

# Sorghum Agronomy, *Kharif* 2013

JS Mishra, Pushpendra Singh, R Kalpana, VS Kubsad, ZN Patel,  
NS Thakur, Sujathamma, Kewalanand, UN Alse

## **C o n t e n t s**

<b>Executive summary</b> .....	<b>1</b>
<b>Detailed report</b> .....	<b>3</b>
<i>Agro-climatic situation and soil types at different AICSIP centers</i> .....	3
<i>Experimental results</i> .....	6
<b>Trail 1K. Response of advanced/pre-released sorghum genotypes to fertility levels under rainfed conditions</b> .....	<b>6</b>
1 K (A) Grain sorghum (Zone-I North) .....	6
1 K (B) Grain sorghum (Zone-I South).....	7
1 K (C). Grain sorghum (Zone-II).....	8
1 K (D). Late Kharif .....	9
1 K (E). Forage sorghum (Single-cut) .....	10
1 K (F). Forage sorghum (Multi-cut) .....	11
<b>Trial 2K. Integrated Nutrient Management in kharif sorghum-chickpea cropping system</b> .....	<b>12</b>
<b>Trial 3K. Improving Nitrogen-use efficiency through method and time of N application</b> .....	<b>13</b>
<i>Annexure 1: Physico-chemical properties of soils at different centers (Kharif 2013)</i> .....	14
<i>Annexure II: Weekly weather data at different centres, Kharif 2013</i> .....	15



## **Executive summary**

Field experiments were conducted during *kharif* 2013 at different AICSIP centres to evaluate the response of pre-released sorghum genotypes to fertility levels, and to develop improved agronomic practices for higher sorghum productivity and profitability.

### **1. Response of advanced/pre-released sorghum genotypes to fertility levels under rainfed conditions**

Pre-released sorghum genotypes that were promoted to the second year of testing in AVHT under the breeding programme were evaluated for their response to fertility [Control (0:0:0), 50% RDF (40:20:20), 75% RDF (60:30:30) and 100%RDF (80:40:40 kg NPK/ha)] across the sorghum growing zones of the country. The salient findings have been summarized as under (Table 1).

**Table 1. Response of promising pre-released sorghum genotypes to fertility levels under rainfed conditions**

S. No.	Types of sorghum	Test entries	Checks	Locations	Promising treatments/entries
1KA.	Grain sorghum (Zone-I North)	SPH 1703, SPH 1705, SPV 2110, SPV 2122, SPV2061	CSH 16, CSV 20, CSV 23	Udaipur	Test hybrids SPH 1703 and SPH 1705 produced 25.74 and 32.52 % higher grain yields; higher net returns and B:C ratio over check CSH 16, whereas test varieties were on a par with their respective checks. The SPH 1703 did not respond significantly to increasing fertility levels, but the SPH 1705 produced significantly higher yield with 75% RDF as compared to 50% RDF.
1KB.	Grain sorghum (Zone-I South)	SPH 1703, SPH 1705, SPV 2110, SPV 2122, SPV2061	CSH 16, CSV 20, CSV 23	Coimbatore, Palem	SPH 1703 among hybrids and SPV 2122 among varieties produced 24.56 and 36.55% higher grain yields over respective checks. SPH 1703 at both the locations and SPV 2122 at Palem and SPV 2061 at Coimbatore produced maximum grain yields among the test varieties. The test genotypes responded significantly up to RDF (80:40:40).
1KC.	Grain sorghum (Zone-II)	SPH 1702, SPH 1703, SPH 1705, SPV 2114, SPV 2061	CSH 16, CSV 20, CSV 23	Surat, Dharwad, Akola	Genotypes varied with the locations in response to grain yield. SPH 1703 at Akola, SPH 1705 at Dharwad and SPH 1702 at Surat produced the highest yield and were superior to check. Irrespective of the locations, test varieties (SPV 2114 and SPV 2061) were on a par with the checks. Increasing fertility response up to 100% RDF was noticed at all the locations, however, the F x G interaction was significant at Akola and Dharwad.
1KD	Late Kharif	SPH 1702, SPH 1703, SPH 1705, SPV 2114, SPV 2061	CSH 16, CSV 20, CSV 23	Coimbatore, Madhira	SPH 1703 (6.67% increase) at Coimbatore and SPH 1702 (24.38% increase) at Madhira yielded significantly better than the hybrid check CSH 16. Test variety SPV 2114 recorded significantly higher grain yield at both the locations. The genotypes responded significantly up to 100% RDF.
1KE	Forage Sorghum (Single-cut)	SPV 2128	CSV 21F, HC 308, Local check	Pantnagar, Udaipur, Hisar, Ludhiana	SPV 2128 produced 5.66% and 11.4 % higher green fodder yield over the checks CSV 21F and HC 308. However, at Hisar, the test genotype was significantly inferior to check HC 308. Significant response was observed up to 100% RDF.
1KF	Forage Sorghum (Multi-cut)	SPH 1697, SPH 1698	CSH 20 MF, CSH 24 MF, SSG 59-3	Hisar, Pantnagar, Udaipur, Coimbatore	SPH 1697 being on a par with CSH 20 MF produced significantly higher green fodder yield over SPH 1698, CHS 24 MF and SSG 59-3. At Hisar, both the test genotypes were significantly inferior to checks. Significant response was observed up to 100% RDF.

## 2 K. Integrated Nutrient Management in *kharif* sorghum-chickpea cropping system

A long-term field experiment was initiated at Dharwad, Indore, Parbhani, Udaipur, Palem and Akola during 2013-14 to find out the effect of integrated nutrient management practices on yield, economics and soil health in sorghum-chickpea cropping system. On mean yield basis, the differences in grain yield among INM treatments were non-significant. However, application of 75% RDN through inorganic fertilizer+25% RDN through vermicompost produced maximum grain yield at Akola, whereas at Dharwad, 50% RDN through inorganic fertilizer+25% RDN through FYM+25% RDN through vermicompost being on a par with 100% RDN through inorganic fertilizer produced the highest grain yield.

### 3K. Improving Nitrogen-use efficiency through method and time of N application

Field experiments were conducted to improve the N-use efficiency through split application of nitrogen. Results revealed that on overall mean basis, there was no significant difference in grain yields due to variation in N application methods, but the response varied with locations. At Coimbatore, application of 25% N at sowing + 45% at 30 DAS + 5% foliar spray at 45 DAS +15% at BLS +10% GFS produced the highest grain yield of both CSH 16 and CSV 20, whereas at Udaipur, CSV 20 produced maximum grain yield with application of 50% N at sowing and 50% at 30 DAS, where as CSH 16 produced higher yield when 50%N was applied at sowing and 25% at 30 DAS +25% at boot-leaf stage (BLS); and the interaction was significant.

## Detailed report

### Agro-climatic situation and soil types at different AICSIP centers

Overall, the country received 936.7 mm of rain [106% of the long period average-LPA (886.9 mm)] during June to September 2013 against 819.8 mm received during 2012 ([www.imd.gov.in](http://www.imd.gov.in)). Seasonal rainfall was 109% of its LPA over Northwest India, 123% of its LPA over Central India, 115% of its LPA over south Peninsula and 72% of its LPA over Northeast (NE) India (Table ). Southwest monsoon current advanced over the Andaman Sea 3 days earlier than its normal date of 20th May and set in over Kerala on its normal date of 1<sup>st</sup> June. However, the southwest monsoon covered the entire country by 16th June, about 1 month earlier than its normal date of 15th July. The withdrawal of monsoon from west Rajasthan commenced on 9th September compared to its normal date of 1st September.

**Table. The actual season (June to September) rainfall over the country as a whole and four broad geographical regions during the 2013 SW monsoon season.**

Region	LPA (mm)	Actual Rainfall for 2013 SW Monsoon Season	
		Rainfall (mm)	Rainfall (% of LPA)
All India	886.9	936.7	106
Northwest India	615.0	671.8	109
Central India	974.2	1195.3	123
Northeast India	1437.8	1037.9	72
South Peninsula	715.7	825.6	115

The sowing details, physico-chemical properties of soil and weekly meteorological data on rainfall, temperature and relative humidity for kharif 2013 cropping season are presented in Annexure I and II.

#### **Zone-I (North):** Udaipur and Pantnagar

**Udaipur:** The centre received a total of 775 mm rainfall during crop season with fairly good distribution during entire crop season. The crop was sown during first week of July and received normal rains during its growth period, however, it received heavy rains during flowering and grain filling stage resulting in crop damage and grain mold development. The soil was clay loam in texture, medium in available N and P, and high in K with pH 8.01.

**Pantnagar:** This centre received 1504 mm rainfall during crop season. The soil was silty loam, neutral (pH 6.5-6.6), with organic carbon (1.2 %), medium in K (268-271 kg) and phosphorus (30-38 kg) content. The experiments were sown during 16<sup>th</sup> Apr to 15<sup>th</sup> May, 13.

