7. Sorghum Pathology Kharif 2008

Contents

Executive summary

Introduction
Total 10 trials (AVT, AVHT, IHT & nurseries of grain, dual purpose & sweet sorghum) were evaluated against earhead & foliar diseases in endemic areas (Palem, Cimbatore, Dharwad, Akola, Parbhani, Surat, Udaipur and Pantnagar) spread over three sorghum growing zones.

General trend
Grain mold incidence in Coimbatore was very high & almost all the test material was badly affected. On the contrary at Palem and Akola the grain mold appearance & incidence was optimum & at Dharwad conditions were quite satisfactory. At Dharwad ergot and Downy Mildew was in epidemic form recording very high incidence to the extent of 40% giving good chance for selecting resistance. The severity of foliar diseases at Udaipur, Pantnagar as well s Dharwad was quite satisfactory as indicated by appearance of disease severity in susceptible checks as well as local checks. At Akola large number/kind of foliar diseases were recorded but severity was low. However these diseases have the potential to cause denting effect with the availability of susceptible crop and environment.

Grain sorghum
In advance varietal & hybrid trial none of the entry was resistant equivalent to resistant check B58586, but SPH 1604 and SPV 1786 were at par when compared with other resistant check IS 14338. These entries need to be retested. Entries in initial varietal trial SPV 1883, SPV 1884, SPV 1875, SPV1879, SPV 1878, SPV 1874 behaved equal to resistant check. Under Initial hybrid trials no entry had resistance but the moderate resistance could be found. IHT entry SPH 1644 was found resistant to DM (<10%) and MR to GM & ergot besides having resistant to almost all the foliar diseases.

Dual-purpose sorghum
Ten to sixteen entries in AVT- DP and IVT – DP were observed to express resistance at par with resistant check IS 14338 & IS 14332. The PGMR rating in these entries ranged from 2.35 to 4.72. The entries were SPV 1820, SPV 1779, SPV 1781, SPV 1861, SPV 1862, and SPV 1863 to name few. These entries are MR resistant to DM & ergot.

Pest disease resistant nursery
GMRP 108 & GMRP 109 had been observed to have resistance rating (3) against grain mold and have resistance against DM & but not against ergot and much not useful to ward from foliar diseases.

Fodder sorghum single cut
Entries SPV 1846, SPV 1845, SPV 1847, have less grain mold, resistant to multiple foliar diseases but moderate resistance to DM & ergot.

Sweet sorghum
Entries screened under advanced varietal & hybrid trial against foliar diseases indicated that most of the entries are resistant to foliar diseases like rust, target leaf spot, anthracnose & leaf blight but not to Zonate leaf spot. Sweet sorghum B lines also showed similar trend of resistance.

Overall conclusion:

1. AVHT entries SPH 1604 and SPV 1786 need to be rested against all the diseases,
2. It seems difficult to have multiple resistance to diseases, therefore combination of resistance & moderate resistance may prove useful.

Looking ahead: Concept of multiline varieties may be explored in view of absence of multiple resistance.

Sorghum Pathology - Detailed report

1. Grain mold (*Fusarium spp, Curvularia spp*.)

Grain sorghum: The grain sorghum materials in three trials (23 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for grain mold resistance under natural conditions. PGMR (panicle grain mold rating) was done using 1-9 rating scale in Zone I (Palem & Coimbatore) & Zone II (Akola & Dharwad). TGMR ratings were only recorded at Palem (Zone I)

Table with summary results

No	**Trial no**	**1**	**2**	**3**	**Comments**
	Name	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	
1	Res. check :IS 14332	1.65	2.22	1.89	Palem centre has not used local check
2	Res. check :IS 14338	2.19	2.08	1.68	
3	Res. check : B 58586	1.58	1.79	1.90	
5	Sus. check : Bulk Y	4.99	3.95	3.54	
6	Local check	4.59	4.06	4.60	
7	Other check: CSH 16	4.02	Not tested	4.22	
8	Other check: CSH 23	4.85	Not tested	4.93	
9	Other check: CSV 15	4.31	4.35	Not tested	
10	Other check :CSV 17	5.13	4.98	Not tested	
11	Other. check: SPV 462	4.47	4.73	Not tested	
12	Mean	4.15	4.22	4.30	
13	Minimum	1.58	1.79	1.68	
14	Maximum	5.13	4.98	5.11	
15	CD (0.05)	2.09	2.60	2.16	
16	CV (%)	35.34	41.68	34.83	
17	Most resistance lines at par with B 58586	Nil	SPV 1883, SPV 1884, SPV 1875, SPV 1879, SPV 1878, SPV 1874	Nil	No resistant found
18	Most resistance lines at par with IS 14338	Not compared	Not compared	Nil	
19	Next resistance lines (= trial mean)	SPV 1786	nil	SPH 1633, SPH 1635, CSH 16	
20	Most susceptible lines (on par with Bulk Y)	All	All	All	On par with susceptible check
21	Selected lines (value: on par with B58586)	Nil	Nil	Nil	No resistance found
22	Selected lines (value: = trial mean)	15	Nil	SPH 1633 (4.28), CSH 16 (4.22), SPH1644 (4.13)	These lines need to be retested for its confirmation
23	Data from locations (no)	4	4	4	
24	Locations considered for national average (no)	4	4	4	
25	Comment 1	Large variation from location to location	Large variation from location to location		

1.1 Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)

The trial comprised of 23 entries includes 18 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338), one susceptible check (Bulk Y) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem, Coimbatore (Zone I) and , Zone II (Akola & Dharwad) (Table 1.1).

