K) A	Evaluation of promising sorghum genotypes for their yield potential under rain-fed condition	Zone-I – Coimbatore and Palem
1 (K) C	Evaluation of promising sorghum genotypes for their yield potential under rain-fed condition	Zone-III – Dessa, Mauranipur* and Udaipur
1 (K) D	Evaluation of promising sorghum genotypes for yield potential under late kharif, early rabi situations	Madira* and Kovilpatti*
Location Specific Trials		
1.1 K	In situ moisture conservation practices and its interaction with nutrients	Dharwad, Udaipur and Dessa
1.2 K	Maximization of sweet sorghum cane yield	Coimbatore, Palem, Akola, Solapur and Indore
1.3 K	Integrated nutrients and moisture conservation in kharif sorghum	Parbhani, Akola, Dharwad and Udaipur
1.4 K	Studies on nutrient uptake, grain and stover qualities of different sorghum genotypes	Coimbatore, Parbhani, Solapur, Dharwad, Indore and Udaipur
2.1 K	Intercrop diversification / intensification in sorghum	Palem
3.1 K	Nutrient recycling in sorghum based double cropping systems	Indore
3.2 K	Response of forage sorghum genotypes to different nitrogen level	Dharwad

Trial 1 (K) A: Evaluation of promising sorghum genotypes for their yield potential under rain-fed condition (Zone-I – Coimbatore and Palem)

In zone-I, nine genotypes including CSV-15 and SPV-462 as check were evaluated at three fertility levels of native fertility, 50% RDF (40:20:00 kg N:P_2O_5:K_2O per ha and 100% RDF (80:40:00 kg N:P_2O_5:K_2O per ha) in Kharif 2006 at Palem and Coimbatore.

The genotype SPH-1524 produced the highest grain yield (2271 kg/ha) which remained on par with SPH-1467 and SPV-462 but was significantly superior to the other genotypes. SPH-1524 produced 11.0 and 21.0 percent higher grain yield compared to SPV-462 (2046 kg/ha) and CSV-15 (1867 kg/ha) respectively. The maximum stover yield (11.22 t/ha) and total biomass (13.26 t/ha) were recorded with SPV-462.

The maximum yields of grain (2328 kg/ha), stover (10.3 t/ha) and total biomass (12.6 t/ha) were recorded with the fertility level of 80:40:00 which were 48.7, 23 and 27.2 percent higher compared to no fertilizer respectively. The increase in yields of grain, stover and total biomass due to 40:20:00 kg N: P2O5:K2O/ ha was 15.8, 11.9 and 12.5 percent over no fertilizer (1565, 8384 and 9949 kg/ha respectively).

The interactions between fertility levels and genotype for yields, grain, stover and total biomass were not significant at both centers of zone-I (Palem and Coimbatore). The combinations of 100% RDF (80:40:00 kg N: P2O5:K2O per ha) and genotype SPH-1524 produced the highest grain yield (2729 kg/ha), whereas,

the combinations of 100% RDF and SPV-462 produced the maximum stover yield (12.25 t/ha) as well as total biomass (14.78 t/ha).

Trial 1 (K) C: Evaluation of promising sorghum genotypes for their yield potential under rain-fed conditions- Zone-III (Dessa, and Udaipur)

Seven sorghum genotypes (SPV-1714, SPV-1715, SPV-1716, SPV-1730, SPH-1467 HC-308 and CSV-15 were evaluated at three fertility levels (50, 100 and 150% RDF 80:40:00 kg N: P2O5:K2O per ha at Udaipur and 0, 50 and 100% RDF at Dessa) in kharif-2006.

At Udaipur the variation in grain and stover yields due to different fertility levels (50, 100 and 150% RDF) were not significant. The 100% RDF however, increased grain and stover yields by 8.2 and 7.2 percent over 50%RDF (3380 and 12164 kg/ha of grain and stover yields respectively). The total biomass increased significantly at 150% RDF compared to 50% RDF (15544 kg/ha) by 8.6 percent. The yields with 100% RDF and 150% RDF were on par.

At Dessa, fertility levels of 100% RDF produced significantly highest yields of grain, stover and total biomass (2590, 9555 and 12145 kg/ha respectively) compared to no fertilizer and 50% RDF. The mean data of Zone-III revealed increase in grain yield by 15.8 and 48.8 percent due to 50 and 100% RDF compared to no fertilizer (1565 kg/ha).

At Udaipur the genotype SPH-1467 produced significantly highest grain yield (4542 kg/ha) which was significantly superior to CSV-15 (4056 kg/ha). The SPV-1730 (4199 kg/ha) was on par with SPV-1714, SPV-1716 and CSV-15 and produced significantly higher than the other genotypes. The highest yields of stover (14809 kg/ha) was recorded with HC-308, while the highest biomass was recorded with SPV-1730 (18026 kg/ha). At Dessa, SPH-1467 produced the significantly highest yields of grain (2255 kg/ha), compared to CSV-15 (1891 kg/ha) and other genotypes. Similarly SPH-1467 produced the highest stover yield (8324 kg/ka) and total biomass (10579 kg/ha). Which were on par with CSV-15.

In the mean data of Zone-III, genotypes SPH-1467 produced the highest grain yield (3399 kg/ha) whereas, HC-308 produced maximum stover yield (11391 kg/ha) with highest total biomass with SPV-1730 (13487 kg/ha).

Location specific trials

Trail 1.1 K: In situ moisture conservation practices and its interaction with nutrients

The experiment was conducted at Dharwad, Udaipur and Dessa in Kharif – 2006. Treatments comprised the combinations of three in situ moisture conservations viz compartmental bunds, ridging at inter cultivation (45 DAS) and flat bed (check) and 3 fertility levels viz ½ N and P K basal, ½ + ½ N K basal and ⅓ + ⅓, ⅓ N P K basal.

The ridging at inter-cultivation produced significantly the highest grain yield (3568 kg/ha) compared to compartmental bunds (3256 kg/ha) and flat bed (3107 kg/ha). The total biomass and stover yields with ridging at inter-cultivation were 8.3 and 6.0 percent higher compared to flat bed (11776 and 8668 kg/ha) respectively

Fertilizer treatment of ⅓ + ⅓ + ⅓ N P K basal revealed 31.0, 14.5 and 18.7 percent higher yields of grain, stover and total biomass compared to ½ N and PK as basal (2813, 8198 and 11011 kg/ha of grain, stover and total biomass) respectively. Fertilizer management of ½ + ½ N and PK basal was significantly superior to ½ N and PK basal at Dharwad and Udaipur. In the mean of all stations, ½+ ½ N and PK as basal produced 21.3, 9.2 and 12.3 percent higher yields of grain, stover and total biomass compared to ½ N and PK basal.

Trial 1.2: Maximization of sweet sorghum cane yield

A experiment with 16 treatments comprising combinations of two row spacing (45 × 15cm and 60 × 15cm), two genotypes (SSV-84 and NSSH-104 / RSSV-9) and 4 levels of nitrogen(30,60,90 and 120 kg N/ha). The experiment was conducted at Coimbatore, Palem, Akola, Solapur and Indore in Kharif-2006. The row spacing of 45 × 15cm recorded the highest cane yield (31.6 t/ha), juice yield (11075 liters/ha), stover yield (13649 kg/ha) and total biomass (14904 kg/ha) compared to spacing of 60× 15cm.

Cane yield of sweet sorghum genotypes not varied significantly. The cane yield potential of SSV-84, NSSH-104 and RSSV-9 was 29473, 30147 and 29008 kg/ha respectively.

N application of 120 kg N/ha registered the highest yields of cane (32.3 t/ha), juice (12587 liters/ha), grain (1810 kg/ha), stover (15219 kg/ha) and total biomass (18005 kg/ha), which were higher by 19.6, 49.2, 51.8, 43.7 and 31.0 percent compared to 30 kg N/ha.

Trial 1.3 Integrated nutrients and moisture conservation in Kharif sorghum

The moisture conservation through opening furrows at 3 weeks after sowing significantly increased yields of grain, stover and total biomass by 8.6, 9.8 and 9.4 percent compared to flat bed (2946, 6842 and 9789 kg/ha) respectively. The grain yield with INM of 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB (3102 kg/ha) was on par with RDF (3220 kg/ha) and both the treatments were significantly superior to FYM @ 5 t/ha + Azotobactor + PSB.

At Dharwad, combinations of paired planting and opening furrows at 3 weeks after sowing and RDF produced the highest grain yield (4753 kg/ha).

Trial 1.4: Studies on nutrient uptake, grain and stover qualities of different sorghum genotypes

A field experiment comprising 8 sorghum genotypes was conducted at Coimbatore, Parbhani, Solapur, Dharwad, Indore and Udaipur in kharif-2006.

Genotype CSH-16 produced the highest grain yield (2732 kg/ha), whereas the maximum stover yield (19190 kg/ha) and total biomass (21160 kg/ha) were recorded with NSSH-104.

Trial – 2.1: Intercrop diversification/ intensification in sorghum

A experiment was conducted at Palem in Kharif-2006 with eight treatments comprising combinations of two genotypes (CSH-13 and CSV-15) and four sorghum based intercropping viz sole sorghum, sorghum + pigeon pea, sorghum + cowpea for vegetable and sorghum + cluster bean.

The intercropping of sorghum cv CSV-15 + pigeonpea registered the highest sorghum equivalent grain yield (3110 kg/ha) compared to sole sorghum CSV-15 (2548 kg/ha).

Trial 3.1 Nutrient recycling in sorghum based double cropping system

The experiment was conducted at Indore in 2006-07. Treatment comprised combinations of three double crop sequences viz.
1. Sorghum (Kharif) – Chickpea
2. Sorghum (Kharif) – Field peas
3. Sorghum (Kharif) – Lentil and two fertility levels viz 100% RDF and vermicompost @ 2 t/ha. Data on sorghum cv CSH-16 recorded in Kharif – 2006 have been reported.

Kharif sorghum cv CSH-16 preceded by field peas or lentil produced significantly higher yields of grain, stover and total biomass compared to sorghum – chickpea. The extent of beneficial effect of lentil and field peas on sorghum grain yield was 16.2 and 13.8 percent respectively compared to chickpea (2350 kg/ha).

The crop given 100% RDF produced significantly higher yields of grain, fodder and total biomass by 17.7, 15.0, 15.8 percent compared to vermicompost @ 2 t/ha (2375, 5296 and 7685 kgs/ha, grain, stover and total biomass, respectively).

Trial 3.2 Response of forage sorghum genotypes to different nitrogen levels

The trial was initiated at Dharwad in kharif-2006; with 16 treatments comprising combinations of four genotypes of forage sorghum viz VTFS-43, HC-308, S-540 and S-541 and four levels of nitrogen 0, 50, 755 and 100 kg N/ha.

VTFS-43 fertilized with 75 kg N recorded the highest total biomass (31134 kg/ha) and dry fodder yield (29398 kg/ha).

AICSIP Agronomy- Rabi 2006-07

Executive Summary

Trial 7RA: Evaluation of rabi sorghum genotypes under receding soil moisture conditions:

A field experiment with 21 treatments comprising combinations of 3 fertility levels viz native fertility, 50 and 100% RDF (RDF 60:30:00 kg/ha NPK) and 7 promising genotypes viz SPH-1449, SPV-1704, SPV-1626, CSV-14R, CSV-216R and M35-1 was conducted in split plot design with 3 replication at Parbhani, Rahuri, Dharwad and Tandur. The rabi sorghum responded significantly upto 100% RDF (2429 kg/ha grain yield) compared to no fertilizer and 50% RDF (2007 and 2204 kg/ha grain yield). Genotypes SPV-1626 (2510 kg/ha) and CSV-216R (2541 kg/ha) were on par and produced significantly higher grain yield and stover yields compared to SPH-1449, SPV-1704, CSV-14R and M35-1. Genotypes differed significantly for harvest index and 1000 seed weight.