#### **Zone- I (South):** Coimbatore and Palem

**Coimbatore:** The total rainfall received during *kharif* crop season (st. week 19 - 47) was 369 mm. The crop was sown on 2nd July 2013. The soil was clay loam in texture, slightly alkaline (pH 7.95), E.C. 0.47; and low in available nitrogen (230 kg/ha), medium in available phosphorus (36 kg/ha) and high in potassium (615 kg/ha) content.

**Palem:** The total rainfall received during *khariif* crop season (st. week 19 - 47) was 938 mm. The crop was sown during 11-14 June 2013. The soils were sandy clay loam in texture, slightly alkaline (pH 8.07), E.C. 0.62; and low in available nitrogen (213 kg/ha), high in available phosphorus (60 kg/ha) and potassium (708 kg/ha).

**Zone- II:** Dharwad, Parbhani, Indore, Surat

**Dharwad:** Total rainfall received during crop period was 636 mm with almost uniform distribution. The crop was sown during 15-16<sup>th</sup> June 2013. The soil was medium-deep black clay, low in available N (194.8 kg/ha) and medium in available P<sub>2</sub>O<sub>5</sub> (33.5 kg/ha) and high in K<sub>2</sub>O (454 kg/ha) with pH (7.8).

**Parbhani:** The total rainfall received during crop season was 1146 mm. Due to high rainfall after sowing and severe shoot fly attack, the crop was damaged heavily and all the trials were vitiated.

**Indore:** The crop was dry-seeded during second fortnight of June 2013. The total rainfall during *khariif* season was 1441 mm with very heavy rainfall during July-August. In spite of very good germination and initial plant stand, the crop damaged severely due to high rainfall and severe shoot fly attack, and hence, all the trials were vitiated.

**Surat:** This centre received very high total rainfall (1778 mm). Initially crop received adequate rains during July and August that has lead to proper crop growth. However, during September, the crop faced severe damage due to heavy rains. Crop was sown on 28<sup>th</sup> June 2013. Soil was deep black, (>100 cm depth) with pH 8.00 and EC 0.33, medium in OC (0.50%), and available N (252 kg/ha), P<sub>2</sub>O<sub>5</sub> (51 kg/ha), and K<sub>2</sub>O (3351 kg/ha).

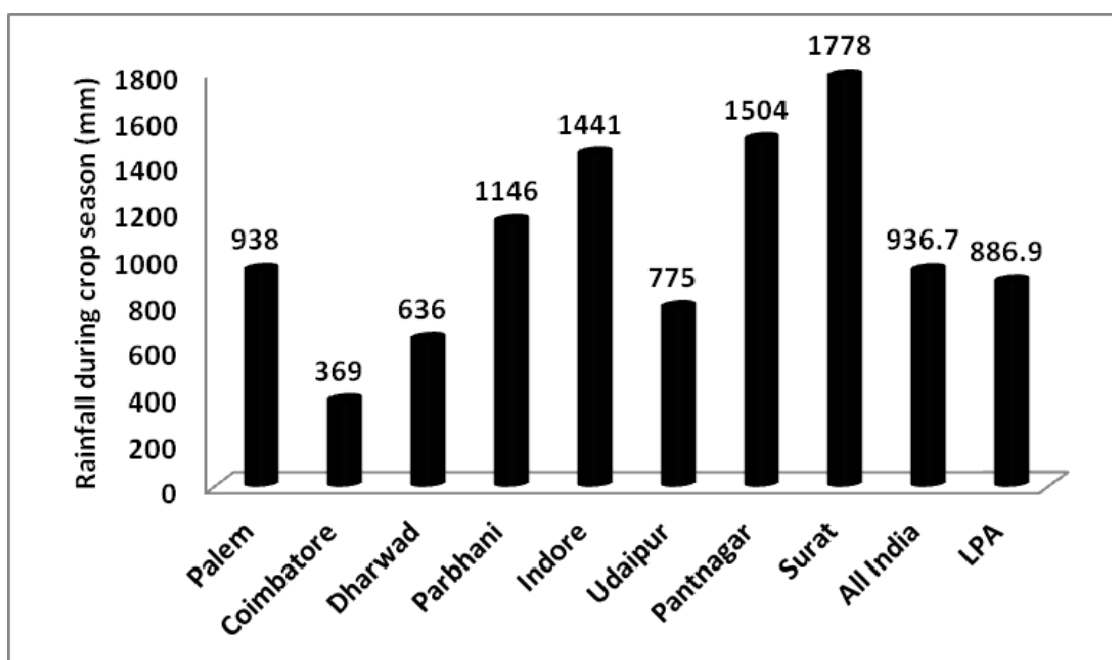


Fig. 1. Total rainfall (mm) received during crop season at various AICSIP centres

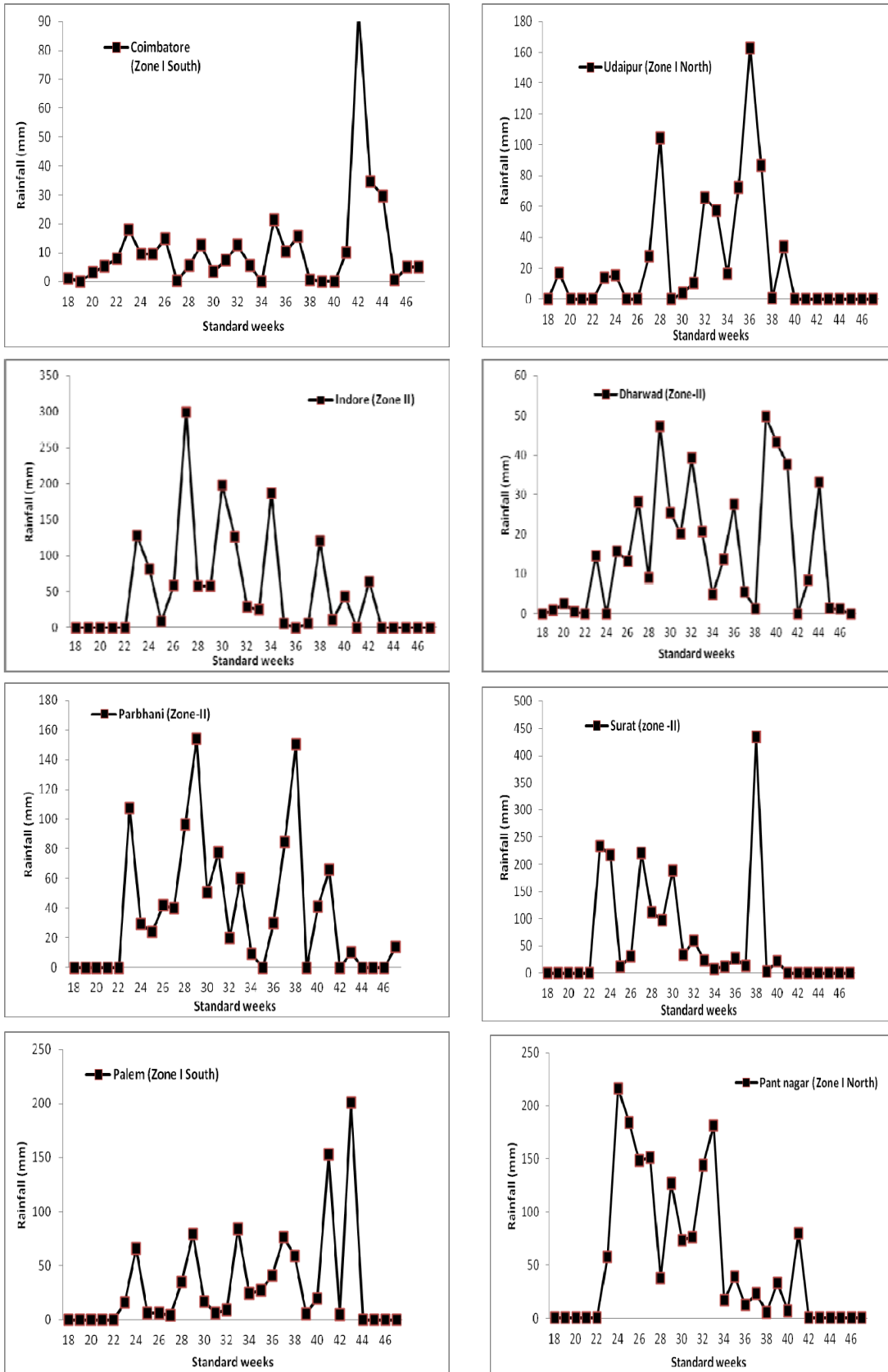


Fig 2. Rainfall distribution during crop season in different sorghum zones

## Experimental results

### Trail 1K. Response of advanced/pre-released sorghum genotypes to fertility levels under rainfed conditions

#### 1 K (A) Grain sorghum (Zone-I North)

The field experiment was conducted at MPUAT,Udaipur. Significant increase in grain yield with increasing fertility was observed up to 100% RDF (Table 1KA). Test hybrid SPH 1703 and SPH 1705 being on a par with each other produced significantly higher (25.74-32.52%) grain yield (2726-2873kg/ha) and net returns compared to hybrid checks CSH 16 (2168 kg/ha). Test varieties SPV 2110, SPV 2122 and SPV 2061 (1702-1803 kg/ha) were on a par with varietal checks CSV 20 and CSV 23 () (1707-1747 kg/ha). Interaction effect between fertility levels and genotypes for grain yield was significant (P=0.04) (Table 1KA-1). Whereas SPH 1703 did not respond significantly to increasing fertility levels, the SPH 1705 produced significantly higher yield (3007 kg/ha) with 75% RDF as compared to 50% RDF (2465 kg/ha). Dry fodder yield, plant height, yield attributes and economics improved significantly up to 100% RDF, but days to flowering and harvest index were unaffected. None of the test genotypes (hybrids/varieties) were significantly superior to their checks for dry fodder yield (Table 1KA-2). Both the test hybrids produced significantly higher grain weight/panicle (44.49-45.73 g) and harvest index (22.08-22.8) compared to hybrid check (36.02 g and 17.88).