Zone-I: In Zone I average PGMR (panicle grain mold rating) ranged between 1.7 to 9; highest (rating 9) was observed at Coimbatore whereas it was 5.07 at Palem. At palem all the entries were statistically at par with resistant check (rating= 2.73) except CSV17 (rating 5.1). At Coimbatore all the test entries showed high degree of susceptibility (rating 6.2 to 9).

Zone II: Trials under Zone II revealed that, all the entries (CSH 16, SPH 1604 SPH 1606, CSV 15, SPH 1615 etc) were statistically at par with resistant checks. At Akola entries SPH1609, CSH23, SPH 1596, SPH1615 showed rating from 3 to 3.5. Remaining other entries was at par with resistant check (rating = 2.7). At Dharwad none of the entry was at par with resistant check but SPH 1616 (5.33) & SPH 1610 (5.0) were moderately resistant.

National: Pooled data analysed indicated that none of the entry behaved as good as resistant check B 58586 however when compared with other resistant check IS 14338, entries SPV 1786, SPH 1604 & CSH 16 had resistance against grain mold (rating 3.8 - 4.1),

Thresh grain mold rating (TGMR): Zone I: Harvested threshed grains of CSV17 had highest TGMR of 4.77 (Table 1.1) & rest of the entries were at par with resistant checks. Fungi- *Fusarium* & *Curvularia* were associated with grain mold. Infection by grain mold fungi *Fusarium* ranged from 4.1 to 34.4%. Entries having lowest 14.5- 20.9% grain affected (at par with resistant check) by *Fusarium* were CSV17, CSV15, CSH16, CSH23, SPH1610, SPV 462. Infection by *Curvularia* ranged from 20 to 36.3%. Entries having lowest 21.3 to 29.2% grain affected (at par with resistant check) by *Curvularia* were SPH 1605, SPH 1611, SPH 1596, CSH23 & CSH16. Grains affected by *Fusarium* & *Curvularia* together was 45.8 & 44% in SPH1786 & SPH1615 respectively while lowest (at par with resistant checks) was in test entries CSH16 & SPH1606.

1.2 Initial Varietal Trial (IVT- GS)

The trial comprised of 26 entries includes 21 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338), one susceptible check (Bulk Y) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem, Coimbatore (Zone I) and , Zone II (Akola & Dharwad) (Table 2.1).

Zone I: The average PGMR rating ranged between 2.1 to 9; highest rating (9) was observed at Coimbatore whereas it was 3.9 at Palem. At Palem entries SPV 1883, SPV 1876, SPV 1886, SPV 1874, SPV 1880 showed resistance whereas SPV 1881, SPV 1882 & CSV 17 showed moderate resistance (>3). At Coimbatore no entry showed resistance & all the entries showed PGMR rating over 8. Pooled data from Palem & Coimbatore indicated that all the test entries were susceptible & lowest rating observed was 5.40 (SPV 1883).

Zone II: In Zone II PGMR rating ranged between 1.48 to 5.67; highest 5.67 at Dharwad & 287 at Akola. Performance of entry varied from location to location. At Akola all the entries showed resistance & highest score (2.87) of PGMR was observed on SPV 462. At Dharwad only SPV 1875 had resistance (rating of 3) at par with resistance check. However pooled data for Akola & Dharwad indicated that all the entries in zone II were as good as resistant checks (at par SPV 1882, CSV 17,SPV 1876 , SPV 1876 & other) however, lowest PGMR rating (2.77-2.87) was observed in SPV 1875, SPV 1884.

National: Combined data for Zone I & II reveals test entries SPV 1883 SPV 1884 SPV 1875 SPV 1879 SPV 1878, local check and SPV 1874 (4.6- 4.34) were at par with resistant check B 58586 (1.79)

Thresh grain mold rating (TGMR): Zone I: TGMR (Table 2.2) at Palem indicated that entries SPV Nos. 1876, 1886, 1884 & 1877 were as good as resistant check (<3). All the other entries (entries with highest scoring CSV17, SPV 1882, SPV 1881; 2.9 to 3.7) could be graded as moderate resistant. At Palem data on grain affected by GM fungi was recorded. Lowest grain (18.8 - 30.7) affected entries were SPV Nos. 462, 1886, 1616 & 1874. Very high per cent grain affected entries were SPV Nos. 1876, 1879, 1881, 1880 & B 58586 (38.5 to 48%). *Curvularia* affected grain ranged 20- 32.7 % in test entries IS 14332, SPV Nos. 1886, 1880, 462, 1874, & CSV 17. Higher = 32 % grain were affected in entries SPV Nos. 1875, 1878, 1881 & CSV15. Incidence of *Fusarium* ranged 12.8-17.7 % in test entries SPV Nos. 462, 1885 & 1884. Higher = 25% grains were affected in entries CSV 15, SPV Nos. 1881, 1886, 1878, 1875 & 1879.

1.3 Initial Hybrid Trial (IHT –GS)

The trial comprised of 27 entries includes 22 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338), one susceptible check (Bulk Y) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem, Coimbatore (Zone I) and Zone II (Akola & Dharwad) (Table 3.1).

Zone I: In Zone I average PGMR rating ranged between 2.1 to 9; highest rating (9) was observed at Coimbatore whereas it was 3.4 at Palem. At palem all the entries (rating = 2.6) were statistically at par with resistant check (IS 14338) (rating 2.1) except SPH1567, SPH1638 & SPH 1634 (rating 3.4). At Coimbatore all the test entries showed high degree of susceptibility (>8.6; CSH16).