Trail 7RB: Evaluation of rabi sorghum genotypes under shallow-medium soil under rainfed conditions.

The experiment was conducted at Solapur. The combinations three fertility levels (no fertilizer, 30:15:0 and 60:30:0 kg/ha NPK) and 8 genotypes (SPH-1449, SPV-1672, SPV-1680, SPV-1709, CSV-14R, SPV-1591, Phule Maulee and M35-1) were evaluated in split plot design with 3 replications. The growth, grain yield and stover yields of rabi sorghum were not varied significantly due to fertility levels. The maximum grain yield was recorded with 100% RDF (2584 kg/ha). SPH-1449, produced significantly highest grain yield (3173 kg/ha) which was 48.6, 35.8 and 32.9 per higher compared to M35-1, Phule Maulee and CSV-14R respectively. Similarly SPV-1709 (2645 kg/ha) was significantly superior to M35-1 but was on par with Phule Maulee and CSV-14R. The genotype SPV -1680 produced maximum stover yield (7814 kg/ha) and total biomass (10335 kg/ha) followed by SPH-1449 (6987 and 10162 kg/ha stover and total biomass respectively).

Trail 7 (R) C: Evaluation of rabi sorghum genotypes under irrigated conditions.

Six genotypes of rabi sorghum viz CSV-18, DSV-5, PKV Kranti, CSH-15R, CSV-216R and M35-1 were evaluated at three fertility levels (no fertilizer, 40:20:0 and 80:40:00 kg/ha N PK) under irrigated conditions at Parbhani, Rahuri and Solapur.

Fertility levels of 50% and 100% RDF significantly increased grain yield, stover yield and total biomass compared to native fertility. The variation due to 50 and 100% RDF was not significant. The highest grain

yield was recorded with 100% RDF (3041 kg/ha) followed by 50% RDF (2918 kg/ha) compared to no fertilizer (2458 kg/ha).

The genotypes CSV-216R (3351 kg/ha), PKV Kranti (3121 kg/ha) and CSH-15R (2989 kg/ha) were on par and produced significantly higher grain yield compared to M35-1 (2521 kg/ha) by 33, 24 and 18.5 percent respectively. Genotype CSV-18 produced the highest stover yield (10481 kg/ha).

Trail 4.1: Methods to improve soil water holding capacity in fallow-rabi sorghum cropping system.

The effect of tillage practices viz., shallow tillage, mould board ploughing and chiseal ploughing and 3 green manuring treatments was found out at Tandur, Dharwad and Rahuri.

Mould board ploughing and chiseal ploughing increased grain yield by 15.8 and 14.4 percent compared to shallow tillage (2677 kg/ha). The mould board ploughing and chiseal ploughing significantly increased grain yield compared to shallow tillage at Tandur and Dharwad. Green manuring of Dhaincha at Tandur (3826 kg/ha grain yield) and incorporation of glyricidia at Rahuri (2674 kg/ha grain yield) and Dharwad (3189 kg/ha grain yield) were promising compared to green manuring of sunhemp.

Trail 4.2: INM for soybean – rabi sorghum double cropping system.

A field experiments was conducted at Parbhani, Solapur and Rahuri. The effect of 4 INM treatments to soybean (organic-5t/ha FYM, in organic (RDF 30:60:30), 50% organic + 50% RDF and glyceridia along with seed treatment with biofertilizers) was found out on succeeding rabi sorghum CV CSV18 by evaluating at four fertility levels (0, 50, 75 and 100% RDF-80:40:40: kg/ha N P2O5 K2O).

The production potential of soybean – rabi sorghum in double cropping system was 2077 kg/ha of soybean seed yield and 2187 kg/ha of rabi sorghum grain yields. The seed yield of soybean was maximum with 100% RDF (30:60:30 kg/ha NPK). Organic-5 t/ha FYM and 100% RDF (30:60:30 kg/ha NPK) applied to soybean in Kharif were promising and increased grain yield of succeeding rabi sorghum significantly (2196 and 2648 kg/ha at Parbhani and Solapur) compared to 50% organic + 50% inorganic (1883 and 2137 kg/ha at respective station. Rabi sorghum, responded significantly upto 50% RDF in terms of grain yield and upto 75% RDF in terms of stover yield and total biomass.

Soil and Agroclimate:

Soil parameter of Soils of AICSIP Centres.

The soils of Kharif sorghum Centres were medium-deep, black clayey at Dharwad and Indore and Udaipur. The soil pH was 8.1 at Coimbatore in Zone-I, 7.4-8.0 in Zone-II (Indore, Dharwad) and 7.1-7.8 in Zone-III (Deesa and Udaipur). The majority of soils of Kharif sorghum Centres were medium in organic carbon (0.32 to 0.57 g/kg at Deesa, Indore, Udaipur and Dharwad) except Coimbatore (1.28 g/kg soil). The available soil nitrogen content was also low (132.5 kg/ha Coimbatore to 288 kg/ha at Udaipur (Table 1.1) Similarly, available P status soils of Kharif sorghum Centres was low (18.2- 26.8 kg P2O5 /ha) with medium soil P at Deesa (53 kg P2O5/ha). The soils at Coimbatore and Udaipur had low available K (106.5 and 190.2 kg/ha) compared soils at Indore, Dessa and Dharwad (630.8, 363 and 315 kg k/ha).

The soils of rabi sorghum Centres were neutral in reaction (soil pH of 7.04, 7.14, 8.5 and 8.8 at Dharwad, Tandur, Solapur and Rahuri respectively) (Table 1.1), medium-deep black, clay loam in texture. The soil depth was 80-90 cm at Rahuri and Dharwad and 50-60 cm at Solapur. The soils were medium in organic carbon (0.32 to 0.54 g/kg soil), low in available Nitrogen (181.0-238.0 kg/ha) and low in available P2O5 (10.8-24.8 kg/P2O5) except rich in available P2O5 at Tandur 69.8-71.3 kg/ha). The available potassium content of soils of rabi sorghum Centres was 295-754 kg K/ha and most of soils were rich in potassium.

Table : 1.1 : Soil parameters of soils of AICSIP Centres

Sl No	AICSIP Centres	pH	Organic Carbon (g/kg soil)	Available Nitrogen (kg/ha)	Available Phosphorous (kg/ha)	Available Potassium (kg/ha)	Electrical conductivity (dsm)
1	Coimbatore	8.1	1.28	132.5	26.2	106.5	0.40
2	Dharwad	8.0	0.57	160.2	26.8	310.5	--
3	Indore	7.4	0.47	144.5	18.2	630.8	--
4	Dessa	7.1	0.32	--	53.0	363.0	--
5	Udaipur	7.8	0.47	288.0	20.8	190.2	--
6	Rahuri	8.3	--	210.0	21.0	425.0	0.70
7	Tandur	7.6	--	238.3	71.3	754.7	--
8	Solapur	8.5	0.32	181.0	10.0	295.0	--

Monthly rainfall

Kharif 2006

Kharif: AICSIP – agronomic experiments were conducted at Coimbatore and Palem in Zone-I. Dharwad, Indore, Parbhani, Akola and Surat in Zone-II and Udaipur and Deesa in Zone-III. Monthly rain fall (mm) recorded at different Centres of different zone is presented in (Table 1.2).

- **Zone I :** Rainfall of 685.3m received in 31 days at Palem. The rainfall in August was inadequate. Coimbatore received a rainfall of 416.6mm in 32 days- more favorable for sorghum in rabi season.

- **Zone-II:** At Dharwad, the total rainfall of 705.1 mm was received in 54 rainy days. Distribution and amount of rainfall was quite favorable for sorghum during both Kharif and rabi seasons. Winter rain of 55.4 mm at panicle initiation stage favored the crop growth and higher yields have been reported in rabi also. Akola had received 995mm rainfall in June to November in 49 rainy days was favourable for sorghum in Kharif season. Parbhani received rainfall of 863.1 mm in June-October was ideal for Kharif sorghum. The rabi sorghum have suffered moisture stress from panicle initiation stage as rain fall received in rabi season (Sept-October) was only 177.3 mm .

- **Zone III**: Deesa received a total rainfall of 1017.6 mm in 35 rainy days. (July-September). The distribution was ideal for Kharif sorghum. Similarly at Udaipur an adequate well distributed rainfall of 841.3 mm was recorded. However, rainfall was very less in September.

Rabi 2006-07:

Rabi Centres received well distributed adequate rainfall (Table-1.3). The crop exhibited its fullest yield potential in rabi season. Bijapur received total rainfall of 643.6 mm in September to November with 3623 mm in September to November. At Tandur, a rainfall of 406.4 mm was recorded in June to November in 43 days. The rainfall was inadequate to recharge of soil profile as well as for better crop growth (185.5mm).

A rain fall of 558.1 mm was recorded at Solapur in June-November in 33 days. During rabi season (September-December) the quantity and distribution of rainfall (334.8 mm) was ideal particularly a rainfall of 93.4 mm at 45 DAS, resulted in better crop growth and yields of rabi sorghum at Solapur. Rahuri received total rainfall of 675.5 mm in June-November. The rainfall received during rabi (September-December) was 366.9 mm was favorable for rabi sorghum. At Parbhani a precipitation of 177.3mm was recorded in rabi season (September-December). Dharwad received 149.8 mm rainfall in rabi season. Rainfall received in November was 55.4 mm, was critical for better crop growth and yields.

In rabi the lowest minimum temperatures of 9.2, 11.3, 8.7, 10.7 and 12.8 0 C were recorded at Rahuri, Solapur, Parbhani, Bijapur and Dharwad respectively in last week of December to first week of January (standard meter logical week 52 and 1).

Table 1 -1.2: Zone wise monthly Rainfall at different Centres during Kharif 2006.

Month	Zone-I		Zone-II			Zone-III	
	Palem	Coimbatore	Dharwad	Akola	Parbhani	Deesa	Udaipur
June	156.4 (8)	48.4 (5)	166.8 (9)	116.8 (5)	130.4 (8)	377.7 (16)	10.8
July	271.1 (9)	6.7	212.4 (14)	277.3 (16)	278 (6)	523.7 (16)	384.5
Aug	26.2 (5)	9.0 (2)	176.1 (18)	331.1 (14)	277.4 (3)	113.2 (3)	407.8
Sept	224.2 (13)	69.3 (7)	91.4 (10)	191.8 (11)	137.1 (10)	0.0	38.2
Oct	7.4 (1)	143.3 (13)	3.0	74.0 (2)	40.2 (1)	0.0	0.0
Nov	0.0	139.9 (5)	55.4 (3)	3.0 (1)	0.0	0.0	0.0
Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0

- Figures in parenthesis are number of rainy days.

Table 2 -1.3: Monthly rainfall (mm) during rabi 2006-07

Month	Bijapur	Tandur	Solapur	Rahuri
June	212.1 (11)	21.9 (4)	132.8 (8)	94.2 (5)
July	35.4 (6)	148.8 (13)	57.3 (6)	96.4 (4)
August	33.8 (6)	49.9 (6)	33.2 (2)	118.0 (4)
September	257.3 (11)	146.3 (12)	205.9 (13)	233.8 (13)
October	102.6 (5)	29.9 (6)	35.5 (2)	75.6 (4)
November	22.4 (1)	9.6 (2)	93.4 (2)	57.5 (3)
December	0.0	0.0	0.0	0.0
January	0.0	0.0	0.0	0.0

Note: Figures in parenthesis are number of rainy days..