**Conclusion:** Test hybrids SPH 1703 and SPH 1705 produced 25.74 and 32.52 % higher grain yields; higher net returns and B:C ratio over check CSH 16, whereas test varieties were on a par with their respective checks. The SPH 1703 did not respond significantly to increasing fertility levels, but the SPH 1705 produced significantly higher yield with 75% RDF as compared to 50% RDF.

**Table 1KA-1. Interaction effect of fertility levels and genotypes on grain yield**

Treatments <i>Genotypes</i>	Fertility levels			Mean
	50% RDF	75% RDF	RDF (80:40:40)	
SPH 1703	2711	2710	2759	2726
SPH 1705	2465	3007	3145	2873
SPV 2110	1686	1831	1822	1780
SPV 2122	1533	1553	2021	1702
SPV 2061	1566	1935	1938	1813
CSH 16	1941	2089	2474	2168
CSV 20	1554	1730	1837	1707
CSV 23	1578	1585	2079	1747
Mean	1879	2055	2259	2726
LSD (P=0.05): Fertility (F)=103; Genotypes (G)=168; FxG=291; CV:8.58%				

**Table1KA-2. Stover yield (kg/ha), yield attributes and economics of promising grain sorghum genotypes as influenced by different fertility levels.**

Treatment	Stover yield (kg/ha)	Days to 50% lowering	Plant height (cm)	Plant stand (000,ha)	Grain weight (g)/panicle	100-seed weight (g)	Harvest index (%)	Net returns (Rs/ha)	B:C ratio
<b>Fertility levels</b>									
50% RDF	9059	63	195	149.11	36.93	2.58	17.13	20233	1.12
75%RDF	10515	63	208	150.15	40.05	2.77	16.48	24019	1.26
100% RDF (80:40:40)	11126	62	213	149.28	44.03	2.86	16.96	26669	1.34
LSD (P= 0.05)	557	NS	8	1.83	1.72	0.05	NS	1656	0.09
<b>Genotypes</b>									
SPH 1703	9667	59	188	149.58	44.49	2.85	22.08	30583	1.61
SPH 1705	9762	61	206	149.93	45.73	2.95	22.80	32503	1.71
SPV 2110	10164	65	201	150.42	32.98	2.59	14.99	20105	1.06
SPV 2122	10649	65	205	149.04	40.93	2.60	13.78	20027	1.05
SPV 2061	9839	64	206	150.42	40.16	2.62	15.73	19935	1.05
CSH 16	10076	58	200	148.25	36.02	2.93	17.88	24605	1.29

Treatment	Stover yield (kg/ha)	Days to 50% lowering	Plant height (cm)	Plant stand (000,ha)	Grain weight (g)/panicle	100-seed weight (g)	Harvest index (%)	Net returns (Rs/ha)	B:C ratio
<b>Fertility levels</b>									
CSV 20	11106	65	218	148.69	42.22	2.64	13.40	20880	1.09
CSV 23	10603	66	217	149.78	40.16	2.72	14.18	20484	1.07
LSD (P=0.05)	909	1	14	2.99	2.81	0.08	1.60	2705	0.14
C.V. (%)	9.36	1.38	7.07	2.11	7.35	3.02	10.03	12.06	12.05

### 1 K (B) Grain sorghum (Zone-I South)

The field experiments were conducted at Palem and Coimbatore centres. Increasing fertility levels from 50% RDF to 100% RDF significantly increased the grain yield from 2931 to 3744 kg/ha at Palem, and 946 to 1564 kg/ha at Coimbatore (Table 1 KB-1). Among the test hybrids, SPH 1703 (3900 kg/ha) was numerically superior to check CSH 16 (3750 kg/ha) at Palem, whereas at Coimbatore, both the test hybrids (SPH 1703 and SPH 1705) produced significantly higher grain yields (1872 and 1468 kg/ha) over CSH 16 (885 kg/ha). All the test varieties (SPV 2110, 2122, 2061) produced significantly higher grain yield than the checks (CSV 20 and CSV 23). SPV 2122 at Palem (3833 kg/ha) and SPV 2061 (1356 kg/ha) at Coimbatore produced maximum grain yields among the test varieties. On location mean basis, SPH 1703 and SPV 2122 produced the higher grain yield. The interaction effect between fertility levels and genotypes was significant at Coimbatore.

**Conclusion:** SPH 1703 among hybrids and SPV 2122 among varieties produced 24.56 and 36.55% higher grain yields over respective checks. SPH 1703 at both the locations and SPV 2122 at Palem and SPV 2061 at Coimbatore produced maximum grain yields among the test varieties. The test genotypes responded significantly up to RDF (80:40:40).

**Table 1KB-1. Interaction effect of fertility levels and genotypes on grain yield**

Treatments <i>Genotypes</i>	Fertility levels			Mean
	50% RDF	75% RDF	RDF (80:40:40)	
<b>PALEM</b>				
SPH 1703	3625	3825	4250	3900
SPH 1705	2625	3125	4050	3267
SPV 2110	3250	3625	3750	3542
SPV 2122	3500	3625	4375	3833
SPV 2061	2375	2950	3525	2950
CSH 16	3300	3900	4050	3750
CSV 20	2650	3025	3125	2933
CSV 23	2125	2375	2825	2442
Mean	2931	3306	3744	
LSD (P=0.05): Fertility (F)=197; Genotypes (G)=321; FxG=NS CV:10.18%				
<b>COIMBATORE</b>				
SPH 1703	1588	1866	2163	1872
SPH 1705	1263	1444	1695	1468
SPV 2110	938	1226	1473	1213
SPV 2122	745	1128	1623	1165
SPV 2061	813	1317	1938	1356
CSH 16	706	883	1066	885
CSV 20	813	1132	1492	1145
CSV 23	700	874	1064	879
Mean	946	1234	1564	
LSD (P=0.05): Fertility (F)=24; Genotypes (G)=39; FxG=68 CV:3.33%				

**Table1KB-2. Mean grain and stover yields (kg/ha), yield attributes and economics of grain sorghum genotypes as influenced by fertility levels (mean of Palem and Coimbatore).**

Treatment	Grain yield (kg/ha)	Stover yield (kg/ha)	Plant height (cm)	Grain wt/panicle (g)	No. of panicles/m <sup>2</sup>	100-seed weight (g)	Harvest index (%)	Net returns (Rs/ha)	B:C ratio
<b>Fertility levels</b>									
50% RDF	1938	9196	200	30.42	12.88	3.00	16.33	28228	1.89
75%RDF	2270	10050	213	34.64	12.92	3.13	17.57	32637	2.02
100% RDF (80:40:40)	2654	11310	223	39.12	12.77	3.26	18.35	38250	2.20
LSD (P= 0.05)	261	829	10	4.85	NS	0.26	2.51	6301	0.23
<b>Genotypes</b>									
SPH 1703	2886	10421	182	37.33	11.72	3.13	21.27	41263	2.55
SPH 1705	2367	10534	199	40.00	12.94	2.94	18.32	33481	2.09
SPV 2110	2377	10574	227	33.92	13.67	3.05	17.30	35670	2.16
SPV 2122	2499	10414	220	36.31	12.83	3.03	17.77	38564	2.26
SPV 2061	2153	10087	230	31.73	14.00	3.06	16.77	28976	1.91
CSH 16	2317	8537	201	38.72	12.83	3.66	19.32	34976	2.01
CSV 20	2039	10603	223	33.19	12.28	3.10	15.42	28895	1.84
CSV 23	1660	10311	216	26.62	12.56	3.07	13.18	22481	1.50
LSD (P=0.05)	427	1354	17	7.92	1.32	0.43	4.10	10290	0.38
C.V. (%)	15.62	11.13	6.53	19.09	8.58	11.6	19.72	26.08	15.5