Zone II: All the trial entries in zone II behaved as good as resistant checks (IS 14338 & IS 14332; rating 1.47 & 1.53) when the averaged data on rating was compared. Nevertheless performance of the entries varied with location. Entries SPH Nos. 1644, 1633, 1646, 1635, 1640 & CSH 16 rated <3 & were at par with resistant checks. Rest of the entries (SPH 1630, SPH 1628, CSH 23, & SPH 1641) showed moderate resistance & rated <5. At Akola All the entries statistically performed as resistant check (<3) except local check (3.80). At Dharwad none of entry was at par with resistant checks but SPH 1644, SPH 1635, CSH 16 & SPH 1633 had resistance 3 rating. Others (CSH 23, SPH 1632, SPH 1628, SPH 1641, SPH 1630 etc) had rating >3 to 6.3.

National: Pooled statistical analysis for both the zone revealed that none of entries statistically equalled to resistant checks but all the entries behaved as moderate resistant = 5 (SPH 1644, SPH 1635, CSH16, SPH 1633, SPH 1640, SPH 1646 had rating between 4.13- 4.38).

Thresh grain mold rating (TGMR)

Zone I: Harvested threshed grains of SPH 1634 was rated highest 3.30 (Table 3.1). Entries SPH 1635, SPH 1644, SPH 1628, SPH 1639, SPH 1633 & few other equalled the resistant check (<3). Data recorded at Palem (Zone I) indicated that *Fusarium* & *Curvularia* are associated with grain mold. Highest percent (41.1%) of grains affected were in entry SPH1567. Lowest grain (31.8%) affected were in entry SPH1639; at par with resistant check IS 14338. In other entries (SPH1636, SPH 1632, SPH1628, SPH 1634,SPH 1567, CSH16 etc) incidence ranged 33.1 to 41.1%. Infection by Fusarium- grain mold was Lowest in SPH 1630 (21.1%). But none of the entry was resistant as IS 14332 or IS 14338. The few of the Entries SPH 1631, 1628, 1641, 1567, CSH16 had 21.6 to 24.5% infection. Highest was in SPH 1638 (33.3%).Lowest *Curvularia* was observed in SPH1645 (24%). At par infection was observed in SPH 1635, SPH 1643, SPH 1628, SPH 1632, SPH 1641 etc. Highest (32.4%) infection was recorded in SPH 1630.

Dual purpose sorghum: Dual purpose Sorghum material were evaluated in two trial under natural conditions. PGMR (panicle grain mold rating) was done using 1-9 rating scale in Zone I (Palem & Coimbatore) & Zone II (Akola & Dharwad). TGMR ratings were only recorded at Palem (Zone I)

Table with summary results

No	Trial no	1	2	Comments
	Name	**AVT (DP)**	**IVT (DP)**	
1	Res. check :IS 14332	2.28	1.87	Need to create congenial environment to get repeatable results.
2	Res. check :IS 14338	2.03	2.03	
3	Res. check : B 58586	2.20	2.46	
5	Sus. check : Bulk Y	2.30	4.48	
6	Local check	2.35	2.85	
7	Other check: CSV 15	3.44	4.67	
8	Other check :CSV 23	3.47	4.33	
9	Mean	3.11	4.2	
10	Minimum	2.03	1.87	
11	Maximum	3.47	4.97	
12	CD (0.05)	1.93	2.92	
13	CV (%)	42.07	46.49	
14	Most resistance lines at par with IS 14338	10		
	Most resistance lines at par with IS 14332		16	
15	Next resistance lines			

No	Trial no	1	2	Comments
	Name	AVT (DP)	IVT (DP)	
16	(= trial mean) Most susceptible lines (on par with Bulk Y			
17	Selected lines (value: on par with IS 14338 in AVT- DP & IS 14332 IVT- DP)	SPV 1820, SPV 1779, SPV 1781, SPV 1782, SPV 1822, SPV 1823, CSV 15, CSV 23, LC (2.35 -3.28)	SPV 1861, SPV 1862, SPV 1863, SPV 1864, CSV 15, CSV 23, SPV 1865, SPV 1866, SPV, Bulk Y (S) 1867, SPV 1868, SPV 1869, SPV 1870, SPV 1871, SPV 1873, LC, Bulk Y (S) (2.85-4.72)	
18	Selected lines (value: = trial mean)			
19	Data from locations (no)	4	4	
20	Locations considered for national average (no)	4	4	
21	Comment 1	In AVT DP all the entries including susceptible check showed resistance at par with resistant check. Akola & Palem had very low GM.	In AVT DP all the entries including susceptible check showed resistance at par with resistant check. Akola & Palem had very low GM.	
22	Comment 2			

1.4 Advanced varietal trial for dual purpose (AVT- DP)

The trial comprised of 13 entries includes 8 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338), one susceptible check (Bulk Y) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem, Coimbatore (Zone I) and , Zone II (Akola & Dharwad) (Table 4.1).

Zone I: In Zone I average PGMR rating ranged between 2.1 to 4.7; highest rating 6.6 was observed at Coimbatore and 2.9 at Palem. Performance of entry varied from location to location. At Palem SPV 1823 & SPV 1781 showed resistance (<3) at par with resistant check (IS 14338, rating 2.10). However at Coimbatore all the entries showed susceptibility. Averaged data for both centres (Zone I) indicated that SPV 1782 have moderate resistance(<5).