Results of AICSIP Agronomy Experiments in 2006-07

Kharif-2006

Trial 1 K (A): Evaluation of promising sorghum genotypes for their yield potential under rain fed condition (Zone – I Palem and Coimbatore)

Nine genotypes of Kharif sorghum viz. SPV-1714, SPV-1715, SPV-1716, SPV-1730, SPV-462, CSV—15, SPH-1524, SPH-1467 and HC-308 were evaluated at three fertility levels (0, 50 and 100 % RDF) at Palem and Coimbatore in Kharif 2006**.** At Coimbatore the level of grain yield (1234 kg/ha) was comparatively lower compared to Palem (2463 kg/ha). Whereas, yield of stover and total biomass (9897 and 11132 kg/ha) were higher at Coimbatore than at Palem (6871 and 8767 kg/ha stover and total biomass respectively).

Effect of fertility levels in Zone I

Fertility levels influenced yield and yield parameters of sorghum genotypes. The crop fertilized with 80:40 kg N: P_2O_5 produced significantly higher grain yield, stover yield and total biomass at Palem and Coimbatore. Fertility level of 80:40:00 produced significantly higher yields of grain (1451 kg/ha), stover (9897 kg/ha) and total biomass (11132 kg/ha) compared to 50% RDF and no fertilizers at Coimbatore. Further 50% RDF also produced significantly higher yield compared to no fertilizer.

Table: 1 (K) A .1: Growth and yields of Kharif sorghum genotypes as influenced by fertility levels. Zone – I (mean of Palem and Coimbatore)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest Index	1000 seed wt (g)
Fertility levels							
00:00:00	61	203	1565	8384	9949	0.17	26.8
40:20:00	60	211	1812	9380	11191	0.17	26.9
80:40:00	60	213	2328	10324	12651	0.20	27.2
CD (0.05)	1.0	NS	NS	2714	1355	0.12	0.10
Genotypes							
SPV-1714	63	210	1817	9041	10657	0.17	25.8
SPV-1715	56	196	1637	7306	8943	0.18	26.0
SPV-1716	57	179	1687	7305	8992	0.18	25.6
SPV-1730	63	234	1912	10299	12211	0.17	25.9
SPV-462	66	226	2046	11220	13266	0.17	25.5
CSV-15	64	215	1867	9783	11649	0.17	24.2
SPH-1524	61	203	2271	10441	12712	0.20	30.0
SPH-1467	61	227	2141	10799	12941	0.19	30.2
HC-308	55	187	1736	8070	9806	0.18	29.2
CD (0.05)	--	33	279	2766	3020	0.01	0.40

In Zone-I the fertility levels of 80:40:00 revealed maximum grain yield (2328 kg/ha), stover yield (10.3 t/ha) and total biomass (12.6 t/ha) followed by 40:20:00 and 00:00:00 fertility level (Table 1 (K)A .1). The increase in grain yield, stover yield and total biomass with 80:40:00 fertility over 00:00:00 fertility level was 48.7, 23.1 and 27.2 percent respectively. The fertility level of 40:20:00 similarly increased yields of grain, stover and total biomass 15.8, 11.9 and 12.5 percent over control.

Performance of genotypes in zone-I

In Zone-I, genotypes HC-308, SPV-1715, SPV-1730, (55-57 days to 50% flowering) were early by 7-10 days compared to CSV-15 (64 days) and SPV-462 (66 days). SPH-1467 and SPH-1524 (61 days) were early by 3-5 days compared to CSV-15 and SPV-462. SPV-1730 was tallest (234 cm) followed by SPH-1467, SPV-462, CSV-15, SPV-1714 and SPH-1524. The genotype SPV-1716 recorded the lowest plant height (179 cm).

SPH-1524 produced the highest grain yield (2271 kg/ha) followed by SPH-1467 (2141 kg/ha), SPV-462 (2046 kg/ha) and SPV-1730 (1912 kg/ha) (Table 1 (K)A .1). SPH-1524 was on par with SPH-1467 and SPV-462 but out yielded he CSV-15 significantly and the other genotypes. The maximum grain yield was recorded with SPH-1524 at Palem (2622 kgs/ha and Coimbatore (1920 kgs/ha)

SPV-462 registered the highest total biomass (13266 kg/ha) followed by SPH-1467, SPH-1524 and SPV-1730 (Table 1(K) A.1). The biomass of these genotypes was 13.9, 11.0, 9.1 and 4.8 percent higher than CSV-15 (11649 kg/ha). SPV-462 produced the maximum stover yield (11.2 t/ha) followed by SPH-1467, SPH-1524 and SPV-1730. Genotype SPH-1524 produced the highest grain yield (2271 kg/ha) which was significantly superior to other genotypes except SPH-1467 and SPV-462 which were on par to each other. SPH-1524 produced 11.0 and 21.6 percent higher grain yield compared to SPV-462 and CSV-15 respectively. The maximum stover (11.22 t/ha) and total biomass (13.2 t/ha) were however, recorded with SPV-462. Hybrids SPH-1524 and SPH-1467 were bold seeded (30-30.2g 1000 seed wt) compared to other genotypes CSV-15 had lowest 1000 seed wt (24.2g).

Interaction effect of fertility levels and genotypes was not significant in Zone-I. However, the combinations of 100% RDF and SPH-1524 produced the highest grain yield (2729 kg/ha). SPV-462 however produced the highest stover yield (12255 kg/ha) followed by SPH-1467, SPH-1524 at 100% RDF. Similar trend was noted in total biomass, where the combinations of 100% RDF and SPV-462 produced the highest total biomass (14781 kg/ha).

Trial 1 (K) C: Evaluation of promising sorghum genotypes for their yield potential under rain fed condition (Zone – III Udaipur and Dessa)

At Udaipur 7 genotypes including CSV-15 as check were evaluated at three fertility levels of 50 %, 100% and 150% RDF in kharif-2006. Effect of fertility levels was not significant (Table 1 (K)C.1) 100% RDF revealed the highest grain yield (3656kg/ka) followed by 150% RDF (3653 kg/ha) and 50% RDF (3380 kg/ha). Similarly stover yield and total biomass were not influenced due to fertility levels except total biomass with 150% RDF was significantly superior to 50 % RDF. The plant height was significantly higher at 150% RDF compared to 50 % and 100% RDF.

The higher yield was recorded with SPH-1467 (4542 kg/ha) followed by SPV-1730 and CSV-15 at Udaipur (Table 1. (K)C.1). The lowest grain yield was recorded with HC-308 (1702 kg/ha). The highest total biomass was recorded with SPV-1730 (18.0 t/ha) where as HC-308 registered highest stover yield (14.8 t/ha) which were significantly higher compared to CSV-15 (12.0 and 16.0 t/ha yields of stover and total biomass respectively). SPH-1467 was early to flower (66 days) compared to 69 days for CSV-15. SPV-1715, SPV-1716 and HC-308 were late compared to CSV-15. HC-308 was tallest (280cm).All genotypes were significantly taller than CSV-15 (228cm). SPV-1714 and SPV-1730 were bold seeded than CSV-15 and other genotypes.

At Dessa, 100% RDF (80:40:00 kg N: P_2O_5: K_2O registered the highest grain yield (2590 kg/ha), which was significantly superior to control and 50% RDF (Table 1 (K)C.2). The similar trend was observed for yields of stover and total biomass. The other parameter viz days to 50% flowering, plant height and 1000 seed wt were not influenced significantly due to fertility levels. HI was higher at 100% RDF. SPH-1467 and SPV-1715 were on par and significantly out yielded the other genotypes. SPH-1467 and SPV-1715 produced 19.2 and 14.0 percent higher grain yield than CSV-15. SPV-1714, SPV-1716 and SPV-1730 produced significantly lower grain yield than CSV-15. The lowest grain yield was recorded with SPV-1730 (1491 kg/ha). Similarly the SPH-1467 (8.3 t/ha) remained on par with CSV-15 (8.1 t/ha) and produced significantly higher stover yield compared to the other genotypes HC-308 had maximum plant height

followed by SPV-1715 and SPH-1467 which were significantly taller than CSV-15 (153cm). SPV-1730 and HC-308 (26.57 and 26.24g 1000 seed wt) were bold seeded than CSV-15(24.69g). SPH-1467 attained 50% flowering by 71 DAS, which was on par with CSV-15 where as SPV-1714, SPV-1730 and HC-308 was late (83-87 days to 50% flowering).

Effect of Fertility levels in zone-III (mean of Udaipur and Dessa)

The higher fertility levels of 50% RDF to 150% RDF hastened flowering to 72 days compared to no fertilizers (73 days) in Zone-III. Similarly the higher fertility levels increased plant at Udaipur. However, at Dessa, the plant height was not affected due to fertilizers.

The yields of grain, stover and total biomass were significantly increased due to 50% and 100% RDF (Table-1 (K) C.1 and Table-1 (K) C.2). The increase in grain yield due to 50 and 100% RDF at Dessa in Zone-III was 58.9 and 121.7 percent over control (1168 kg/ha). At Udaipur (Zone-III), similarly 100% RDF and 150% RDF increased grain yield by 8.2 and 8.0 percent compared to 50% RDF (3380 kg/ha).

Performance of Genotypes in zone-III (mean of Udaipur and Dessa)

In zone-III SPH-1467 registered the highest yield (3399 kg/ha) followed by CSV-15 (2974 kg/ha) and SPV-1730 (2845 kg/ha). Whereas HC-308 produced the highest stover yield (11391 kg/ha) followed by SPV-1730, SPV-1715, SPV-1714 and CSV-15. The genotype SPV-1730 registered the maximum biomass (13487 kg/ha) followed by HC-308, SPH-1467, SPV-1715 and CSV-15.

In Zone-III, HC-308 had highest plant height (236 cm) followed by SPV-1715, SPH-1467, SPV-1730, SPV-1714. CSV-15 had lowest plant height (191 cm).

The interaction between fertility levels and genotypes was not significant at both the centers of Zone-III. However in Zone-III at Udaipur the combinations of 150% RDF and SPH-1467 registered maximum grain yield (4654 kg/ha). The combinations of 150% RDF and HC-308 produced the highest stover yield (15759 kg/ha).

At Dessa, combinations of 100% RDF and SPH-1467, produced the highest yields of grain (3287 kg/ha), stover (10309 kg/ha) and total biomass (13596 kg/ha)

Table 1 (K) C.1.2: Growth and yield of sorghum genotypes as influenced by fertility levels (Zone-III at Udaipur)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	1000 seed wt (g)	Harvest Index
Fertility levels							
50% RDF	73	250	3380	12164	15544	26.6	0.22
100% RDF	73	261	3656	13046	16702	26.6	0.22
150% RDF	72	269	3653	13222	16875	27.0	0.22
CD (0.05)	NS	5.0	NS	NS	1313	NS	NS
Genotypes							
SPV-1714	71	260	3681	13386	17067	29.6	0.22
SPV-1715	77	265	3159	12944	16103	26.6	0.20
SPV-1716	78	257	3602	11586	15188	20.4	0.24
SPV-1730	70	266	4199	13827	18026	29.1	0.23
SPV-1467	66	263	4542	11099	15641	28.2	0.29
HC-308	77	280	1702	14809	16511	25.8	0.10
CSV-15	69	228	4056	12025	16080	27.4	0.25
CD (0.05)	1.0	12	390	851	920	1.24	0.02

Table 1 (K) C.2: Growth and yield of sorghum genotypes as influenced by fertility levels (Zone-III at Dessa)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	1000 seed wt (g)	Harvest Index	Plant stand (000/ha)
Fertility levels								
00:00:00	78	170	1168	5854	7023	25.5	0.17	133
40:20:00	79	170	1855	7528	9383	25.7	0.20	135
80:40:00	79	170	2590	9555	12145	25.5	0.21	132
CD (0.05)	1.0	NS	110	179	249	NS	0.01	NS
Genotypes								
SPV-1714	87	161	1705	6829	8534	24.9	0.20	134
SPV-1715	77	187	2156	7927	10083	25.7	0.21	133
SPV-1716	81	158	1687	6871	8559	25.2	0.19	131
SPV-1730	83	156	1491	7456	8947	26.6	0.16	134
SPV-1467	71	184	2255	8324	10579	25.5	0.21	136
HC-308	83	192	1913	7974	9887	26.2	0.19	132
CSV-15	71	153	1891	8140	10031	24.7	0.19	134
CD (0.05)	1.0	5.0	141	324	385	0.24	0.01	3.10

In the mean of zone-I and zone-III, SPH-1467 produced the maximum grain yield (2770 kg/ha) which was 14.5 percent higher than CSV-15 (2420 kg/ha). Whereas SPV-1730 registered the highest stover yield (10470 kg/ha) followed by SPH-1467 (10225 kg/ha) and CSV-15 (9933 kg/ha). The stover yield of SPV-1730 and SPH-1467 was 5.4 and 3.2 percent higher than CSV-15 (9933 kg/ha). On the basis of means of Zone-I and Zone-III, SPH-1467 was the tallest (226 cm) followed by SPV-1730 (225 cm), SPV-1714, SPV-1715, and HC-308 (211 cm) and CSV-15 (203 cm). The genotype SPV-1716 had the lowest plant height (194 cm).