### 1 K (C). Grain sorghum (Zone-II)

Field experiments were conducted at Parbhani, Dharwad, Indore, Akola and Surat. The experiments at Indore and Parbhani were vitiated due to heavy rains. Hence, the data of 3 centres viz., Dharwad, Akola and Surat is being presented. At **Akola**, test hybrid SPH 1703 produced significantly higher grain yield (2450 kg/ha) over check CSH 16 (2187 kg/ha). Test varieties SPV 2114 (2207 kg/ha) and SPV 2061 (2130 kg/ha) yielded on a par with varietal checks (CSV 20 (2039 kg/ha) and CSV 23 (2163 kg/ha). Interaction between fertility levels and genotypes for grain yield was found significant (Table 1KC-1). There was significant response of increasing fertility levels up to 100% RDF incase of SPH 1702 and SPH 1703, however, SPH 1705 and both the test varieties did not respond much to RDF as compared to 50% RDF. At **Dharwad**, SPH 1705 (4547 kg/ha) being on a par with SPH 1703 (4492 kg/ha) and SPH 1702 (4364 kg/ha) produced 6.5% higher grain yield over check CSH 16 (4270 kg/ha). Both the test varieties SPV 2114 (4103 kg/ha) and SPV 2061(4016 kg/ha) were on a par with CSV 23 (4294 kg/ha), but produced significantly lower grain yield than CSV 20 (4722 kg/ha). Irrespective of the genotypes, increasing fertility levels up to 100% RDF (5883 kg/ha) significantly increased (108%) the grain yield over 50% RDF (2822 kg/ha). Interaction between fertility levels and genotypes for grain yield was found significant (Table 1KC-1).SPH 1705 with 100% RDF produced the maximum grain yield (6228 kg/ha).At **Surat**, test hybrid SPH 1702 (3355 kg/ha) being on a par with SPH 1705 (3084 kg/ha) and the check CSH 16 (3119 kg/ha) produced 7.56% higher grain yield over check. Both the test varieties were on a par with both the checks. The interaction between fertility levels and genotypes for grain yield was found non-significant (Table 1KC-1). Increasing fertility levels significantly increased the grain yield, irrespective of the genotypes.

**Conclusion:** Genotypes varied with the locations in response to grain yield. SPH 1703 at Akola, SPH 1705 at Dharwad and SPH 1702 at Surat produced the highest yield and were superior to check. Irrespective of the locations, test varieties were on a par with the checks. Increasing fertility response up to 100% RDF was noticed at all the locations, however, the F x G interactions were significant at Akola and Dharwad.

**Table 1KC-1. Interaction effect of fertility levels and genotypes on grain yield**

Treatments	Fertility levels			Mean
	50% RDF	75% RDF	RDF (80:40:40)	
<b>AKOLA</b>				
SPH 1702	1812	1934	2692	2146
SPH 1703	1972	2584	2795	2450



Treatments	Fertility levels			Mean
Genotypes	50% RDF	75% RDF	RDF (80:40:40)	
SPH 1705	1808	2001	2003	1937
SPV 2114	2073	2269	2281	2207
SPV 2061	2210	1785	2395	2130
CSH 16	1797	1913	2851	2187
CSV 20	2043	2058	2016	2039
CSV 23	2003	2092	2395	2163
Mean	1965	2079	2428	
LSD (P=0.05): Fertility (F)=155; Genotypes (G)=253; FxG=438; CV:12.35%				
<b>DHARWAD</b>				
SPH 1702	2420	4568	6105	4364
SPH 1703	3228	4457	5790	4492
SPH 1705	2735	4679	6228	4547
SPV 2114	2519	4235	5556	4103
SPV 2061	2117	4210	5722	4016
CSH 16	2975	3833	6000	4270
CSV 20	3142	4932	6093	4722
CSV 23	3438	3870	5574	4294
Mean	2822	4348	5883	
LSD (P=0.05): Fertility (F)=180; Genotypes (G)=295; FxG=510; CV:7.13%				
<b>SURAT</b>				
SPH 1702	2850	3473	3741	3355
SPH 1703	2516	3086	3364	2989
SPH 1705	2570	3220	3461	3084
SPV 2114	2475	2963	3276	2905
SPV 2061	2401	2926	3146	2824
CSH 16	2619	3218	3521	3119
CSV 20	2488	3123	3368	2993
CSV 23	2477	3138	3383	2999
Mean	2550	3144	3407	
LSD (P=0.05): Fertility (F)=202; Genotypes (G)=330; FxG=NS; CV:11.46%				

**Table 1 KC-2. Phenology and yield components and economics of grain sorghum as influenced by fertility levels and genotype (mean of 3 locations).**

Treatment	Grain yield (kg/ha)	Stover yield (kg/ha)	Plant height (cm)	Days to 50% flowering	Days to maturity	Grain wt (g) /panicle	100- seed wt (g)	HI (%)	Net returns (Rs/ha)	B:C ratio
<b>Fertility levels</b>										
50% RDF	2445	11981	195	72	120	52.21	2.74	27.02	28220	1.43
75%RDF	3190	13331	201	71	119	57.81	2.85	31.43	45331	1.91
100% RDF	3906	15289	215	71	118	70.61	3.01	34.71	59086	2.27
LSD (P= 0.05)	374	1103	11	2	NS	2.47	NS	4.06	5782	0.16
<b>Genotypes</b>										
SPH 1702	3288	11867	187	72	119	62.02	3.47	33.89	44695	1.88
SPH 1703	3310	13571	178	67	114	63.70	2.91	31.96	44362	1.87
SPH 1705	3189	11976	191	69	117	72.84	3.09	33.33	43359	1.83
SPV 2114	3072	15084	226	73	118	52.79	2.67	28.36	43888	1.87
SPV 2061	2990	14069	217	74	122	53.08	2.39	28.40	38883	1.70
CSH 16	3192	11230	195	68	114	58.51	3.19	32.59	39982	1.73
CSV 20	3252	14743	220	74	121	66.56	2.49	31.56	49409	2.03
CSV 23	3152	15729	216	75	127	52.19	2.75	28.33	49122	2.03
LSD (P=0.05)	NS	1801	17	3	6	4.04	0.47	6.63	9442	0.26
C.V. (%)	20.24	14.02	9.04	4.11	4.09	7.06	13.8	17.87	17.88	11.6

### 1 K (D). Late Kharif

Field experiments were conducted at Coimbatore and Madhira. Increasing fertility levels significantly increased the grain and stover yields at both the centres. At Coimbatore, SPH 1703 (1865 kg/ha) recorded 6.67% higher grain yield over CSH 16 (1739 kg/ha). The other check hybrid, SPH 1705 was at par to CHS 16 but SPH 1702

produced lower grain yield than the check. Test variety SPV 2114 was superior to both the check varieties CSV 20 and CSV 23 (Table 1KD-1). At Madhira, SPH 1702 produced the highest grain yield (4566 kg/ha), and was significantly superior to CSH 16 (3671 kg/ha). Other test hybrids SPH 1703 and SPH 1705 performed poorly compared to check. Test variety SPV 2114 was significantly superior to both the varietal Checks CSV 23 and CSV 20, but SPV 2061 being on a par with CSV 20 was significantly superior to CSV 23. The interaction effect between fertility levels and genotypes was found to be non-significant.

**Conclusion:** Test genotype SPH 1703 (6.67% increase) at Coimbatore and SPH 1702 (24.38% increase) at Madhira yielded significantly better than the hybrid check CSH 16. Test variety SPV 2114 recorded significantly higher grain yield at both the locations. The genotypes responded significantly up to 100% RDF.

**Table 1KD-1. Effect of fertility levels and genotypes on yield and economics.**

Treatment	Grain yield (kg/ha)			Stover yield (kg/ha)			Harvest index (%)			100-seed weight (g)		
	Coimbatore	Madhira	Mean	Coimbatore	Madhira	Mean	Coimbatore	Madhira	Mean	Coimbatore	Madhira	Mean
<b>Fertility levels</b>												
50% RDF	1513	2970	2242	10828	7943	9385	12.63	27.12	19.87	2.98	2.60	2.79
75%RDF	1786	3308	2547	11419	7543	9481	13.36	30.68	22.02	3.08	2.65	2.87
100% RDF (80:40:40)	1940	3628	2784	13053	7714	10383	13.01	32.23	22.62	3.08	2.66	2.87
LSD (P= 0.05)	48	210	358	725	615	1061	0.75	2.24	2.07	0.10	0.04	0.08
<b>Genotypes</b>												
SPH 1702	1593	4566	3080	12739	9151	10945	11.12	33.36	22.24	2.98	2.66	2.82
SPH 1703	1865	3542	2704	10561	7994	9277	15.08	30.87	22.97	3.07	2.69	2.88
SPH 1705	1705	3266	2486	9427	7608	8518	15.39	30.25	22.82	3.01	2.66	2.83
SPV 2114	1857	3328	2592	11163	7461	9312	14.26	30.97	22.61	2.98	2.75	2.86
SPV 2061	1789	2847	2318	14261	7253	10757	11.14	28.86	20.00	3.12	2.44	2.78
CSH 16	1739	3671	2705	10945	7299	9122	12.70	33.70	23.20	3.04	2.73	2.89
CSV 20	1724	2829	2277	13054	8580	10817	11.85	25.20	18.52	3.04	2.43	2.74
CSV 23	1698	2369	2034	11982	6520	9251	12.47	26.88	19.68	3.16	2.75	2.95
LSD (P=0.05)	79	343	584	1183	1004	1733	1.23	3.66	3.37	0.16	0.06	0.13
C.V. (%)	4.77	10.93	19.39	10.60	13.69	14.88	9.94	12.85	13.13	5.63	2.59	3.91