Zone II: In Zone II PGMR rating ranged between 1.9 to 2.7; highest 4.3 at Dharwad & 3.7 at Akola. Performance of entry varied from location to location. At Akola (zone II) SPV 1782 & SPV 1779 were resistant & equalled the resistant checks & at Dharwad SPV 1822 showed resistance. On Zone basis (Akola & Dharwad together) SPV 1779 & SPV 1822 proved resistant equalled to the resistant checks (IS 14338, IS 14332, B 58586) (rating <3).

National: Statistically analysed data for PGMR ratings from Zone I & Zone II showed that all the entries were at par with resistant checks (IS 14332) & CSV23, CSV 15, SPV 1823, SPV 1781, SPV 1820 had highest PGMR rating ranging from 3.3 to 3.5.

Thresh grain mold rating (TGMR)

Zone I: Thresh grade grain mold at Palem indicated that entries SPV 1823 & 1781 were as good as resistant check (<3). At Palem data on grain affected by GM fungi was recorded. Lower grain (31-32%) affected entries were SPV1779 & CSV23. Highest grain (~33-30%) affected entries were local check & SPV1782. *Curvularia* affected grains in test entries to the extent of ~24 - 31% & *Fusarium* ~14 to 24% (Table 4.1).

1.5 Initial Varietal Trial for dual purpose (IVT – DP)

The trial comprised of 20 entries includes 15 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338), one susceptible check (Bulk Y) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem, Coimbatore (Zone I) and Zone II (Akola & Dharwad) (Table 5.1).

Zone I: In Zone I average PGMR rating ranged between 2.1 to 6.2; highest rating 9 was observed at Coimbatore and 3.4 at Palem. At Palem SPV 1887 & SPV 1863, SPV 1864 showed resistance (=3) at par with resistant check (IS14338; rating 2.1). However at Coimbatore all the test entries showed high susceptibility (rating~9, & checks were not used). Averaged data for both centres (Zone I) indicated that SPV 1867, SPV 1863 & SPV 1864 were at par with resistant checks (IS 14338, IS 14332 & B 58586).

Zone II: In Zone II PGMR rating ranged from 1.5 - 6.7; highest 6.7 at Dharwad & 3.1 at Akola. At Akola (zone II) SPV 1781, CSV 15 and at Dharwad SPV 1867 & 1873 showed resistance (<3). On Zonal basis (Akola & Dharwad together) SPV 1871, SPV 1861 & SPV 1867 proved resistant equalled to the resistant checks (IS 14338, IS 14332 & B 58586) (rating <3).

National: Statistically analysed data for PGMR ratings from Zone I & Zone II together showed that all the entries (rating 2.85- 4.72) behaved at par with resistance check IS 14332.

Thresh grain mold rating (TGMR)

Zone I: Thresh grade grain mold at Palem (Table 5.1) indicated that entries SPV 1867, SPV 1863 & SPV 1864 were as good as resistant check ((<3). Data on grain affected by GM fungi was recorded. Lowest grains 21% were affected in SPV 1865.Highest grain (~30-33%) affected entries were SPV 1866, SPV 1867, SPV 1861, SPV 1864 & CSV 23. *Curvularia* & *Fusarium* affected grains in test entries to the extent of ~30%.

Forage sorghum: Sorghum fodder Single cut entries were evaluated in a single trial under natural conditions. PGMR (panicle grain mold rating) was done using 1-9 rating scale in Zone I (Palem) & Zone II (Dharwad). TGMR ratings were only recorded at Palem (Zone I)

Table with summary results

No	**Trial no**	**1**	
	Name	**AVT(F-SC)**	
1	Res. check : IS 14332	2.6	
2	Res. check :IS 14338	2.1	
3	Res. check : B 58586	2.4	
4	Sus. check :		**Not included**
5	Local check	1	
6	Other check: CSV 21F	4.97	
7	Other check: HC 308	4.8	
8	Other check: SSG 59-3	Not tested	
9	Other check :CSH 20 MF	Not tested	
10	Mean	3.68	
11	Minimum	1.0	
12	Maximum	5.28	
13	CD (0.05)	2.33	
14	CV (%)	26.93	
15	Most resistance lines (on par with res check)	8	
16	Next resistance lines(= trial mean)	Nil	
17	Most susceptible lines (on par with CSV 21F)	SPV 1849, SPV 1852, HC 308	
18	Selected lines (value: on par with res check)	SPV 1845, SPV 1846 , SPV 1847, SPV 1848,SPV 1850, SPV 1851, SPV 1853, LC , (4.3-2.55)	
19	Selected lines (value: = trial mean)	Nil	
20	Data from locations (no)	2	
21	Locations considered for national average (no)	2	
22	Comment 1		

1.6 Advanced Varietal Trial for forage single cut (AVT- SC)

The trial comprised of 16 entries includes 12 test varieties, three resistant checks, (B 58586, IS 14332 and IS 14338) and one local checks from respective centre.

Panicle grain mold (PGMR): PGMR was recorded at Palem (Zone I) and , Zone II (Dharwad) (Table 6.1).

Zone I: At Palem PGMR rating ranged between 2.1 to 4.47. Entries SPV 1845, SPV 1847 & SPV 1846 had shown PGMR intensity as in case of resistant check.

Zone II: At Dharwad PGMR rating ranged from 1 to 6.7. SPV 1845 recorded lowest PGMR. Other at par entries was SPV 1850, SPV 1847 & SPV 1851. Susceptible entries were SPV 1852, SPV 1853, SPV 1849, CSV 21 F, & HC 308 showing 5.3 to 6.7 rating.