Location specific trials – Kharif-2006

1.1 In situ soil moisture conservation practices and its interaction with nutrients

The experiment was conducted at Dharwad, Udaipur and Dessa in Kharif – 2006. Treatments comprised the combinations of three in situ moisture conservations viz compartmental bunds, ridging at inter cultivation (45 DAS) and flat bed (check) and 3 fertility levels viz ½ N and P K basal, ½ + ½ N K P as basal and ⅓ + ⅓, ⅓ N P K basal. The cultivar used was CSH-14.

The crop attained 50% flowering by 63, 52 and 56 DAS at Dharwad, Dessa and Udaipur respectively. The effect of in situ moisture conservation practices on plant height and days to 50% flowering was not significant (Table-1.1.1). Fertility levels of 2 or 3 splits hastened flowering by 1-2 days as well as significantly increased plant height (170-171 cm) compared to ½ N and P K as basal (164 cm).
Effect of in situ moisture conservation practices on yields of biomass, stover and grain was not significant (Table-1.1.1). The total biomass was highest with ridging at inter cultivation (12753 kg/ha) followed by compartmental bund and flat bed. The compartmental bunds and ridging at inter cultivation at Dharwad (4012 and 4167 kg/ha respectively) and ridging inter cultivation at Udaipur produced significantly higher total biomass compared to flat bed (3642 and 3430 kg/ha at Dharwad and Udaipur respectively).

Grain yield was significantly highest with ridging at inter cultivation (3568 kg/ha) compared to compartmental bunds (3236 kg/ha) and flat bed (3107 kg/ha) and the later two were on par (Table-1.1.1). The variation in stover yields due to in situ moisture conservation practices was not significant in overall mean, but at Udaipur, ridging at inter cultivation (9191 kg/ha) revealed significantly higher stover yield compared to compartmental bunds and flat bed (8125 and 8290 kg/ha). Thus in mean data 3 centers ridging at inter cultivation produced 8.3, 6.0 and 14.8 percent higher yields of total biomass, stover and grain compared to flat bed (11776, 8668 and 3107 kg/ha) respectively. Similarly compartmental bunds increased grain yield by 4.1 percent over flat bed (3107 kg/ha), while biomass and stover yields with compartmental bunds and flat bed were almost similar.

Effect fertility levels

Application of fertilizer as N in 2 or 3 splits PK basal hastened flowering by 1-2 days compared to ½ N and as PK basal. Fertilizer management of N in 2 or 3 splits and PK as basal revealed significantly higher yields of total biomass, grain and stover compared to ½ N and PK basal. Fertilizer management of ⅓ + ⅓+ ⅓ N and PK as basal produced maximum total biomass (13072 kg/ha), stover yields (9384 kg/ha) and grain yield (3687 kg/ha). Further, grain yield was significantly higher with ½ + ½N and KP basal 93412 kg/ha) compared to ½ N PK as basal(2813 kg/ha). The total biomass and stover yields were on par with 2 or 3 splits of N and KP as basal treatments.

Thus, fertilizer management ⅓ + ⅓+ ⅓ N,K and P basal and ½ + ½ N,K and P basal produced 31.0 and 21.3 percent higher grain yields compared to ½ N and PK as basal (2813 kg/ha) (Table-1.1.1). The stover yield was 14.5 and 9.2 higher with 3 splits N and PK basal and 2 splits of N and PK basal compared to ½ N and PK basal (8198 kg/ha). Similarly total biomass was higher by 18.7 and 12.3 with 3 and 2 splits N and PK basal compared to ½ N and PK basal (11011 kg/ha).

Fertilizer treatment of ⅓ + ⅓ + ⅓ N P K basal revealed 31.0, 14.5 and 18.7 percent higher yields of grain, stover and total biomass compared to ½ N and PK as basal (2813, 8198 and 11011 kg/ha of grain, stover and total biomass) respectively. Fertilizer management of ½ + ½ N and PK basal was significantly superior to ½ N and PK basal at Dharwad and Udaipur. In the mean of all stations, ½+ ½ N and PK as basal produced 21.3, 9.2 and 12.3 percent higher yields grain, stover and total biomass compared to ½ N and PK basal.

Table-1.1.1: Growth and yields of sorghum as influenced by in situ soil moisture conservation practices and its interaction with nutrients (mean of 3 stations Dharwad, Dessa and Udaipur)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest Index	1000 seed wt (g)	Plant stand (000/ ha)
In situ soil moisture conservation								
Compartmental bund	57	169	3236	8683	11920	26.6	0.27	149
Ridging at inter cultivation	57	169	3568	9185	12753	26.7	0.28	151
Flat bed (check)	57	167	3107	8668	11776	26.3	0.26	150
CD (0.05)	NS	NS	256	NS	NS	NS	NS	NS
Fertility levels								
½ N and PK as basal	58	164	2813	8198	11011	26.3	0.25	149
½ + ½ N, KP as basal	56	170	3412	8955	12366	26.8	0.27	149
⅓ + ⅓ + ⅓ N, KP as basal	57	171	3687	9384	13072	26.6	0.28	151
CD (0.05)	1.0	3.0	359	619	957	NS	0.01	NS

Trial 1.2: Maximization of sweet sorghum cane yield

A experiment with 16 treatments comprising combinations of two row to row spacing (45 × 15cm and 60 × 15cm), two genotypes (SSV-84 and NSSH-104 / RSSV-9) and 4 levels of nitrogen (30,60,90 and 120 kg N/ha). The experiment was conducted at Coimbatore, Palem, Akola, Solapur and Indore in Kharif-2006.

Effect of row spacing

A spacing of 45 × 15cm produced significantly higher cane yield compared to 60 × 15cm at Akola and Indore. At Coimbatore however, 60 × 15cm revealed significantly higher cane yield (38.1 t/ha) than narrow spacing (45 × 15cm). At Solapur, cane yield with both spacing were on par. In All India mean, 45 × 15cm row spacing (31.6 t/ha) registered significantly higher cane yield compared to 60 × 15cm (27.4 t/ha) (Table-1.2.1). Data on Juice yield recorded at Akola and Solapur revealed maximum juice yield of sweet sorghum with 45 × 15cm spacing (11075 liters/ha) compared to 9854 liters/ha with wider spacing of 60 × 15cm. A spacing of 60 × 15cm had higher Brix value (15.4 %) than 45 × 15cm (14.54%), whereas, juice extraction was on par with both the spacing (42.9 and 41.5% with 45 × 15cm and 60 × 15cm respectively).

Growth parameters viz days to 50% flowering (82 days) and plant height (257 and 258 cm) were not varied significantly due to row spacing (Table 1.2.2). Total biomass stover yield and grain yields were not varied significantly due to spacing (Table 1.2.2). However, 45 × 15cm resulted in higher total biomass (16757 kg/ha) compared to 60 × 15cm (14904 kg/ha). Similarly stover yield was maximum with narrow spacing 45 × 15cm (13649 kg/ha) compared to wider spacing 60 × 15cm (11914 kg/ha). Grain yield was significantly higher with 45 × 15cm at Palem (1531 kg/ha) and Coimbatore (792 kg/ha) and Indore (1530 kg/ha) compared to 60 × 15cm spacing. At Akola however, 60 × 15cm produced significantly higher grain yield (2811 kg/ha) at 60 × 15cm spacing compared to 45 × 15cm (2230 kg/ha). In All India mean grain yields with both spacing were similar (1521 and 1521 kg/ha at 45 × 15cm and 60 × 15cm spacing respectively).

Performance of genotypes

Cane yield of sweet sorghum genotypes not varied significantly (Table 1.2.1). The cane yield potential of SSV-84, NSSH-104 and RSSV-9 was 29473, 30147 and 29008 kg/ha respectively. The juice yields of genotype were also similar (9645, 10580 and 11986 liters with SSV-84, NSSH-104 and RSSV-9 respectively). Sweet sorghum genotype NSSH-104 was significantly taller 283 and 201cm at Akola and Indore respectively than SSV-84 (251 and 181cm at Akola and Indore respectively). At Solapur RSSV-9 was significantly taller (287cm) than SSV-84 (260cm). Days to 50% flowering of different genotype were varied from 76 to 107 days. The crop flowered by 59 days at Palem was early. At Akola, Coimbatore and Solapur it was medium late 76-87 days and 105-107 days at Indore was late. Total biomass of NSSH-104 at Akola (21686 kg/ha) and Indore (19996 kg/ha) was significantly higher than SSV-84 (19074 kg/ha at Akola and 16238 kg/ha at Indore). The total biomass yield at Palem (5021 and 5112 kg/ha RSSV-9 and NSSH-104 respectively) and at Solapur (20880 and 18640 kg/ha in SSV-84 and RSSV-9 respectively) was not varied due to genotypes. Grain yield however, was significantly superior with NSSH-104 (1705 kg/ha) compared to SSV-84 / RSSV-9 (1327 kg/ha). 1000 seed of different genotypes was not varied significantly in SSV-84 26-34.2, in NSSH-104 30.4-34.2 and in RSSV-9 24.2 gm.

Table 1.2.1:Yields of cane and juice, Brix value and juice extraction percentage of sweet sorghum genotypes as influenced by row spacing and N levels.