**Table 1 KD-2. Phenology and yield components of sorghum as influenced by fertility levels and genotype (mean of Coimbatore and Madhira).**

Treatment	Plant height (cm)	Days to 50% flowering	Panicles/m <sup>2</sup>	Grain wt/panicle (g)*	Grains/panicle*	Plant stand at harvest (000/ha)	Days to maturity**	Net returns (Rs/ha)*	B:C ratio*
<b>Fertility levels</b>									
50% RDF	189	70	14.17	13.95	1516	132.47	109	8487	2.30
75%RDF	195	70	15.71	13.86	1621	129.39	110	9391	2.21
100% RDF (80:40:40)	197	70	14.96	14.07	1753	126.47	111	9831	2.09
LSD (P= 0.05)	11	NS	1.13	1.13	72	5.26	1	475	0.06
<b>Genotypes</b>									
SPH 1702	173	72	14.78	12.15	1949	126.07	111	8797	2.14
SPH 1703	170	66	14.67	17.58	1733	130.17	109	9233	2.20
SPH 1705	185	64	14.78	16.34	1665	132.95	109	7649	2.00
SPV 2114	207	65	14.67	15.01	1660	131.53	108	9511	2.23
SPV 2061	224	75	14.89	14.45	1524	128.89	111	10811	2.40
CSH 16	178	68	14.56	15.01	1803	128.89	109	9119	2.18
CSV 20	212	70	15.33	13.09	1415	130.32	109	9758	2.27
CSV 23	200	79	15.89	8.05	1293	126.71	114	9012	2.17
LSD (P=0.05)	18	4	1.84	1.84	117	8.59	1	775	0.10
C.V. (%)	7.74	4.81	12.96	13.90	7.56	5.56	1.38	8.84	4.96

\*Coimbatore, \*\*Madhira

### 1 K (E). Forage sorghum (Single-cut)

Field experiments were conducted at Udaipur, Ludhiana, Hisar and Panthagar. Irrespective of the locations, increasing fertility levels up to 100% RDF significantly increased the green and dry fodder yields (Table 1KE-1). On mean basis, there were 24 and 26 % increase in green and dry fodder yields due to 100% RDF as

compared to 50% RDF. On location mean basis, the test genotypes SPV 2128 (49.44 t/ha) produced 5.66% and 11.4 % higher green fodder yield over the checks CSV 21F (46.79 t/ha) and HC 308 (44.38 t/ha). The performance of SPV 2128 however varied with locations. At Hisar, the test genotype was significantly inferior to check HC 308 and the local check HJ 541.

**Conclusion:** On location mean basis, the test genotypes SPV 2128 produced 5.66% and 11.4 % higher green fodder yield over the checks CSV 21F and HC 308. However, at Hisar, the test genotype was significantly inferior to check HC 308. Significant response was observed up to 100% RDF.

**Table 1KE-1. Effect of fertility levels and genotypes on fodder yields of single-cut sorghum under rainfed conditions.**

Treatment	Green fodder yield (t/ha)					Dry fodder yield (t/ha)				
	Hisar	Udaipur	Ludhiana	Pantnagar	Mean	Hisar	Udaipur	Ludhiana	Pantnagar	Mean
<b>Fertility levels</b>										
50% RDF	49.62	32.42	42.64	40.93	41.40	10.39	10.28	11.38	10.48	10.63
75% RDF	51.77	36.98	51.12	48.15	47.01	11.24	11.76	13.64	12.41	12.26
100% RDF (80:40:40)	53.60	39.56	56.55	55.94	51.41	11.76	12.52	14.96	14.3	13.39
LSD (P= 0.05)	1.82	2.74	1.34	4.35	2.56	0.6	0.83	0.38	1.41	0.81
<b>Genotypes</b>										
SPV 2128	50.10	40.81	51.85	54.99	49.44	10.61	12.75	13.41	12.94	12.43
CSV 21F	50.51	36.61	52.47	47.58	46.79	10.64	11.84	14.09	12.67	12.31
HC 308	52.30	34.39	48.36	42.45	44.38	11.35	10.33	12.57	11.58	11.46
Local check	53.74	33.48	47.72	-	-	11.89	11.15	13.23	-	-
CD (P= 0.05)	2.1	3.17	1.55	4.35	2.79	0.69	0.96	0.44	1.41	0.88
C.V. (%)	4.17	8.92	3.17	9	6.32	6.35	8.55	3.36	11.39	7.41

Local Checks: HJ 541 (Hisar); PC 1080 (Udaipur); Ramkel (Ludhiana)

### 1 K (F). Forage sorghum (Multi-cut)

Field experiments were conducted at Hisar, Pantnagar, Udaipur and Coimbatore. The maximum green fodder yield was recorded at Pantnagar (105 t/ha) followed by Hisar, Coimbatore and Udaipur. Irrespective of the locations, increasing fertility levels up to 100% RDF significantly increased the green and dry fodder yields (Table 1KF-1). On mean basis, there were 31.6 and 35 % increase in green and dry fodder yields due to 100% RDF as compared to 50% RDF. On mean basis, SPH 1697 (80.83 t/ha), being on a par with CSH 20 MF (77.53 t/ha) produced significantly higher green fodder yield over SPH 1698 (72.45 t/ha), CHS 24 MF (70.59 t/ha) and SSG 59-3 (67.85 t/ha). However, there were differences in green fodder yields at different locations. At Hisar, both the test genotypes were significantly inferior to checks CSH 20 MF and CSH 24 MF. However, at Pantnagar, both the test hybrids were at par with CSH 20 MF and superior to CSH 24 MF and SSG 59-3. At Udaipur and Coimbatore, SPH 1697 produced significantly higher green fodder yield compared to SPH 1698 and all the checks. The interaction effect between fertility levels and genotypes for the green fodder yield was not significant, irrespective of the locations and mean basis.

**Conclusion:** On location mean basis, the test genotype SPH 1697 (80.83 t/ha), being on a par with CSH 20 MF (77.53 t/ha) produced significantly higher green fodder yield over SPH 1698 (72.45 t/ha), CHS 24 MF (70.59 t/ha) and SSG 59-3 (67.85 t/ha). However, at Hisar, both the test genotypes were significantly inferior to checks CSH 20 MF and CSH 24 MF. Significant response was observed up to 100% RDF.

**Table 1KF-1. Effect of fertility levels and genotypes on total fodder yields (3 cuts) of multi-cut sorghum**

Treatment	Green fodder yield (t/ha)					Dry fodder yield (t/ha)				
	Hisar	Pantnagar	Udaipur	Coimbatore	Mean	Hisar	Pantnagar	Udaipur	Coimbatore	Mean
<b>Fertility levels</b>										
50% RDF	62.66	84.09	50.29	57.51	63.64	12.65	16.87	14.75	-	14.76
75% RDF	67.77	104.40	61.86	62.69	74.18	13.64	20.96	18.15	-	17.58
100% RDF (80:40:40)	71.57	127.65	67.79	67.91	83.73	14.37	25.48	19.91	-	19.92
LSD (P= 0.05)	2.51	4.68	2.73	2.72	6.08	0.49	1.26	0.76	-	1.82
<b>Genotypes</b>										
SPH 1697	65.72	112.39	72.54	72.67	80.83	13.20	22.01	21.01	-	18.74
SPH 1698	63.84	107.10	61.53	57.31	72.45	12.86	21.78	18.12	-	17.59

Treatment	Green fodder yield (t/ha)					Dry fodder yield (t/ha)				
	Hisar	Pantnagar	Udaipur	Coimbatore	Mean	Hisar	Pantnagar	Udaipur	Coimbatore	Mean
CSH 20MF	70.79	110.41	68.89	60.03	77.53	14.16	21.74	20.21	-	18.70
CSH 24MF	69.46	95.07	56.12	61.72	70.59	14.04	19.41	16.49	-	16.65
SSG 59-3	66.86	101.94	40.81	61.80	67.85	13.52	20.57	12.18	-	15.42
CD (P= 0.05)	3.24	6.04	3.52	3.51	7.85	0.63	1.63	0.97	-	2.34
C.V. (%)	4.98	5.93	6.08	5.79	12.90	4.80	7.98	5.73	-	13.94

## Trial 2K. Integrated Nutrient Management in kharif sorghum-chickpea cropping system

A long-term field experiment was initiated at Dharwad, Indore, Parbhani, Udaipur, Palem and Akola during 2013-14 to find out the effect of integrated nutrient management practices on yield, economics and soil health in sorghum-chickpea cropping system. Trials at Indore and Parbhani were vitiated due to higher rain fall. Results revealed that different INM treatments did not influence the grain yield significantly, though the highest mean grain yield (3322 kg/ha) was observed with the application of 100% RDN through inorganic fertilizer. However, the responses varied with the locations (Table 2K-1). Application of 75% RDN through inorganic fertilizer+25% RDN through vermicompost produced maximum grain yield at Akola, whereas at Dharwad, 50% RDN through inorganic fertilizer+25% RDN through FYM+25% RDN through vermicompost being on a par with 100% RDN through inorganic fertilizer (6315 kg/ha) produced the highest grain yield (6340 kg/ha). On mean basis, though, the differences in grain yield among the treatments were non-significant, maximum grain yield was obtained with application of 100% RDN through inorganic fertilizer (3322 kg/ha), followed by application of 50% RDN through inorganic fertilizer+25% RDN through FYM+25% RDN through vermicompost (3095 kg/ha).