National : Averaged data for both the zones revealed that SPV 1845, SPV 1846 , SPV 1847 ,SPV 1848, SPV 1850, SPV 1851, SPV 1853, LC were as good (4.3-2.55) as resistant check (IS 14338). Susceptible test lines were SPV 1849, SPV 18

Thresh grain mold rating (TGMR)

Zone I: Thresh grade grain mold Palem (Table 6.1) indicated that entries SPV 1846, SPV 1853, SPV 185 & all other entries were resistant to GM. However grains infection ranged from 31 - 38 % SPV 1847 & SPV 1850 were least infected. *Fusarium* infected ~27 to 33 % grains were as *Curvularia* infected ~23 to 31% grains.

Pest & disease nursery for resistance against diseases

SorghumPest & Disease resistance nursery was evaluated in a single trial under natural conditions. PGMR (panicle grain mold rating) was done using 1-9 rating scale in Zone II (Dharwad) and Zone III (Udaipur).

No	**Trial no**	**1**	**Comments**
	Name	**PDRN GM (Dharwad)**	
1	Res. check : IS 14332		Not used
2	Res. check :IS 14338		Not used
3	Res. check : B 58586		Not used
4	considered R Check – QL3		QL 3 was considered as resistant check as it had lowest PGMR & also resistant to DM
5	Local check	1	
6	Mean	4.02	
7	Minimum	1	
8	Maximum	6	
9	CD (0.05)	2.67	
10	CV (%)	38.7	
11	Most resistance lines (on par with QL3)	7	
12	Next resistance lines (= trial mean)		
13	Most susceptible lines	H 112	
14	Selected lines (value: on par with QL3)	GMRP 108, GMRP 109, GMRP 96, SUENT 9, NRCSFR06-2, B 58586 (R-GM), LC (1-3.67)	
15	Data from locations (no)	1	
16	Locations considered for national average (no)	no	
17	Comment 1	Another centre Udaipur have no GM problem	

1.7 Pest & Disease resistant nursery

The trial comprised of 17 entries includes 16 test varieties & one local check.

Panicle grain mold (PGMR): PGMR was recorded at Dharwad in Zone II (Table 7.1).

Zone II: At Dharwad GMRP 108, GMRP 109, GMRP 96, SUENT 9, NRCSFR06-2 (rating 1. 3.67 showed resistance at par with QL3. H 112, DJ 6514, BY (S-GM), SUENT 8 & GMRP 12 showed highest disease reaction ranging from ~5-6 .

Germ plasm: B lines of sweet sorghum were evaluated in a single trial under natural conditions. PGMR was done using 1-9 rating scale in Zone II.

Table with summary result

No	Trial no	1	Comments
	Name	**B line (Dharwad)**	
1	Res. check : IS 14332		Not used
2	Res. check :IS 14338		Not used
3	Res. check : B 58586		Not used
4	considered R Check –QL#		QL 3 was consisered as resistant check as it had lowest PGMR & also resistant tp DM
5	Local check	2	
6	Mean	4.13	
7	Minimum	1	
8	Maximum	6	
9	CD (0.05)	1.19	
10	CV (%)	17.6	
11	Most resistance lines (on par with QL3)	0	
12	Next resistance lines (= trial mean)	8	
13	Most susceptible lines	2, NSSB 1002, H 112 (LC)	
14	Selected lines (value: on par with QL3)	0	
15	Data from locations (no)	1	
16	Locations considered for national average (no)	1	
17	Comment 1	Trial lack standard resistant checks.	
18	Comment 2	Incidence of GM is OK.	

1.8 Sweet sorghum (B-Lines) against sorghum diseases

The trial comprised of 27 entries includes 25 test B lines & two local check. In absence standard GM check, QL3 having lowest PGMR & resistance against DM was considered for evaluation of resistance

Panicle grain mold (PGMR): PGMR was recorded at Dharwad in Zone II (Table 10.1).

Zone II: QL3 & DMS 652 scored lowest PGMR (1). None of the other entries were at par. But individually lowest rating = 3 was recorded in NSSB 25, NSSB 23, NSSB 11, NSSB 6. Highest (~5-6) PGMR was observed in NSSB 1002, H 112 (LC), NSSB 26, NSSB 1007 & NSSB 19.

2. Downy mildew (*Peronosclerospora sorghi*)

Grain sorghum: The grain sorghum materials in three trials (23 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for downy Mildew resistance under natural conditions. Incidence of downy Mildew was recorded in per cent. The trials were carried in Zone II. Standard method of resistance grading i.e. resistance =10 % DM; MR = 11-30% DM was followed

Table with summary results

		DM			
No	**Trial no**	**1**	**2**	**3**	**Comments**
1	**Name**	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	
2	Local check	38.9	40.8	38.9	The trial should be extended to Coimbatore with proper resistant check
3	Other check: CSH 16	16.85	Not used	19	
4	Other check: CSH 23	18.1	Not used	202	
5	Other check: CSV 15	18.63	23.6	Not used	
6	Other check : CSV 17	14.76	9.5	Not used	
7	Other. check: SPV 462	22.23	21.2	Not used	
8	Mean	21.1	21	16	
9	Minimum	12.8	9.5	9.8	
10	Maximum	38.9	40.8	27.3	
11	CD (0.05)	9.3	10.2	12.6	
12	CV (%)	26.79	28.63	48.15	
13	No <10% DM	0	1	2	
14	Next resistance lines	0	7	16	

DM					
No	**Trial no**	**1**	**2**	**3**	**Comments**
1	**Name**	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	
	(= trial mean)				
15	Most susceptible lines	2, Local Check (38.9%), SPH 1615(34.5%)	Local check (40.8)	Local check (33.7)	On par local check
16	Selected lines (value: <10%)	0	CSV 17 (9.5%)	SPH 1644 (9.8%), IS 14332 (9.9%)	
18	Data from locations (no)	1	1		
19	Locations considered for national average (no)	no	no	no	

2.1 Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)

The trial comprised of 23 entries includes 22 test varieties and one local check. DM was recorded in, Zone II (Dharwad) (Table 1.2).