Treatments	Cane Yield (t/ha)				Mean	Juice yield (liter/ha)		Mean	Juice extract-ion (%)	Brix value (%)
	Coimbatore	Akola	Solapur	Indore		Akola	Solapur			
Row spacing										
45 × 15cm	35.6	45.5	29.5	16.0	31.6	9470	12680	11075	42.89	14.54
60 × 15cm	38.1	31.0	29.0	11.5	27.4	7617	12090	9854	41.51	15.41
CD (0.05)	1.56	2.20	NS	3.26	2.96	906	NS	--	NS	NS
Genotype										
SSV-84	37.4	36.4	29.0	13.5	29.1	6507	12784	9645	43.79	15.81
NSSH-104	36.4	40.1	--	13.9	30.1	10580	--	10580	--	14.14
RSSV-9	--	--	29.4	--	29.4	--	11986	11986	40.62	11.94
CD (0.05)	NS	2.89	NS	NS	NS	906	NS	--	1.11	NS
N level										
30	36.2	32.3	27.2	12.1	26.9	6453	10414	8434	38.25	14.71
60	36.2	35.3	28.4	13.8	28.4	7262	12647	9955	44.55	15.13
90	36.6	39.8	29.9	15.3	30.4	8560	13203	10882	44.12	14.65
120	38.4	45.5	31.5	13.7	32.3	11899	13276	12587	41.89	15.42
CD (0.05)	1.45	2.61	2.96	1.10	2.49	644	1260	--	1.71	NS

Table 1.2.2: Growth and yields of grain, stover and total dry matter and yield parameters of sweet sorghum genotypes as influenced by row spacing and N levels

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	1000 seed wt (g)	Harvest Index	Plant stand at harvest (000/ha)
Row spacing								
45 × 15cm	82	257	1521	13649	16757	38.0	0.16	117
60 × 15cm	82	258	1511	11914	14904	30.1	0.16	90
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	23.4
Genotype								
SSV-84	83	249	1327	11985	14833	29.6	0.15	102
NSSH-104	80	265	1705	13577	15598	30.4	0.17	104
RSSV-9	--	287	--	--	20510	--	--	--
CD (0.05)	--	--	520	NS	2558	NS	NS	NS
N level								
30	83	246	1192	10585	13742	28.9	0.16	99.8
60	83	256	1420	11954	15300	29.7	0.16	101
90	82	263	1642	13368	16273	30.3	0.16	104
120	80	264	1810	15219	18005	31.0	0.16	108
CD (0.05)	1.0	5.0	196	1090	1221	0.89	NS	4.8

Response to N levels

Cane yield of sweet sorghum increased significantly due to N levels (Table 1.2.1). Application of 120 kg N/ha registered the highest cane yield (32.3 t/ha) which was significantly higher by 19.6 and 13.4 percent compared to 30 and 60 kg N/ha (26.9 and 28.4 t/ha respectively). The cane yield due to 90 and 120 kg N/ha were on par. Similarly 120 kg N/ha had maximum juice yield (12587 liters/ha) which was 49.2, 26.4 and 15.7 percent high compared to 30, 60 and 90 kg N/ha. The juice extraction improved with N levels upto 60 kg N/ha (44.55%) and decreased at 120 kg N/ha to (41.89%) compared to 30 kg N/ha (38.25%). Brix value increased with N levels upto 120 kg N/ha (15.42%). Similarly N levels significantly increased yields of grain, stover and total biomass upto 120 kg N/ha. The increase in grain yield due to 120 kg N/ha (1810 kg/ha) over 30, 60 and 90 kg N/ha was 51.8, 27.5 and 10.2 percent respectively. The similarly highest stover yield (15219 kg/ha) was recorded at 120 kg N/ha which was 43.7 percent higher than to 30 kg N/ha (10585 kg/ha). The 120 kg N/ha hastened 50% flowering by 3 days compared to 30 kg N/ha (83 days). Plant height increased significantly with increasing N levels upto 90 kg N/ha (263cm) compared to 30 kg N/ha (246cm).The number of canes per ha and 1000 seed wt increased with N levels upto 120 kg N/ha. Harvest index was not affected due to N levels (Table-1.2.2).

Trial 1.3 Integrated nutrients and moisture conservation in Kharif sorghum

A field experiment was conducted at Parbhani, Akola, Dharwad and Udaipur in kharif-2006. Treatments consisted combinations of 4 moisture conservations viz flat bed, (rows at 45cm), sowing at 45cm and opening furrows at 3 weeks after sowing, paired planting at 30:60:30 and opening furrows and paired planting 30:60:30 with 1 row of green gram/ cowpea in inter pair spaces and three integrated nutrient managements viz RDF 80:40:40 KgN, P_2O_5, K_2O per ha, FYM @ 5 t/ha + Azotobactor + PSB and 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB.

Effect of moisture conservation measures

The plant height and days to 50% flowering were not affected due to moisture conservation measures (Table 1.3.1). The moisture conservation through opening furrows at 3 weeks after sowing in crop sown at 45cm (3199 kg/ha) or paired planting 30:60:30 (3122 kg/ha) produced significantly higher grain yield

compared to flat bed (2946 kg/ha). Planting row of legumes in inter pair spaces of paired planted sorghum decreased grain yield to 2827 kg/ha compared to flat bed. Sowing at 45cm and opening furrows at 3 weeks after sowing registered the highest grain yield at Parbhani, Akola and Udaipur (1873, 2922 and 4056 kg/ha) respectively. Paired planting at 30:60:30 and opening furrows at 3 weeks after sowing produced maximum grain yield at Dharwad (4300 kg/ha). The similar trend was noted for stover yield. The maximum stover yield was recorded with sowing at 45cm and opening furrows at 3 weeks after sowing (7516 kg/ha). The extent of increase in grain and stover yields with sowing at 45cm and opening furrows was 8.6 and 9.8 percent compared to flat bed (2946 and 6842 kg/ha) respectively. Similarly total biomass was highest with opening furrows at 3 weeks after sowing in normal crop (10715 kg/ha) followed by opening furrows in inter pair spaces of paired planted sorghum (10499 kg/ha) and flat bed (9789 kg/ha). The Harvest Index and 1000 seed wt were not affected due to moisture conservation measures.

Effect of integrated nutrient management

RDF 80:40:40 Kg N, P_2O_5, K_2O per ha significantly hastened flowering by 2 days, increased plant height (172cm) and produced higher yields of grain (3220 kg/ha), stover (7474 kg/ha) and total biomass (10694 kg/ha) compared to FYM @ 5 t/ha + Azotobactor + PSB (Table-1.3.1). The variation in yields of grain, stover and total biomass due to 100% RDF and 50% RDF + 2.5 t/ha FYM + Azotobacter + PSb was not significant.One thousand seed weight with RDF was on par with INM – 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB but significantly superior to FYM @ 5 t/ha + Azotobactor + PSB. Harvest Index was not varied significantly due to integrated nutrient managements.

The interaction between moisture conservation measures and integrated nutrient managements was significant for grain yield at Dharwad (Table-1.3.2) Application of RDF for sorghum paired planting at 30:60:30 and opening furrows at 3 weeks after sowing revealed significantly higher grain yield (4753 kg/ha) compared to the other INM treatments. Where as, INM – 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB produced significantly higher grain yield with sowing at 45cm and opening furrows at 3 weeks after sowing (4198 kg/ha) compared to the other INM viz RDF and FYM + Azotobactor + PSB. The effect of integrated nutrient management was not significant when sorghum was paired planted with 1 row of legumes. In flat bed (45cm) sown crop, RDF and 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB were on par and produced significantly higher grain yield compared to 5t FYM + Azotobactor + PSB.

Stover yield and total biomass varied significantly due to the interaction of moisture conservation and integrated nutrient management at Parbhani (Table-1.3.3 and Table-1.3.4).RDF produced significantly higher stover yield (6481 kg/ha) compared to the other INM treatments when sorghum was sown at 45cm and opened furrows at 3 weeks after sowing. The effect of different INM was not significant in sorghum paired planted and opening furrow. Thus RDF produced significantly higher than the other INM, in sorghum given various moisture conservation measures except paired planted and opening furrows. FYM 5 t/ha + Azotobactor + PSB favored paired planted and opening furrows, similarly 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB were more effective with opening furrows in normal or paired planted sorghum. RDF was effective in sorghum at 45cm and opening furrow which revealed the highest stover yield (6481 kg/ha) and total biomass (8488 kg/ha).

Trial 1.3.1: Growth, grain and stover yields of kharif sorghum as influenced by INM and moisture conservation (means of 4 centers Parbhani, Akola, Udaipur, Dharwad)

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	1000 seed wt (g)	HI	Plant stand at Harvest (000/ ha)
Moisture conservation practices								
Flat bed (45cm)	61	170	2946	6842	9789	28.1	0.30	168
Sowing at 45cm opening furrows (21 DAS)	61	172	3199	7516	10715	28.0	0.30	166
Paired planting 30:60:30 and opening furrows (21 DAS)	61	170	3122	7378	10499	28.2	0.29	166
Paired planting 30:60:30 and sowing 1 row of green gram / cowpea inter pair space	61	169	2827	6633	9460	28.2	0.29	166
CD (0.05)	NS	NS	196	344	515	NS	NS	NS
Integrated nutrient management								
100% RDF 80:40:40 kg N: P_2O_5: K_2O/ ha	60	172	3220	7474	10694	28.7	0.30	167
FYM 5t @ + Azotobactor + PSB	62	167	2749	6550	9298	27.5	0.29	166
50% RDF + 2.5 t/ha FYM + Azotobactor + PSB	60	171	3102	7253	10356	28.2	0.30	167
CD (0.05)	1.0	3.0	170	298	446	0.71	NS	NS

Table 1.3.2: Grain yield as influenced by interaction of moisture conservation and integrated nutrient management (Dharwad)

Moisture conservation	INM			Mean
	F_1	F_2	F_3	
Flat Bed (45cm)	4115	3560	4012	3896
Sowing at 45cm and opening furrow at 21 DAS	3868	3765	4198	3944
Paired planting 30:60:30 and opening furrows at 21 DAS	4753	3868	4280	4300
Paired planting 30:60:30 with 1 row of green gram/ cowpea	3909	3745	3951	3868
Mean	4162	3735	4110	4002
CD (0.05) for comprising moisture conservation				308

Table 1.3.3: Stover yield as influenced by interaction of moisture conservation and integrated nutrient management (Parbhani)

Moisture conservation	INM			Mean
	F_1	F_2	F_3	
Flat Bed (45cm)	5329	4856	4887	5024
Sowing at 45cm and opening furrow at 21 DAS	6481	5062	5700	5748
Paired planting 30:60:30 and opening furrows at 21 DAS	5514	5597	5669	5593
Paired planting 30:60:30 with 1 row of green gram/ cowpea	5082	4053	4397	4510
Mean	5602	4892	5162	
CD (0.05)	371			

Table- 1.3.4: Total biomass as influenced by moisture conservations and integrated nutrient at Parbhani

Moisture conservation	INM			Mean
	F_1	F_2	F_3	
Flat Bed	6872	6200	6327	6466
Sowing at 45cm and opening furrow	8488	6800	7574	7621
Paired planting 30:60:30 and opening furrows	7300	7302	7261	7288
Paired planting 30:60:30 with 1 row of green gram/ cowpea	6486	5169	5712	5789
Mean	7282	6368	6719	6719
CD (0.05)	641			

F_1- RDF 80:40:40 kg N: P_2O_5: K_2O per ha
F_2- FYM @ 5 t/ha + Azotobactor + PSB
F_3- 50% RDF + 2.5 t/ha FYM + Azotobactor + PSB

Trial 1.4: Studies on nutrient uptake, grain and stover qualities of different sorghum genotypes

A field experiment comprising 8 sorghum genotypes was conducted at Coimbatore, Parbhani, Solapur, Dharwad, Indore and Udaipur in kharif-2006. Data on growth and yields of grain, stover and total biomass and grain yield attributes have been summarized (Table-1.4.1). Data on nutrient content and its uptake are presented in Table 1.4.2.

Genotype CSH-20MF, CSH-16 and SSG 59-3 were early and attained 50% flowering by 69, 73 and 73 days respectively. HC-308 and SPV-1616 and CSV-15 attained 50% flowering 77-80 DAS (Table-1.4.1) where as sweet sorghum genotypes SSV-84 and NSSH-104 were late which flowered by 88 and 83 days. Plant height of genotypes varied from 209-225cm. SPV-1616 and HC-308 were tallest (254cm) followed by SSG 59-3, NSSH-104, CSV-15, CSH-20MF and SSV-84. The lowest plant height was recorded with CSH-16 (209cm) CSH-16 produced the highest grain yield (2732 kg/ha) followed by SPV-1616, CSH-20MF and CSV-15 (2629, 2423 and 2393 kg/ha respectively), which were significantly superior to HC-308, SSV-84 and SSG 59-3. The highest stover yield was recorded in NSSH-104 (19190 kg/ha) followed by SSV-84, SPV-1616, CSV-15, HC-308 and CSH-16. The lowest stover yield was recorded with SSG 59-3 (14990 kg/ha). Similarly, NSSH-104 produced the highest biomass (21160 kg/ha) and the lowest biomass

was recorded with SSG 59-3 (15694 kg/ha). NSSH-104, CSV-15, SSV-84 and CSH-16 were bold seeded (28.8-29.59 1000 seed wt) compared to SSG 59-3, HC-308 and CSH-20MF (18.3-22.6 1000 seed wt). The Harvest index of genotypes varied from 0.07 to 0.15.