**Conclusion:** On mean yield basis, the differences in grain yield among INM treatments were non-significant. However, application of 75% RDN through inorganic fertilizer+25% RDN through vermicompost produced maximum grain yield at Akola, whereas at Dharwad, 50% RDN through inorganic fertilizer+25% RDN through FYM+25% RDN through vermicompost being on a par with 100% RDN through inorganic fertilizer produced the highest grain yield.

**Table. 2K-1 Effect of INM treatments on grain yield (kg/ha) of sorghum**

Treatment	Palem	Akola	Dharwad	Udaipur	Mean
T1-100% RDN through inorganic fertilizer	2667	2736	6315	1572	<b>3322</b>
T2-50% RDN through inorganic fertilizer+50% RDN through FYM	2852	2168	5316	1256	2898
T3-75% RDN through inorganic fertilizer+25% RDN through FYM	2111	2757	5058	1379	2826
T4-50% RDN through inorganic fertilizer+50% RDN through vermicompost	2333	1957	4852	1326	2617
T5-75% RDN through inorganic fertilizer+25% RDN through vermicompost	2296	<b>3178</b>	4980	1332	2946
T6-50% RDN through inorganic fertilizer+25% RDN through FYM+25% RDN through vermicompost	2556	2041	<b>6340</b>	1443	3095
T7-75% RDN through inorganic fertilizer+25% RDN through FYM+ seed treatment with microbial fertilizers like PSB+ Azospirillum	2685	2694	4793	1519	2923
T8-75% RDN through inorganic fertilizer+25% RDN through vermicompost+ seed treatment with microbial fertilizers like PSB+ Azospirillum	2667	2630	5123	<b>1581</b>	3000
T9-75% RDN through inorganic fertilizer+seed treatment with microbial fertilizers like PSB+Azospirillum	<b>3741</b>	1915	4133	1477	2816
Location mean	2656	2453	5212	1432	2938
LSD (P=0.05)	772	579	450	226	NS
C.V. (%)	16.8	13.6	5.0	9.1	17.4

**Table 2K-2 Effect of INM treatments on stover yield, growth and yield attributes and economics of sorghum (mean of different locations)**

Treatment	Stover yield (kg/ha)	Plant ht (cm)	Days to 50% flowering	Days to maturity	Panicles /m <sup>2</sup> **	Grain nos/panicle*	100-seed wt (g)	Panicle length (cm)*	HI (%)	B:C ratio
T1	12606	214	64	106	12.33	1463	2.83	27.13	27.12	1.82
T2	11682	198	65	105	12.33	1669	2.72	29.00	25.65	1.30
T3	11600	202	65	109	11.83	1390	2.70	28.60	28.87	1.26
T4	10669	197	65	107	12.17	1639	2.77	26.80	26.00	1.06
T5	11956	204	65	108	12.33	1492	2.76	27.13	28.80	1.22
T6	11365	200	65	106	12.33	1674	2.80	27.00	27.05	1.36
T7	11917	205	65	108	12.50	1588	2.78	25.53	26.05	1.41
T8	12203	198	65	108	12.83	1610	2.60	26.80	25.70	1.45
T9	10293	197	66	109	12.00	1685	2.65	28.13	28.74	1.81
LSD (P=0.05)	1844	16	1	4	NS	261	NS	2.74	4.69	NS
C.V. (%)	10.9	5.4	1.2	1.6	8.02	9.5	4.01	5.8	11.86	25.6

\*Palem

### Trial 3K. Improving Nitrogen-use efficiency through method and time of N application

Field experiments were conducted at Palem, Coimbatore, Akola, Surat and Udaipur to improve the N-use efficiency in grain sorghum through split application of nitrogen. Results revealed that on over all mean basis, there was no significant difference in grain yields due to variation in N application methods. Application of 50% at sowing + 25% at 30 DAS +25% at boot-leaf stage (BLS) was slightly better (2.2% higher) than the normal practice of applying 50% N at sowing and 50% at 30 DAS. Further splitting did not show any yield improvements. However, there were variations in response location wise (Table 3K-1). At Coimbatore, application of 25% N at sowing + 45% at 30 DAS + 5% foliar spray at 45 DAS +15% at BLS +10% GFS produced the highest grain yield of both CSH 16 and CSV 20. At Akola, application of 50% N at sowing + 25% at 30 DAS +25% at boot-leaf stage (BLS) showed better performance. At Udaipur, CSV 20 produced maximum grain yield with application of 50% N at sowing and 50% at 30 DAS, where as CSH 16 produced higher yield when 50%N was applied at sowing and 25% at 30 DAS +25% at boot-leaf stage (BLS); and the interaction was significant.

**Conclusion:** On overall mean basis, there was no significant difference in grain yields due to variation in N application methods, but the response varied with locations. At Coimbatore, application of 25% N at sowing + 45% at 30 DAS + 5% foliar spray at 45 DAS +15% at BLS +10% GFS produced the highest grain yield of both CSH 16 and CSV 20, whereas at Udaipur, CSV 20 produced maximum grain yield with application of 50% N at sowing and 50% at 30 DAS, where as CSH 16 produced higher yield when 50%N was applied at sowing and 25% at 30 DAS +25% at boot-leaf stage (BLS); and the interaction was significant.

**Table 3K-1. Interaction effect of N application methods and sorghum cultivars on grain yield (kg/ha).**

Treatment	N1	N2	N3	N4	N5	Mean
<b>PALEM</b>						
CSH 16	3444	2000	2333	2000	2185	2393
CSV 20	2444	2907	3185	3111	1778	2685
Mean	2944	2454	2759	2556	1981	
LSD (P=0.05)	N=936	C=592 (NS)	NxC= 1324 (NS)			
<b>COIMBATORE</b>						
CSH 16	1039	1235	1263	1409	1529	1295
CSV 20	957	1088	1284	1214	1364	1181
Mean	998	1162	1274	1312	1447	
LSD (P=0.05)	N=61	C=39	NxC= 86			
<b>AKOLA</b>						
CSH 16	2525	3030	2483	2462	2420	2584
CSV 20	1957	2525	1810	1852	1957	2020
Mean	2241	2778	2146	2157	2189	
LSD (P=0.05)	N=378	C=239	NxC= 534 (NS)			
<b>SURAT</b>						
CSH 16	3776	3759	3796	3829	3907	3814
CSV 20	3506	3558	3533	3628	3716	3588
Mean	3641	3658	3665	3728	3812	
LSD (P=0.05)	N=566	C=358 (NS)	NxC= 800 (NS)			
<b>UDAIPUR</b>						
CSH 16	1319	1585	1447	1556	1348	1451
CSV 20	1600	1378	1013	1120	1350	1292
Mean	1459	1481	1230	1338	1349	
LSD (P=0.05)	N=162	C=103	NxC= 229			

**Annexure 1: Physico-chemical properties of soils at different centers (Kharif 2013)**

<b>S.No</b>	<b>Particulars</b>	<b>Palem</b>	<b>Coimbatore</b>	<b>Dharwad</b>	<b>Udaipur</b>	<b>Pant nagar</b>	<b>Surat</b>
1	Soil texture	Sandy clay loam	Clay loam	Medium deep black (Clay)	Clay loam	Silty loam	Deep black
2	Soil depth (cm)		105	Deep			>100
3	Soil pH value (1:2.5 soils: water)	8.07	7.84		8.01	6.5-6.6	8.00
4	Field capacity (%)	14	24				33.3
5	Wilting point (%)	6	12	15			16.6
6	Bulk density(g/cc)	1.29	1.26	1.31	1.46		1.37
7	EC (1:2.5 soils: water) (d/Sm)	0.62	0.47	7.8	0.84		0.33
8	Soil organic carbon (%)	0.38	0.44	32	0.67	1.18-1.2	0.50
9	Soil organic matter (%)		0.758				0.86
10	Available Nitrogen (kg/ha):	213	230	194.8	258		252
11	Available P <sub>2</sub> O <sub>5</sub> (kg/ha)	60	36	33.5	20.12	29.6-38.6	52
12	Available K <sub>2</sub> O (kg/ha)	708	615	454.2	312.5	268-271	351
13	Available Fe (ppm)		-		1.729		7.1
14	Available Zn (ppm)		-		0.468		1.6
15	Date of sowing	11-14 June 2013	2nd July 2013	15-16 <sup>th</sup> June 2013	5-7 July 2013	16 <sup>th</sup> Apr and 15 <sup>th</sup> May, 2013	28 <sup>th</sup> June 2013
16	Rainfall received during crop period (mm)	<b>938</b>	<b>369</b>	<b>635.6</b>	<b>775.20</b>	<b>1504</b>	<b>1778</b>