Zone II No resistant entry having less than 10% Downy Mildew was recorded. Among the test entries lowest incidence (14.8 to 20%) was observed in SPH 1817, CSH16, CSH23, CSV15 &17, SPH1596, SPH 1616, SPV 1786 whereas SPH1615& local check had incidence ranging from 34.5 to-39%.

2.2 Initial Varietal Trial trial (IVT- GS)

The trial comprised of 26 entries includes one local check.

Zone II: Lowest DM was observed in CSV17 (9.5%) (Table 2.2). Other entries having 14-18.2% incidence were SPV 1884, SPV 1878, SPV 1882, SPV 1885 and SPV 1877. High incidence was recorded in entries SPV 1879, SPV 1876, SPV 1881, and CSV 15 & SPV 1875 (22.6 - 26.4%). Local check had incidence of 40.8 %.

2.3 Initial Hybrid Trial (IHT –GS)

The trial comprised of 27 entries including 1 local check.

Zone II: Among the test entries lowest incidence (9.8 %) was observed in SPH 1644 and the entries SPH 1640, SPH 1637,SPH 1642, SPH 1646, SPH 1645, SPH1643,SPH 1631 etc were were having incidence less than 16% (10.1- 14.8%). Other entries SPH 1628, SPH1638 & local check showed 25.4 to 33.70% DM incidence (Table 3.2)

Dual purpose sorghum: Dual purpose Sorghum material were evaluated in two trial (AVT DP and IVT DP) under natural conditions in Zone II at Dharwad.

Table with summary results

No	**Trial no**	**1**	**2**	**Comments**
1	**Name**	**AVHT (DP)**	**IVT (DP)**	
2	Local check	39.5	41.8	.Resistance was taken on the basis of incidence.
3	Other check: CSV 15	19.3	13.1	
4	Other check: CSV 23	19.6	9.8	
5	Other. check: SPV 462	Not used	Not used	
6	Mean	20.1	12.9	
7	Minimum	13.9 (SPV 1820)	4.1 (SPV 1873)	
8	Maximum	39.5	41.8	
9	CD (0.05)	9.6	9.5	
10	CV (%)	23.0	43.2	
11	No <10% DM	0	10	No resistant found
12	Next resistance lines (= trial mean)	0	1 (SPV 1871- 11.4%)	
13	Most susceptible lines	1, Local check (39.5)	1, Local check (41.8%)	
14	Selected lines (value: <10%)	0	SPV 1861, SPV 1864, CSV 23, SPV 1865, SPV 1866, SPV 1868, SPV 1869, SPV 1870, SPV 1872, SPV 1873 (4,1 - 10%)	
15	Data from locations (no)	1		
16	Locations considered for national average (no)	1		On par with susceptible check

2.4 Advanced varietal trial for dual purpose (AVT- DP)

The trial comprised of 9 entries includes 8 test varieties, and one local checks from respective centre.

Zone II: No entry was found having resistance i.e. <10% DM. Lowest DM was observed in SPC1820 (13.9%) & equaly low DM occurred in test entries SPV 1781, SPV1779, SPV 1822, SPV 1782 etc. High incidence was recorded in local check (39.5) (Table 4.2).

2.5 Initial Varietal Trial for dual purpose (IVT – DP)

The trial comprised of 16 entries includes 15 test varietiesand one local checks from respective centre.

Zone II: Lowest DM was observed in SPV1873 (4.1%). Other entries having incidence 4.1 to 10% were SPV 1861, SPV 1864, CSV 23, SPV 1865, SPV 1866, SPV 1868, SPV 1869, SPV 1870, SPV 1872, SPV 1873 High incidence was recorded in local check (~42%) (Table 5.2).

Forage sorghum: Sorghum fodder Single cut entries were evaluated in a single trial under natural conditions. Trial comprised of 12 entries inclusive of one local check. The trials were carried in Zone II (Dharwad). Standard method of resistance grading i.e. resistance =10 % DM; MR = 11-30% DM was followed.

Table with summary results

No	**Trial no**	**1**	Comments
	Name	**AVT(F-SC)**	
1	Local check	32.3	Compared on the basis of incidence.
2	Other check: CSV 21F	25.1	
3	Other check: HC 308	20.5	
4	Mean	27.1	
5	Minimum	16.1	
6	Maximum	45.7	
7	CD (0.05)	10.4	
8	CV (%)	19.7	
9	No <10% DM	0	
10	Next resistance lines (= trial mean)	0	No resistance
11	Most susceptible lines	SPV 1852 (45.7)	
12	Selected lines (value: <10%)	0	No resistance
13	Data from locations (no)	1	
14	Locations considered for national average (no)	1	

2.6 Advanced Varietal Trial for forage single cut (AVT- SC)

The trial comprised of 12 test varieties includes one local checks from respective centre.