The various quality parameters of different sorghum genotypes presented in Table 1.4.2. The dry matter content in different genotypes was 92.2 to 93.6 percent. The crude protein varied from 3.76 in CSV 84 to 4.83 in HC 308. The range in content Ash was 7.53-9.49 percent. The nitrogen content was varied from 0.601 to 0.774 percent. The invitro dry matter digestibility was 44.1 to 47.7 percent in different genotypes with metabolizable energy of 6.36 to 7.45.

Trial 1.4.1: Growth yield and yield parameters of sorghum genotypes (means of 6 locations)

Genotypes	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	1000 seed wt (g)	HI	Plant stand at harvest (000/ ha)
CSH-16	73	209	2732	15691	18423	28.8	0.15	135
CSV-15	80	244	2395	16339	18734	29.5	0.13	140
SPV-1616	77	254	2629	17031	19660	26.3	0.13	158
SSV-84	88	225	1272	18195	19467	29.0	0.07	126
NSSH-104	83	250	1970	19190	21160	29.6	0.09	100
CSH-20MF	69	243	2423	14064	16487	22.6	0.15	153
HC-308	77	254	1587	16179	17766	22.5	0.09	137
SSG 59-3	73	253	1204	14490	15694	18.3	0.08	182
CD (0.05)	8.0	31	1073	NS	NS	7.30	--	36.9

1.4.2 : Stover of quality parameters, yields of crude protein and digestible dry mater and nitrogen uptake of sorghum genotypes (Mean of Coimbatore, Solapur, Dharwad, Indore and Udaipur)

Genotypes	Dry matter (%)	Crude protein (%)	Ash (%)	Nitrogen (%)	Metabolizable energy	Invitro dry matter digestibility (%)	Crude Protein Yield (kg/ha)	Digestible Dry matter yield (kg/ha)	Nitrogen uptake by stove (kg/ha)
CSH-16	93.6	4.05	9.49	0.649	6.36	44.1	660	6688	106
CSV-15	92.5	3.94	7.98	0.630	6.90	47.2	709	8010	113
SPV-1616	92.7	4.03	7.53	0.645	6.71	45.9	750	8813	120
SSV-84	93.1	3.76	8.03	0.601	6.77	46.4	723	9255	115
NSSH-104	92.2	4.45	9.29	0.713	6.79	46.8	956	10200	153
CSH-20 MF	92.9	4.49	8.29	0.719	6.59	45.5	732	7258	117
HC-308	92.5	4.83	8.55	0.774	6.95	47.7	873	8748	141
SSG-59-3	92.7	4.41	8.67	0.706	6.45	44.8	650	7069	104
CD (0.05)	NS	NS	NS	NS	NS	NS	--	--	--

Crude protein yield from stover of different genotypes varied from 650-956 kg/ha (Table 1.4.2). The genotypes NSSH 104 recorded maximum crude protein yield (956 kg/ha) , digestible dry matter yield 10200 kg/ha and maximum nitrogen uptake in stover (153 kg/ha). The other genotypes viz. HC-308 recorded crude protein yield of 873 kg/ha with digestible dry matter yield of 8748 kg/ha and nitrogen uptake of 141 kg/ha. The SSG-59-3 registered the lowest crude protein yield (650 kg/ha) and nitrogen uptake in stover (104 kg/ha). CSH-16 registered the lowest digestible dry matter yield (6688 kg/ha).

Trial – 2.1: Intercrop diversification/ intensification in sorghum

A experiment was conducted at Palem in Kharif-2006 with eight treatments comprising combinations of two genotypes (CSH-13 and CSV-15) and four sorghum based intercropping viz sole sorghum, sorghum + pigeon pea, sorghum + cowpea for vegetable and sorghum + cluster bean. Sorghum + Pigeon pea intercropping recorded higher sorghum equivalent yield (2982 kg/ha) compared to other intercropping systems and sole sorghum (Table-2.1.1). Among the other intercropping systems sorghum + cowpea for vegetable (2639 kg/ha) revealed significantly higher sorghum grain equivalents compared to sole sorghum (Table 2.1.1). The growth parameters and seed weight of sorghum were not varied significantly due to intercropping systems and genotype except, CSH-13 had significantly higher 1000 seed wt (29.8 g) compared to CSV-15 (24.7 g). CSV-15 produced significantly higher sorghum grain equivalent yield which was higher by one quintal than CSH-13 (2622 kg/ha). Sorghum cv CSV-15 + Pigeon pea intercropping resulted in the highest sorghum grain equivalent yield (3110 kg/ha) followed by sorghum cv CSH-13 + Pigeon pea (2855 kg/ha) compared to sole sorghum cv CSV-15 and CSH-13 (2548 and 2501 kg/ha)

Table 2.1.1: Growth yield of sorghum genotypes and sorghum equivalent grain yield as influenced by intercrops

Treatments	Sorghum equivalent grain yield (kg)	Days to 50% flowering	Plant height (cm)	1000 seed wt (g)
Genotypes				
CSH – 13	2622	60	201	29.8
CSV – 15	2721	63	199	24.7
CD (0.05)	76.0	1.0	NS	0.52
Intercropping systems				
Sole sorghum	2524	62	198	27.5
Sorghum + Pigeon pea	2982	62	199	27.3
Sorghum + Cowpea	2639	62	201	27.2
Sorghum + Cluster bean	2541	62	201	27.0
CD (0.05)	107	NS	NS	NS

Trial 3.1 Nutrient recycling in sorghum based double cropping system

The experiment was conducted at Indore in 2006-07. Treatment comprised combinations of three double crop sequences viz
1. Sorghum (Kharif) – Chickpea
2. Sorghum (Kharif) – Field peas
3. Sorghum (Kharif) – Lentil and two fertility levels viz 100% RDF and vermi compost @ 2 t/ha. Data on sorghum cv CSH-16 recorded in Kharif – 2006 have been reported (Table 3.1.1)

Kharif sorghum cv CSH-16 preceded by field peas or lentil produced significantly higher yields of grain, stover and total biomass compared to sorghum – chickpea (Table 3.1.1). The extent of beneficial effect of lentil and field peas on sorghum grain yield was 16.2 and 13.8 percent respectively compared to chickpea (2350 kg/ha). Similarly total biomass was 13.2 higher with lentil and field peas compared to chickpea. Growth and yield parameters of sorghum were not influenced significantly due to double cropping.

The crop given 100% RDF had significantly taller plants compared to vermicompost @ 2 t/ha (Table 3.1.1). Similarly 100% RDF produced significantly higher yields of grain, fodder and total biomass by 17.7, 15.0, 15.8 percent compared to vermicompost @ 2 t/ha (2375, 5298 and 7685 kg/ha of grain, stover and total biomass) respectively. Interaction between lentil and gram double cropping systems and fertilizer N was not significant. However, sorghum preceded by lentil along with 100% RDF, produced maximum grain yield (3048 kg/ha). Where as stover and total biomass were highest with sorghum preceded by field peas (6481 stover and 9414 kg/ha fodder and total biomass respectively).

Table 3.1.1: Growth and yields of grain stover and total biomass, sorghum cv CSH-16 as influenced by nutrient recycling in sorghum based double cropping systems

Treatments	Days to 50% flowering	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest Index	1000 seed wt (g)	Plant stand (000/ ha)
Cropping Systems								
Sorghum – Chickpea	83	206	2350	5285	7639	0.31	32.9	122
Sorghum – Field peas	82	205	2675	5903	8596	0.31	32.0	124
Sorghum – Lentil	83	204	2731	5903	8650	0.32	33.0	125
CD (0.05)	NS	NS	193	348	523	NS	NS	NS
Fertilizer								
In organic – Inorganic 100% RDF	81	209	2796	6096	8904	0.31	31.9	125
Organic – vermi compost 2 t/ha	85	201	2375	5296	7685	0.31	33.3	122
CD (0.05)	1.0	4.0	158	284	427	NS	1.37	NS

Trial 3.2 Response of forage sorghum genotypes to different nitrogen levels

A field experiment with 16 treatments comprising combinations of four genotypes of forage sorghum viz VTFS-43, HC-308, S-540 and S-541 and four levels of nitrogen 0, 50, 755 and 100 kg N/ha was initiated at Dharwad in kharif-2006.

Performance of genotypes : Genotypes S-541 and VTFS-43 were early to flower (68 and 69 days) compared to HC-308 (78 days to 50% flowering) and S-540 (77 days to 50% flowering) (Table-3.2.1). S-541 was tallest (260 cm) followed by S-540 and HC-308. The lowest plant height was recorded in VTFS-43 (245 cm). The genotypes VTFS-43 produced significantly highest total biomass (29282 kg/ha) which was 7.5% higher compared to HC-308 (27240 kg/ha). The lowest total biomass was recorded in S-541 (24688 kg/ha). Similarly seed production was maximum in VTFS-43 (1794 kg/ha) followed by HC-308 (793 kg/ha) and S-540 (313 kg/ha).

Response to N level:

The higher N levels (50 to 100 kg N/ha) hastened 50% flowering by 2 days compared to no nitrogen (75 days) (Table-3.2.1). Plant height significantly increased due to N levels upto 100 kg N/ha (plant height 271 cm) compared to no nitrogen (232 cm). One thousand seed wt lowered with higher N rates. Dry matter (fodder) yield and total biomass increased with increase in N levels upto 50 kg N/ha. The highest total biomass was however was recorded with 75 kg N/ha which was 13.5 higher than no fertilizer (24861 kg/ha). Similarly, the magnitude of response to 50 kg N was 12.2 percent over no nitrogen (24861 kg/ha total biomass). Grain yield increased significantly with increase in N levels upto 100 kg N/ha. The maximum grain yield was recorded with 100 kg N/ha (1186 kg/ha).

The interaction between genotype and N levels was significant. VTFS-43 fertilizer with 75 kg N recorded the highest total biomass (31134 kg/ha) and dry fodder yield (29398 kg/ha) (Table 3.2.2).

Table 3.2.1: Growth and yields of forage sorghum genotypes at different nitrogen level

Treatments	Days to 50% flowering	Plant Height (cm)	Grain yield (Kg/ha)	Stover yield (Kg/ha)	Total biomass (Kg/ha)	1000 seed wt (g)	Plant stand (000/ ha)
Genotypes							
VTFS – 43	69	245	1794	27488	29282	19.6	215
HC – 308	78	251	793	26447	27240	17.3	218
S – 540	77	253	313	27373	27685	17.9	217
S – 541	68	260	266	24421	24688	18.9	219
CD (0.05)	1.0	9.0	61	1352	1355	1.52	2.29
N levels (kg/ha)							
0	75	232	498	24363	24861	18.1	215
50	73	246	689	27199	27888	18.7	217
75	73	259	793	27431	28223	18.7	218
100	73	271	1186	26736	27922	18.2	219
CD (0.05)	1.0	4.0	102	1115	1129	NS	1.92

Table 3.2.2: Total biomass (kg/ha) as influenced by genotypes N levels

Genotype	N levels kg/ha				Mean
	0	**50**	**75**	**100**	
VTFS – 43	26806	28356	31134	30833	29282
HC – 308	25139	27130	27639	29051	27240
S – 540	27222	27917	29028	26574	27685
S – 541	20278	28148	25093	25231	24688
Mean	24861	27888	28223	27922	27224

CD (0.05) – 2230

S-541 responded significantly upto 50 kg N/ha whereas, VTFS-43 and S-540 responded significantly upto 75 kg N/ha, HC-308 was responded significantly upto 100 kg N/ha (Table 3.2.2).