**Annexure II: Weekly weather data at different centres, Kharif 2013**

Coimbatore :Lat: 11 <sup>o</sup> N Long:77 <sup>o</sup> E										Palem					
Std week	Dates	Evaporation (mm/day)	Rain fall (mm)	RH (%)		Temperature (°C)		Solar radiation (MJ/m2/day)	Sun shine hours/day	Rainy days (no)	Rain fall (mm)	Temperature (°C)		RH (%)	
				AM	PM	Max	Min					Max.	Min.	AM (7.30h)	PM (14.30h)
18	Apr 30-May 6	5.6	1.2	84	48	35.2	25.2	355.5	7.1						
19	May,7-13	6.3	-	84	53	36.2	25.3	378.9	6.4						
20	14-20	6.7	3.2	81	40	36.1	24.4	404.4	7.3						
21	21-27	7.1	5.2	78	45	35.0	23.6	386.4	8.7						
22	28-03	5.8	7.9	83	54	32.2	23.5	304.2	4.9						
23	Jun 04-10	5.8	18	81	55	31.8	23.5	343.2	4.9	-	16.0	33.9	23.8	74.4	67.3
24	11-17	6.1	9.4	74	58	30.2	23.4	270.0	3.0		65.6	30.9	21.8	69.71	62.4
25	18-24	5.6	9.6	79	60	30.0	23.5	277.6	2.1		5.8	31.8	22.1	77.0	67.3
26	25-01	4.9	14.8	84	55	30.5	23.1	312.5	3.7		6.2	31.0	22.4	75.85	63.71
27	Jul 02-08	5.8	0.2	81	60	31.0	23.0	293.1	3.5		4.2	28.9	21.8	61.7	67.14
28	09-15	5.1	5.6	84	59	30.0	23.0	263.8	2.6		34.8	30.0	21.1	61.71	60.86
29	16-22	5.6	12.6	73	70	29.3	23.7	250.8	1.8		79.2	28.6	20.3	71.57	65.28
30	23-29	6.7	3.5	80	57	29.6	23.1	310.5	2.2		16.6	28.6	20.8	79.86	67.86
31	30-05Aug	6.4	7.4	79	60	29.6	22.6	307.5	4.4		5.8	28.6	19.9	88.40	63.14
32	Aug 6-12	4.8	12.8	89	61	30.9	22.2	284.2	4.5		9.0	29.1	21.2	87.14	56.57
33	13-19	5.8	5.5	88	51	31.4	22.3	336.3	4.4		84.2	26.7	20.9	90.43	68.0
34	20-26	7.7	-	81	50	32.0	22.6	394.9	8.9		24.4	29.1	23.7	81.57	70.0
35	27-02	5.4	21.5	90	52	33.1	22.9	348.7	7.0		27.2	30.1	23.6	83.86	61.14
36	Sep 3-9	4.7	10.4	90	64	30.7	22.3	310.7	5.5		40.2	29.4	22.1	85.86	64.86
37	10-16	4.8	15.6	89	65	30.3	22.7	312.9	4.1		76.4	31.8	21.0	85.71	55.57
38	Sep17-23	7.1	0.6	76	55	30.4	24.1	363.2	5.3		59.0	29.9	21	87.85	68.43
39	24-30	7.1	-	84	48	32.3	21.4	414.6	9.1		5.4	31.1	21.1	82.57	62.0
40	Oct 01-07	6.8	-	82	46	32.4	20.9	410.2	9.0		19.4	30.4	21.1	82.29	59.0
41	08-14	5.4	10	85	57	32.3	22.3	344.3	7.3		152.8	31.2	20.9	87.86	53.87
42	15-21	4.0	93.4	94	61	31.4	22.2	301.4	5.8		5.0	30.4	20.1	79.29	60.43
43	22-28	3.6	34.6	92	65	29.8	21.3	301.4	4.2		200.8	27.2	20.5	86.14	62.88
44	29-04 Nov	4.7	29.6	89	60	31.1	22.6	367.8	8.1						
45	Nov 5-11	4.2	0.5	87	55	29.1	22.4	378.4	5.7						
46	12-18	2.9	5.1	90	64	28.7	21.6	274.0	2.4						
47	19-25	3.5	5.1	91	56	30.4	22.1	373.5	6.3						
<b>Total</b>			<b>369</b>								<b>938</b>				

**Annexure II (Cont..)**

Parbhani (Maharashtra)									Surat (Gujarat): Altitude: 11.34 m (above MSL), Lat: 20°12'N, Longitude: 72°52'E							
Std week	Dates	Rain fall (mm)	Temperature (°C)		RH (%)		Evaporation (mm/day)	Sun shine (hrs)	Rainy days (no)	Rain fall (mm)	Temperature (°C)		RH (%)		Sun shine (hrs)	Evaporation (mm)
			Max.	Min.	Max.	Min.					Max.	Min.	AM (7.30h)	PM (14.30h)		
22	May 29-Jun-3								2	28.4	37	30	69	51	0	
23	Jun 04-10	107.5	34.9	23.3	86	55	5.8	4.9	6	233	33.8	28.8	76.3	62.6	2.5	
24	11-17	29.2	31.4	22.9	86	66	4.3	1.8	6	217.4	28.9	25.4	89.7	76.3	0	
25	18-24	24.0	33.3	23	85	61	5.4	6.0	2	12.6	31.9	26.4	89.6	77.1	0.6	
26	25-01	41.8	30.1	22.5	85	64	4.7	2.9	5	31	31.3	27.6	84.4	79.1	0.7	
27	Jul 02-08	40.1	32.1	22.6	92	62	5.1	5.4	6	220.7	31.1	28.1	85.1	76.7	0	
28	09-15	96.4	29.2	22.7	90	79	3.4	2.2	5	112.2	30	27.2	89.7	81.1	1.5	
29	16-22	154	26.7	22.0	93	84	2.9	0.8	7	97.5	29.5	27.3	89.3	83.6	0	
30	23-29	50.5	29.4	22.6	86	65	3.7	2.5	7	189	28	26.6	89.3	82.7	0	
31	30-05Aug	77.5	28.3	21.8	91	75	3.5	2.8	4	34.2	30.2	27.7	88.9	75.4	0	
32	Aug 6-12	19.7	29.8	22.5	89	67	4.6	3.2	7	60	30.4	27	90.1	79.7	0	
33	13-19	59.8	30.5	22.7	91	65	3.6	4.2	3	22.6	30.6	27.4	85.6	78.3	0	
34	20-26	9.3	28.5	21.7	89	71	3.6	1.5	3	8.4	31.1	27.1	84.3	70.6	3.2	
35	27-02	0	31.0	22.9	82	59	4.6	5.7	3	12.6	32.1	27.2	86	74.4	3.7	
36	Sep 3-9	29.8	33.1	22.6	85	61	5.9	8.1	3	27	33.9	26.8	87.6	61.4	3.5	
37	10-16	84.5	32.0	22.2	92	63	3.2	6.1	2	13.3	34	27.1	85.3	74.7	2.8	
38	Sep17-23	150.6	30.2	22.4	93	67	3.9	3.6	6	434.2	28.9	26.4	92.7	91.9	1.4	
39	24-30	0	32.2	22.0	86	52	5.0	8.2	2	2	32.2	27.6	88.6	82.4	2.4	
40	Oct 01-07	40.8	31.5	22.8	89	64	4.8	5.8	3	22.2	31.6	26.5	90.4	83.7	3.2	
41	08-14	66.2	30.7	21.7	93	70	4.4	6.1								
42	15-21	0	32.5	19.5	83	46	5.2	8.5								
43	22-28	10.3	30.8	21.2	85	56	4.1	6.1								
44	29-04 Nov	0	31.7	15.0	78	37	5.1	9.2								
45	Nov 5-11	0	30.4	13.3	71	36	5.2	8.8								
46	12-18	0	29.2	12.1	79	35	4.9	7.9								
47	19-25	14	30.4	14.5	81	41	4.6	7.6								
<b>Total</b>		<b>1146</b>							<b>82</b>	<b>1778</b>						