Downy mildew: DM was recorde in, Zone II (Dharwad) (Table 6.1).

Zone II: None of the resistant entry was recorded that has <10% DM. Lowest DM was observed in SPV 1848 (16.1%) & at par were the SPV1851, SPV 1847, SPV 1846 & others. High incidence was recorded in SPV 1852 & local check (~40 to 46 %).

Pest & disease nursery for resistance against diseases: Sorghum Pest & Disease resistance nursery was evaluated in a single trial under natural conditions. Trial comprised of 17 entries inclusive of one local check & one resistant check QL3.

Expt entries- LC + 16 =17, only Dharwad- DM

No	**Trial no**	**1**	**Comments**
	Name	**PDRN-DM**	
1	Resistant check QL3	4.1	
2	Local check	39.7	
3	Mean	9.3	
4	Minimum	4.1	
5	Maximum	39.7	
6	CD (0.05)	14.9	
7	CV (%)	92.78	

No	Trial no	1	Comments
	Name	PDRN-DM	
8	Most resistance lines	14	
9	Next resistance lines (= trial mean)		
10	Most susceptible lines	1 LC (39.7%), 2. H112 (31.6%)	
11	Selected lines (value: on par with QL3)	GMRP 96 GMRP 112 GMRP 109 GMRP 12 GMRP 90 GMRP 108 B 58586 (R-GM) BY (S-GM) NRCSFR06-1 NRCSFR06-2 SUENT 8 SUENT 9 IS 2312 DJ 6514 (4.1-12.3)	
12	Data from locations (no)	1	
13	Locations considered for national average (no)	1	
14	Comment 1		

2.7 Pest & disease resistant nursery

The trial comprised of 17 entries includes 16 test varieties & one local check.

DM incidence was recorded at Dharwad in Zone II (Table 7.1)

Zone II: Lowest DM was observed in QL 3 (4.1%) & equally at par low DM was observed in other 14 entries namely GMRP 96, GMRP 112, GMRP 109, GMRP 12, GMRP 90, GMRP 108, B 58586 (R-GM), BY (S -GM), NRCSFR06-1, NRCSFR06-2, SUENT 8, SUENT 9, IS 2312, DJ 6514 (4.1-12.3 l therefore resistant. Entries local check & H112 had incidence of ~31 to 40%.

Germ plasm: B lines of sweet sorghum were evaluated in a single trial under natural conditions. Trial comprised of 29 entries inclusive of one local check & one resistant c heck QL3

No	Trial no	1 Comments
	Name	SS B lines
1	Resistant check QL3	4.1
2	Local check	31.2
3	Mean	10.9
4	Minimum	4.1
5	Maximum	38.2
6	CD (0.05)	10.5
7	CV (%)	58.3
8	Most resistance lines	24
9	Next resistance lines (= trial mean)	
10	Most susceptible lines	DMS 652 (58.3)
11	Selected lines (value: on par with QL3)	24 entries (4.1 to 14.4)
12	Data from locations (no)	1
14	Locations considered for national average (no)	1
15	Comment 1	

2.8 Sweet sorghum (B-Lines) against sorghum diseases

DM was recorded at Dharwad in Zone II (Table 10.1).

Zone II: Entries NSSB 1005, NSSB 1002, NSSB 1001, NSSB 25, NSSB 11, NSSB 10 & NSSB 9 had lowest DM (~ 4%). Only four entries DMS 652,, NSSB 1, H 112 (LC), & NSSB 13 showed incidence between 21 to 38% DM.

3. Ergot (*Claviceps sorghi*)

Grain sorghum: The grain sorghum materials in three trials (23 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for ergot resistance under natural conditions. Incidence of ergot was recorded in per cent. The trials were carried in Zone II. Standard method of resistance grading i.e. resistance =10 % ergot; MR = 11-30% ergot was followed.

Table with summary results

No	Trial no	1	2	3	Comments
1	**Name**	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	
2	Local check	8.7	11.6	28.2	Require standard resistance check
3	Other check: CSH 16	21.6	Not used	16.2	
4	Other check: CSH 23	13.5	Not used	20.5	
5	Other check: CSV 15	26.5	18.3	Not used	
6	Other check : CSV 17	11.9	13.9	Not used	
7	Other. check: SPV 462	18.9	23.4	Not used	
8	Mean	16.9	17.1	22.3	
9	Minimum	4.1	9.1	13.7	
10	Maximum	33.1	29.4	32.8	
11	CD (0.05)	12.4	11.1	10.9	
12	CV (%)	44.8	38.44	29.67	
13	No <10% ergot	4	1	0	
14	Next resistance lines (= trial mean)	8	11	16	
15	Most resistance lines <10%	5	1	0	
16	Most susceptible lines	33.1%, SPV 1817	29.4%, SPV 1878	32.8%, IS 14338	
17	Selected lines (value: <10%)	L C, SPH 1611 , SPH 1596 ,B 58586 (4.1 -8.7)	B 58586	0	
18	Data from locations (no)	1	1	1	
19	Locations considered for national average (no)	no	no	N0	
20	Comment 1	SPH 1611 , SPH 1596 needs to be promoted			
21	Comment 2				

3.1 Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)

The trial comprised of 23 entries includes 22 test varieties and one local check. Ergot was recorded in Zone II (Dharwad) (Table 1.1).