AICSIP Agronomy Rabi Experimental Results – 2006-07

Trial 7RA: Evaluation of rabi sorghum genotypes under receding soil moisture conditions

A field experiment with 21 treatments consisting combinations of 3 fertility levels viz., native fertility, 50% RDF and 100% RDF (RDF-60:30:00 Kg N:P P2O : 420/ha) and 7 promising genotypes from AVHT viz. SPH 1449, SPV-1704, SPV-1626 along with check viz. CSV-14R, M35-1 and CSV-216R. The experiment was laid out in split plot design with fertility levels as main plots and genotypes as subplots with 3 replications. The experiment was conducted at Parbhani, Rahuri, Dharwad and Tandur during rabi 2006-07.

Effect of fertility levels:

In the mean data, application of 100% RDF hastened flowering by one day over native fertility (72 days) and increased plant height significantly upto 217 cm compared to native fertility (206 cm) (Table : 7 (R) A-1). The Plant height was not varied significantly due to fertility levels at Tandur and Rahuri.
Grain yield varied significantly due to fertility levels. The significantly highest grain yield (2429 kg/ha) was recorded with 100% RDF which was higher by 422 kg/ha i.e. 21.0 percent higher compared to native fertility (2007 kg/ha). Similarly, 50% RDF increased grain yield (2204 kg/ha) significantly compared to native fertility by 9.8 percent.

Stover yield varied significantly due to fertility levels at all centres except Dharwad.

In the mean data of 4 centres, significantly highest stover yield was recorded with 100% RDF (5844 kg/ha) followed by 50% RDF (5557 kg/ha) which were significantly superior to native fertility (5137 kg/ha) (Table 7 (R) A.1. The increase in stover yield due to application of 50% RDF and 100% RDF was 8.1 and 13.8 percent compared to native fertility (5137 kg/ha). Similarly total biomass was significantly highest with 100% RDF (8273 kg/ha) followed 50% RDF (7761 kg/ha) compared to 7144 kg/ha in native fertility.
The harvest index (0.28-0.29) was not varied significantly due to fertility levels. Thousand seed weight varied significantly due to fertility levels. Whereas, in mean data of centres, 100% RDF significantly increased 1000 seed weight (29g) compared to native fertility (28.0g). 1000 seed weight with 50% RDF (28.5g) on par with native fertility.

Performance of genotypes:

Genotypes differed significantly with respect of days to 50% flowering, plant height, harvest index yields of grain stover and total biomass and 1000 seed weight (Table 7RA.1).

SPH-1449 was early to flower (67 days) and was on par with M35-1 (69 days) for days to 50% flowering. Genotypes SPV-1704, (73 days) and SPV-1626 (72 days) were on par with CSV-216R (75 days) and significantly early to flower compared to M35-1 and CSV-14R (69 and 70 days) respectively. SPV-1626 and CSV-216R remained on par for plant height (223 and 227 cm) were significantly taller than the other genotypes. Similarly, SPV-1704 and SPH-1449 (214 and 213 cm plant height) were significantly taller than CSV-14R (192cm) and M35-1 (204cm).

SPV-1626 remained on par with CSV-216R and produced significantly higher grain yield, stover and total biomass (2510 kg/ha, 5960 and 8469 kg/ha respectively) compared to M35-1, CSV-14R, SPV-1704 and SPH-1449. The genotypes SPH-1449 and SPV-1704 were (1961 and 2040 kg/ha grains yield) however on par with CSV-14R and M35-1 with respect to grain (2088 and 2141 kg/ha respectively). The similar trend was observed with respect to stover yield and total biomass. Genotypes SPH-1449 and SPV-1704 has significantly lower harvest index (0.26, 0.27 respectively) compared to the other genotypes (0.28-0.30). The thousand seed weight of SPV-1704 (29.3g) and SPV-1626 (28.9g) were on par with CSV-14R. M35-1 and CSV-216R (28.2, 29.9 and 29.1 g respectively). SPH 1449 had the lowest 1000 seed weight (25.7 g)

Table 7(R) A.1: Growth and yields of rabi sorghum genotypes at different fertility level under (mean of Parbhani, Rahuri, Dharwad and Tandur)

Treatments	Days to 50% flower	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest index	1000 seed weight (g)	Plant stand (000/ha)
Fertility levels								
No-fertilizer (native fertility)	72	206	2007	5137	7144	0.28	28.0	131.9
30:15:00 (50% RDF)	71	213	2204	5557	7761	0.28	28.5	132.1
60:30:00 (100% RDF)	71	217	2429	5844	8273	0.29	29.0	132.9
CD (0.05)	**0.01**	**10.0**	**153.0**	**288.0**	**332.0**	**NS**	**0.81**	**NS**
Genotypes								
SPH-1449	67	214	1961	5552	7513	0.26	25.7	131.1
SPV-1704	73	213	2040	5272	7312	0.27	29.3	132.3
SPV-1626	72	223	2510	5960	8469	0.29	28.9	132.8
CSV-14R	70	192	2088	5239	7328	0.28	28.2	132.7
M35-1	69	204	2141	5238	7379	0.29	29.9	132.7
CSV-216R	75	227	2541	5816	8357	0.30	29.1	132.1
CD (0.05)	**3.0**	**6.0**	**332.0**	**401.0**	**657.0**	**0.02**	**1.42**	**NS**

Trial 7 (R) B: Evaluation of rabi sorghum genotypes under rainfed condition on shallow-medium soil

A field experiment comprising 24 treatment combinations of 3 fertility levels (0, 50 and 100% RDF) and eight genotypes (SPH-1449, SPV-1704, SPV-1626, CSV-14R, M35-1, CSV-216R AND SPV-1591) was conducted at Solapur and Bijapur. The experiment at Bijapur was vitiated**.**

Results of experiment conducted at Solapur are presented in the following text. At Solapur the crop was sown on September 25, 2006. The trial was laid out on spilt plot design with fertility levels as main plot treatments and genotypes on sub plot treatments with 3 replications. Fertilizer were applied as per treatment as a basal.

Effect of fertility levels

Effect of fertility levels on growth and yields of rabi sorghum genotypes were not significant (Table 7(R)B.1 and Table1(R).B.1). The grain and stover yields were not varied significantly due to different fertility levels. Whereas stover yield was 13.6 and 11.0 percent higher with 50% and 100% RDF compared to no fertilizer (6217 kg/ha). Similarly seed weight per ear head was also similar at different fertility levels. One thousand seed weight significantly increased with 100% RDF compared to no fertilizer (35.2g).

Performance of Genotypes:
The genotypes flowered by 64-70 days after sowing SPV-1709 was early to flower (64days), compared to Phule Maulee (66 days) and M35-1 (68 days). SPH-1449 (66 days) was also early than M35-1 (68 days) where SPV-1680 was late (70 days to flowering) compared to M35-1 (68 days). Genotype SPH-1449 has maximum plant height (271 cm) followed by SPV-1680 (263 cm) which were significantly taller than M35-1 (258 cm), CSV-14R (251cm) and Phule Maulee (253 cm), SPV-1709, had the lowest plant (246 cm).

Grain yield of genotypes varied significantly (Table 7 (R) B1). SPH-1449 produced significantly highest grain yield (3173 kg/ha) compared to other genotypes. It was followed by SPV-1591 (2963 kg/ha), SPV-1709 (2645 kg/ha) and SPV-1680 (2520 kg/ha) which were significantly superior to M35-1 but on par with Phule Maulee and CSV-14R (2337 and 2387 kg/ha respectively). SPV-1672 (2289 kg/ha) was on par with M35-1 and CSV-14R.

SPV-1680 produced the maximum stover yield (7814 kg/ha), which was on par with Phule Maulee (7555 kg/ha) and these both genotypes were significantly, superior to the M35-1 and CSV-14R (6333 kg/ha) and the other genotypes. The lowest stover yield was recorded with SPV-1709 (4851 kg/ha). Total biomass was the highest SPV-1591 (10715 kg/ha, followed by SPV-1680 (10334 kg/ha) SPH-1449 (10160 kg/ha) and Phule Maulee (9892 kg/ha).

Grain weight per ear head was maximum with SPH-1449 (49.9 g), followed by M35-1, SPV-1680 and SPV-1591.

The harvest index was maximum in SPV-1709 (0.31), followed by SPH-1449 (0.29) and CSV-14R (0.25) Phule Maulee had lowest harvest index (0.21).

Table 7 R B.1: Growth and yields of rabi sorghum genotypes as influenced by fertility levels under rainfed conditions (Centre : Solapur)

Treatments	Days to 50% flowering	Plant height (cm)	LAI	Grain yield (kg/ha)	Stover yield (kg/ha)	Grain weight / earhead (g)	1000 seed wt. g	H1	Plant stand (000/ha).
Fertility levels									
0:0:0	68	254	2.91	2541	6217	48.3	35.2	0.25	90.0
20:40:00	67	256	3.14	2543	7068	48.9	36.4	0.24	91.8
40:20:00	66	257	3.05	2584	6897	48.8	36.9	0.25	100.8
CD (.05)	**1.0**	**NS**	**--**	**NS**	**NS**	**NS**	**1.29**	**--**	**NS**
Genotypes									
SPV-1672	67	250	2.85	2289	6197	47.4	36.3	0.24	86.8
M35-1	68	258	2.92	2135	6333	49.8	39.3	0.22	86.2
SPV-1680	70	263	3.52	2520	7814	49.3	34.8	0.22	94.4
Phule Maulee	66	253	2.84	2337	7555	44.9	38.3	0.21	96.4
CSV-14R	67	251	2.94	2387	6333	48.3	35.2	0.25	89.3
SPH-1449	66	271	3.16	3173	6987	49.9	31.9	0.29	96.7
SPV-1709	64	246	2.76	2645	4851	43.8	37.4	0.31	97.8
SPV-1591	70	257	3.25	2963	7752	49.3	37.3	0.25	107.5
CD (.05)	**1.0**	**6.5**	**--**	**376.6**	**816.0**	**NS**	**1.45**	**--**	**9.52**

7 (R) C: Evaluation of rabi sorghum genotypes under irrigated conditions:

Production potential of rabi sorghum genotypes was found out under irrigated conditions at Parbhani, Rahuri and Solapur during rabi 2006-07. Six Genotypes viz. CSV-18, DSV-5, PKV Kranti, CSH-15R, CSV-216R and M35-1 were evaluated at three fertility levels of native fertility, 50% RDF and 100% RDF (RDF-80:40:40 kg/ha NPK) in split plot design replicated thrice.

Effect of fertility levels:

Days to 50% flowering and plant height were not influenced significantly due to fertility levels. (Table 7 (R) C-1). The crop flowered by 75 days after sowing and had plant height of 264-265 cm. The yields of grain stover and total biomass varied significantly due to fertility levels (Table 7 (R) C-1). In the mean data, 50% RDF and 100% RDF increased grain significantly (2918 and 3041 kg/ha respectively) compared

to no fertility (2458 kg/ha), however the variation in grain yield due 50% RDF and 100%RDF was not significant. The fertility level of 50% RDF and 100% RDF increased grain by 18.7 and 23.7 percent compared to no fertilizer (2458 kg/ha). Similarly stover yield increased by 12.6 and 16.8 percent due to 50% and 100% RDF respectively compared to no fertilizer (6116 kg/ha). The similar increase in total biomass was 14.3 and 18.8 percent with 50% and 100% RDF compared to no fertilizer (8574 kg/ha).

The harvest index varied significantly due to fertility levels at Rahuri only. One thousand seed weight increased significantly due to 50 and 100% RDF at Parbhani and Rahuri. The 100% RDF resulted in bolder seeds (38.1 g 1000 seed weight) compared to no fertilizer (35.0 g 1000 seed weight.)

Performance of genotypes:

Genotypes differed significantly with respect to days to 50% flowering and plant height. CSH-15R and M35-1 (69 days to 50% flowering) were significantly early to flower compared to the PKV Kranti (76 days), CSV-216R and CSV-18 (78 days) and DSV-5 (80 days).