**Annexure II (Cont..)**

Indore :Lat: 11 <sup>o</sup> N Long:77 <sup>o</sup> E										Pantnagar							
Std week	Dates	Rainy days (No)	Rain fall (mm)	Temperature (°C)		RH (%)				Rainy days (no)	Rain fall (mm)	Temperature (°C)		RH (%)		Sun shine (hrs)	Evapora tion (mm)
				Max.	Min	Av.						Max.	Min.	AM (7.30h)	PM (14.30h)		
19	May,7-13									1	1.20	38.5	19.5	57	26	8.4	9.8
20	14-20									0	0.00	38.8	23.8	60	32	7.2	9.1
21	21-27									0	0.00	39.3	29.1	70	44	5.5	10.0
22	28-03 June									0	1.20	37.2	25.8	64	41	7.5	8.3
23	Jun 04-10	03	128.3	34.4	23.4	77.9				3	57.60	35.2	26.1	75	57	3.6	7.2
24	11-17	02	82	31.3	24.4	82.0				4	216.40	32.0	25.2	80	66	3.6	5.7
25	18-24	02	8.7	28.6	23.6	83.9				3	184.20	31.9	25.2	87	69	3.0	3.9
26	25-01	05	58.8	27.1	24.4	86.8				5	148.80	31.7	25.2	92	72	2.4	3.4
27	Jul 02-08	05	299.4	26.7	21.2	83.1				5	151.20	30.4	25.4	91	73	2.7	5.4
28	09-15	04	57.5	28.2	22.5	85.5				2	37.20	32.6	26.3	87	71	6.2	4.6
29	16-22	04	57.3	26.0	22.3	85.1				5	127.00	31.1	25.5	91	77	2.5	4.0
30	23-29	07	197.8	26.4	22.5	86.1				5	73.00	32.6	25.6	85	69	4.6	4.4
31	30-05Aug	03	125.6	25.6	22.1	84.1				5	75.80	33.0	26.0	87	68	6.1	4.7
32	Aug 6-12	02	28.8	27.0	22.2	87.4				6	143.80	32.1	25.3	91	74	5.0	4.4
33	13-19	02	25.2	28.1	22.6	85.1				5	181.40	31.8	24.5	90	72	5.5	5.1
34	20-26	04	186.5	24.6	21.7	84.8				3	17.00	33.4	25.9	87	65	5.9	3.7
35	27-02	01	6.0	27.5	21.5	83.7				3	39.20	31.3	25.2	93	73	3.1	3.5
36	Sep 3-9	00	0.0	29.9	21.3	82.7				2	12.60	32.0	23.6	91	68	6.7	4.2
37	10-16	02	6.2	34.0	23.1	81.8				3	23.20	33.5	24.0	86	61	8.7	4.0
38	Sep17-23	03	119.8	32.1	21.9	83.0				1	5.40	33.0	23.8	81	65	8.4	3.7
39	24-30	01	10.2	28.4	21.4	81.8				2	33.20	32.0	24.1	89	64	6.0	3.7
40	Oct 01-07	01	42.8	29.5	22.6	87.3				1	6.80	30.5	23.1	82	65	4.2	3.4
41	08-14	00	0.0	31.0	22.0	76.0				2	79.60	31.1	22.1	90	62	6.4	2.7
42	15-21	2	64.80	29.36	21.21	82.57				0	0.00	30.3	20.1	91	65	5.5	2.3
43	22-28	0	0.00	32.07	19.71	81.71				0	0.00	29.9	16.8	88	53	7.8	2.8
44	29-04 Nov	0	0.00	30.21	15.50	77.29				0	0.00	28.5	13.4	90	48	6.9	2.3
45	Nov 5-11	0	0.00	30.36	15.07	79.14				1	0						
46	12-18	0	0.00	28.50	15.29	77.86				0	0						
47	19-25	0	0.00	27.00	11.79	76.43				0	0						
<b>Total</b>		<b>51</b>	<b>1440.9</b>							<b>66</b>	<b>1615.8</b>						

**Annexure II(Cont..)**

Udaipur: Latitude: 24°35'0"N; Longitude: 73°42'0"E										Dharwad							
Std week	Dates	Evaporation (mm)	Rain fall (mm)	Temperature (°C)		RH (%)		Wind speed (km/h)	Sun shine hours	Rainy days (no)	Rain fall (mm)	Temperature (°C)		RH (%)		Sun shine (hrs/day)	Evaporation (mm)
				Max	Min	AM	PM					Max.	Min.	AM (7.30h)	PM (14.30h)		
18	Apr 30-May 6		0							-	-	36.1	20.5	82.85	28.42		
19	May,7-13	7.7	17.0	37.5	23.0	72.7	32.1	6.9	10.1	-	0.8	34.94	21.2	81	33.42		
20	14-20	12.8	0.0	37.9	24.6	65.4	49.0	7.7	10.1	1	2.6	36.08	21.7	85.42	28.71		
21	21-27	13.9	0.0	40.1	26.6	80.9	57.6	7.8	9.5	-	0.4	37.1	21.97	81	30.71		
22	28-03	13.9	0.0	39.5	25.6	67.7	41.6	8.3	8.7	-	-	33.94	21.88	84.85	39.14		
23	Jun 04-10	11.51	14.0	36.6	24.4	61.7	31.4	6.7	7.17	1	14.6	31.67	21.8	90	55.28		
24	11-17	8.5	15.20	36.1	24.0	69.86	46.0	10.8	9.3	-	-	31.08	21.34	89.28	51.42		
25	18-24	10.9	0.0	34.2	24.3	66.9	35.3	10.5	9.1	1	15.6	28.77	20.77	91.42	68.28		
26	25-01	12.3	0.0	36.2	24.8	64.0	34.7	7.3	3.9	2	13.2	27.87	20.71	92.14	79.14		
27	Jul 02-08	8.1	27.7	35.4	23.7	73.1	44.7	7.1	3.3	3	28.2	26.27	20.67	94.14	75.14		
28	09-15	5.7	104.6	31.0	22.8	81.4	56.1	6.8	4.3	1	9	28.35	20.8	92.28	66.71		
29	16-22	5.7	0.0	31.8	23.6	76.1	54.7	8.4	2.4	4	47.2	26.84	20.82	47.2	92.57		
30	23-29	5.8	4.0	31.2	23.4	76.1	58.3	7.3	1.3	2	25.4	26.9	21.01	92.72	74.71		
31	30-05Aug	4.2	10.6	29.0	22.2	78.0	62.7	4.2	1.2	2	20.2	27.01	20.51	91.85	74.85		
32	Aug 6-12	2.8	65.9	30.1	22.2	83.4	75.9	4.9	1.3	3	39.2	26.44	20.81	94.57	77.57		
33	13-19	1.9	57.4	27.4	21.2	86.1	69.9	4.6	3.3	2	20.8	27.25	20.25	92.71	71.42		
34	20-26	3.3	16.4	30.0	22.0	82.7	68.3	2.0	2.9	1	4.8	28.04	20.51	93.71	68.42		
35	27-02	2.7	72.4	31.5	22.1	90.7	70.0	3.1	2.2	4	13.8	26.38	20.18	94.85	82		
36	Sep 3-9	1.9	162.6	29.3	22.0	93.6	76.0	3.0	2.1	5	27.6	26.3	20.75	94.85	88		
37	10-16	1.8	86.4	28.9	22.4	89.0	76.1	1.9	5.1	1	5.6	27.47	20.1	92.14	74.57		
38	Sep17-23	3.4	0.4	31.0	21.4	87.3	59.7	2.2	7.8	-	1.2	28.8	18.97	88.42	61.85		
39	24-30	4.4	34.0	31.8	19.6	81.7	44.1	2.0	8.9	3	49.8	30.42	18.8	86	50.71		
40	Oct 01-07	4.8	0.0	33.7	19.3	75.1	30.6	1.8	8.1	2	43.2	27.52	20.6	92.42	76		
41	08-14	4.7	0.0	33.4	16.8	72.1	24.4	1.8	9.0	1	37.6	30.08	19.02	82.28	52.28		
42	15-21	4.0	0.0	33.2	15.9	78.0	19.9	2.0	8.7	-	-	31.7	16.48	63.28	33.71		
43	22-28	5.0	0.0	31.6	13.7	67.0	18.7	2.4	7.8	1	8.4	29.47	18.61	86.14	51.85		
44	29-04 Nov	4.1	0.0	29.6	11.5	75.6	20.9	1.9	7.4	1	33.1	28.07	17.2	79.57	55.85		
45	Nov 5-11	3.1	0.0	28.7	11.7	73.6	22.7	1.7	8.0	-	1.4	29.82	20.01	91.57	55.71		
46	12-18	3.4	0.0	29.4	11.7	68.4	22.6	1.5	8.3	-	1.2	29.21	15.04	68	38.85		
47	19-25	3.1	0.0	28.4	10.8	77.3	27.0	6.9	10.1	-	-	29.81	13.94	72.14	42.57		
<b>Total</b>			688.6							<b>41</b>	<b>450.3</b>						