The plant height of genotypes varied from 245 to 274 cm. The genotypes CSV-18, CSV-216R and DSV-5, PKV-Kranti (272, 273 and 274cm) were significantly taller than CSH-15R (245cm) and M35-1 (251cm). The genotypes CSV-216R (3351 kg/ha) and PKV Kranti (3121 kg/ha) and CSH-15R (2989 kg/ha) were on par and produced significantly higher grain yield compared to DSV-5, CSV-18 and M35-1(2346, 2507 and 2521 kg/ha) respectively. PKV Kranti and CSV-216R produced 24 and 33 percent higher grain yield compared to M35-1 (2521 kg/ha) CSV-8and DSV-5 were on par (7975 and 7440 kg/ha respectively) and both produced significantly higher stover yield compared to CSH-15 and M35-1 (5773 and 6148 kg/ha respectively). The stover yield of CSV-216R, PKV Kranti, DSV-5 CSH-15R and M35-1 were on par to each other. The genotype CSV-18 produced the highest total biomass (10481 kg/ha) followed by CSV-216R (9862 kg/ha), DSV-5 (9792 kg/ha) and PKV Kranti (9560 kg/ha) compared to CSH-15R (8762 kg/ha) and M35-1 (8669 kg/ha). The variation in total biomass of different genotypes was not significant. PKV Kranti, CSH-15R and CSV-216R had significantly higher harvest index (H1-0.33-0.34) than CSV-18 and DSV-5 (0.25) and M35-1 (0.29). One thousand seed weight of genotypes varied from 35.5 – 38.4 g and CSH-15R was bold seeded (38.4g) followed by M35-1, CSV-18, CSV-216R and DSV-5 (37.9, 37.1, 35.6, 35.5 and 35.4 g respectively).

Table 7(R) C.1: Growth and yields of rabi sorghum as influenced by fertility levels under irrigated conditions (mean of Parbhani, Rahuri and Solapur)

Treatments	Days to 50% flower	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest index	1000 seed weight (g)	Plant stand (000/ha)
Fertility levels								
No-fertilizer (native fertility)	75	265	2458	6116	8574	0.29	35.1	112.2
40:20 (50%RDF)	75	265	2918	6885	9803	0.30	36.8	120.7
80:40 (100% RDF)	75	264	3041	7144	10186	0.30	38.1	117.5
CD (0.05)	**NS**	**NS**	**287**	**770**	**787**	**NS**	**NS**	**6.22**
Genotypes								
CSV-18	78	272	2507	7975	10481	0.25	37.1	117.8
DSV-5	80	274	2346	7446	9792	0.25	35.4	112.8
Kranti	76	274	3121	6439	9560	0.33	35.6	117.3
CSH-15R	69	245	2989	5773	8762	0.34	38.4	116.6
CSV-216R	78	273	3351	6512	9862	0.34	35.5	117.7
M35-1	69	251	2521	6148	8669	0.29	37.9	118.5
CD (0.05)	**2.0**	**9.0**	**398**	**1300**	**1500**	**0.03**	**2.29**	**NS**

4.1 : Methods of improve soil water holding capacity in fallow rabi sorghum cropping system:

A field experiment with 9 treatments, comprising combinations of 3 tillage practices, (shallow, tillage, mould board ploughing and chisel / deep ploughing) and 3 green manuring (viz. sunhemp (in situ), Dhaincha (brought in) and glyricidia) was conducted at Tandur, Dharwad and Rahuri and Coimbatore during rabi 2006-07. At Coimbatore fallow sorghum and sunhemp sorghum were the green manuring treatments. The experiment was conducted in split plot design with 3 replication with tillage practices as main plots and green manuring crops as sub plot treatments. The cultivar of rabi sorghum was CSV-216R. In the mean data of Tandur, Dharwad and Rahuri the days to 50% flowering and plant height were not varied significantly due to tillage practices (Table 4.1.1). The crops reached 50% flowering by 78-79 days in various tillage practices with plant height of 208-219 cm. Chiseal ploughing resulted in taller plants (219cm) followed by mould board plough (211cm) compared to 209 cm in shallow tillage. Grain yield, stover yield and total biomass was not varied significantly due to tillage practices. Mould board ploughing (3101 kg/ha) and chiseal / ploughing (3062 kg/ha) increased grain yield by 15.8 and 14.4 percent compared to shallow tillage (2677 kg/ha). At Dharwad and Tandur both Mould ploughing and chiseal ploughing were on par and produced significantly higher grain yield compared to shallow tillage. At Rahuri however, the effect of tillage practices was not significant. Similarly stover yield and total biomass were maximum with mould board ploughing. Harvest index (0.31) and 1000 seed weight (29-30g) were not varied significantly due to tillage practices.

Effect of green manuring:

Green manuring of sunhemp hastened flowering by 1 day compared to Dhaincha (79 days). Plant height was not varied significantly due to different green manuring (211-214 cm) in mean data, the grain yield, stover yield and total biomass were not varied significantly due to different green manuring treatments. However, at Dhaincha at Tandur (3826 kg/ha), and glyricidia at Rahuri (2674 kg/ha) and Dharwad (3189 kg/ha) resulted in significantly highest grain yield than the other green manuring treatments (sunhmep). The highest stover yield and biomass were recorded with glyricidia at Dharwad and Rahuri and the highest yields with Dhaincha at Tandur.

Table 4.1.1: Growth and yields of rabi sorghum as influenced by tillage and organic manures (mean of Rahuri, Dharwad and Tandur)

Treatments	Days to 50% flower	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest index	1000 seed weight (g)	Plant stand (000/ha)
Tillage								
Shallow tillage	79	208	2677	6317	8993	0.31	29.3	127
Deep (Mould board ploughing	78	211	3101	7450	10551	0.31	30.0	131
Chised plouging	78	219	3062	7437	10499	0.31	30.3	131
CD (0.05)	**NS**	**11**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Organic Manures								
Sunhemp	78	213	2859	6801	9660	0.31	29.6	131
Dhaincha	79	211	3005	7279	10283	0.31	29.4	127
Glyricida	78	214	2975	7125	10100	0.31	30.5	131
CD (0.05)	**1.0**	**NS**	**NS**	**NS**	**1137**	**NS**	**0.08**	**2.0**

The harvest index was varied significantly due to green manuring treatment. 1000 seed weight was maximum with glyricidia at Rahuri (334 g) and Dharwad (27.7) compared to the sunhemp and Dhaincha.

At Coimbatore, the significantly higher grain yield (2042 kg/ha) was recorded with fallow-sorghum compared sunhemp-sorghum (1922 kg/ha) (Table 4.1.2). Disc ploughing recorded maximum grain yield (2154 kg/ha) followed by mould board ploughing (1999 kg/ha) and the lowest with country plough (1794 kg/ha). Similarly disc ploughing revealed maximum stover yield (9.9 t/ha) and the maximum benefit cost ratio of 1.45.

Table 4.1.2: Grain and stover yields of sorghum as influenced by tillage practices and green manuring at Coimbatore.

Treatments	Grain yield (Kg/ha)	Stover yield (t/ha)	B:C cost ratio
Tillage practices			
Country plough	1794	8.8	1.31
Mould board plough	1991	9.9	1.38
Disc plough	2154	9.6	1.45
CD (0.05)	55.1	0.56	--
Green manuring			
Fallow Sorghum	2042	10.0	1.41
Sunhemp Sorghum	1922	8.8	1.35
CD (0.05)	**82.0**	**0.54**	**--**

Trial 4.2 : INM for soybean – rabi sorghum double cropping system:

A field experiment was initiated during Kharif 2006 and rabi 2006-07.

Treatments were comprised of four INM treatments to soybean in Kharif viz. organic source – FYM @ 5 t/ha , inorganic source 100% RDF (30:60:30 kg/ha NPK), 50% organic + 50% inorganic (2.5 t/ha FYM + 50% RDF) and Glyricidia @ 5 t/ha and 4 fertility levels to rabi sorghum viz no fertilizer, 50, 75 and 100% RDF (80:40:40 kg/ha NPK).

The experiment was conducted in split plot design with INM to soybean in Kharif as main plot treatments and fertility levels to rabi sorghum as subplot treatments with 3 replications. The experiment was conducted at Parbhani, Solapur and Rahuri.

Performance of Soybean:

The data on seed yields of soybean from Solapur and Rahuri are summarized. At Solapur the significantly highest seed yield of soybean (2419 kg/ha) was recorded with 50% RDF + 2.5 t/ha FYM followed by glyricidia (2305 kg/ha), 100% RDF (2278 kg/ha) and 5 t/ha FYM (2163 kg/ha). At Rahuri, 100% RDF revealed the highest seed yield of soybean (2223 kg/ha) which was significantly superior to he other INM treatments.

Effect of Soybean INM on Performance of rabi sorghum:

In mean of data from Parbhani and Soybean, the effect of INM treatments on sorghum was not significant for days to 50% flowering (80-82 days) and plant height (259-265 cm). (Table: 4.2.1). The soybean fertilized with 100% RDF (30:60:30 kg/ha NPK) significantly increased height of succeeding rabi sorghum to 299cm. The grain yield of rabi sorghum was not varied significantly due to INM to preceding soybean. At Parbhani and Solapur, preceding soybean given 100% RDF increased grain yield of succeeding rabi sorghum significantly (2196 and 2648 kg/ha) compared to 50% RDF + 50% organic (1883 and 2137 kg/ha at Parbhani and Solapur respectively. 5t/ha FYM was the next best which also significantly increased the grain yield of rabi sorghum compared 50% RDF + 50% organic at Solapur. Similar trend was observed for stover yield, harvest index and 1000 seed weight (Table 4.2.1).

Effect of fertility levels in succeeding rabi sorghum.

Data on rabi sorghum in soybean – rabi sorghum double cropping from Solapur and Parbhani have been summarized. Days to 50% flower and plant height of rabi sorghum CV CSV-18 were not varied significantly due to fertility levels. The crop flowered by 80-82 DAS and had plant height 259-264 cm at different fertility levels.

Grain yield increased significantly due to fertility levels upto 50% RDF over control. (Table 4.2.1). The grain yield of rabi sorghum with 50, 75 and 100% RDF was on par. The increase in seed yield with 50% RDF (2197 kg/ha) over control was 10.6 percent, similarly 75 and 100% RDF increased grain yield of rabi sorghum by 14.3 and 15.6 percent respectively compared to no fertilizer (1986 kg/ha). Stover yield of rabi sorghum however increased significantly upto 75% RDF and the variation in stover yield with 75 and 100% RDF was not significant. The harvest index and 1000 seed weight were not varied significantly due to fertility levels.

Table 4.2.1: Growth and yields of rabi sorghum as influenced by fertility levels in soybean – rabi sorghum double cropping under irrigated conditions (mean of Parbhani and Solapur)

Treatments	Days to 50% flower	Plant height (cm)	Grain yield (kg/ha)	Stover yield (kg/ha)	Total biomass (kg/ha)	Harvest index	1000 seed weight (g)	Plant stand (000/ha)	Seed yield of soybean (kg/ha)
INM of Soybean									
FYM 5 t/ha	80	265	2331	7920	10251	0.23	42.7	124	2006
100%RDF (30:60:30 kg/ha NPK)	80	264	2422	7762	10184	0.25	45.7	113	2248
50%RDF+2.5 t/ha FYM	80	259	2010	6834	8844	0.23	43.6	118	2107
Glyricidia	82	261	1986	7225	9211	0.22	39.1	124	1948
CD(0.05)	**NS**	**NS**	**573**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Fertility levels									
No Fertilizer	82	259	1986	6730	8716	0.23	41.3	116	--
50% RDF	80	263	2197	7141	9337	0.24	42.0	120	--
75% RDF	80	263	2271	7811	10081	0.23	43.8	120	--
100% RDF (80:40:40 kg/ha NPK)	80	264	2296	8059	10355	0.23	43.9	123	--
CD (0.05)	**NS**	**NS**	**126**	**455**	**536**	**NS**	**NS**	**NS**	**--**