Zone I: Among the test entries highest incidence (33.1%) of ergot was recorded in SPV1817 followed by SPH1596 (7%) & SPH 1611 (7.7%). Other entries with incidence of 27.8 – 26.5 were SPH1604, SPH1610 & CSV15 (27.8- 26.5%).

3.2 Initial Varietal Trial (IVT- GS)

The trial comprised of 26 entries includes one local check.

Zone II Lowest ergot observed in entries SPV 1882 (13%) & it was 9.1% in B 58586, SPV 1883, SPV 1886 (13-14%) followed by SPV 1884, SPV 1876, SPV 1875 (<20%). Higher incidence was recorded in entries SPV 1878 & SPV 1885 (29.43 & 26.8% respectively).

3.3 Initial Hybrid Trial (IHT –GS)

The trial comprised of 27 entries including 1 local check.

Zone II: None of the entry had resistance. Lowest ergot (15.6%) was observed in entry SPH 1636. However moderate resistance (<26.5%) was found in CSH16, SPH 1643, SPH 1637, SPH 1633, SPH 1635, SPH 1646 etc. SPH entries 1631, 1634, 1641 and1642 had higher incidence (27.54 - 31.63%).

Dual purpose sorghum: Dual purpose Sorghum material were evaluated in two trials (AVT DP and IVT DP) under natural conditions in Zone II at Dharwad.

Table with summary results

No	Trial no	1	2	Comments
1	**Name**	**AVHT (DP)**	**IVT (DP)**	
2	Local check	33.1	33.0	.
3	Other check: CSV 15	21.4	22.4	
4	Other check: CSV 23	23.5	26.0	
5	Other. check: SPV 462	Not used	Not used	
6	Mean	20.1	25.8	

No	Trial no	1	2	Comments
1	**Name**	**AVHT (DP)**	**IVT (DP)**	
7	Minimum	21.0	19.6	
8	Maximum	33.1	33.0	
9	CD (0.05)	8.5	9.8	
10	CV (%)	16.6	22.2	
11	No <10% ERGOT	0	0	No resistant found
12	Next resistance lines (= trial mean)	0	0	
13	Most susceptible lines	LC (33.1%)	LC (33%)	
14	Selected lines (value: <10%)	0	0	
15	Data from locations (no)	1	1	
16	Loc. considered for national av.(no)	no	no	On par with susceptible check
18	Comment 1			

3.4 Advanced varietal trial for dual purpose (AVT- DP)

The trial comprised of 9 entries includes 8 test varieties, and one local checks from respective centre.

Zone II: No test entry showed resistance (<10%). However lowest (>21) ergot was observed in entries SPV 1882, SPV 1879, SPV 1820, CSV 15, CSV23 & others. Highest incidence was recorded in entries local check & SPV 1782 (30- 33 %.).

3.5 Initial Varietal Trial for dual purpose (IVT – DP)

The trial comprised of 19 entries includes one local checks from centre.

Zone II: None oftest entry had <10% resistance. Lowest ergot was observed in entries SPV 1872, SPV 1864, SPV 1862 to the extent of 21. Highest incidence was recorded in entries local check & SPV 1868, SPV 1865 & SPV 1873(~29-33%).

Forage sorghum: Sorghum fodder Single cut entries were evaluated in a single trial under natural conditions. The trials were carried in Zone II (Dharwad). Standard method of resistance grading i.e. resistance =10 % ergot; MR = 11-30% ergot was followed

Table with summary results

No	Trial n o	1	Comments
	Name	**AVT(F-SC)**	
5 6	Local check Other check: CSV 21F	32.3 28.8	
7	Other check: HC 308	29.7	
10	Mean	27.3	
11	Minimum	21.1	
12	Maximum	32.25	
13	CD (0.05)	9.2	
14	CV (%)	17.1	
15	No <10% ERGOT	0	
16	Next resistance lines (= trial mean)	0	No resistance
18	Most susceptible lines	32.25 (LC)	
19	Selected lines (value: <10%)	0	No resistance
20	Data from locations (no)	1	
21	Locations considered for national average (no)	1	
22	Comment 1		

3.6 Advanced Varietal Trial for forage single cut (AVT- SC)

The trial comprised of 12 test varieties includes one local checks from respective centre. Ergot was recorded in Zone II (Dharwad) (Table 6.1).

Zone II: Lowest ergot was observed in entries SPV 1846 & other (~21- 30%). Local check had ~ 32% incidence. None proved resistant.

Pest & disease nursery for resistance against diseases: Sorghum Pest & Disease resistance nursery was evaluated in a single trial under natural conditions.

No	Trial no	1	Comments
1	**Name**	**PDRN-ERGOT**	
2	Local check	34.5	
3	Mean	28.6	
4	Minimum	19.5	
5	Maximum	34.5	
6	CD (0.05)	14.5	
7	CV (%)	29.39	
8	No <10% ERGOT	0	
9	Next resistance lines (= trial mean)		
10	Most susceptible lines	4	
11	Selected lines (value: <10%)	0	
12	Data from locations (no)	1	
13	Locations considered for national average (no)	no	
14	Comment 1		

3.7 Pest & disease resistant nursery

Trial comprised of 17 entries inclusive of one local check. Ergot incidence was recorded at Dharwad in Zone II (Table 7.1).

Zone II: Lowest ergot observed in entry QL3 (19.5%) & at par resistance was recorded in all the other entries except local check (34.5%) & GMRP 109 (31.6%) But none of the entries proved resistant giving less than 10%incidence.

3.8 Sweet sorghum (B-Lines) against sorghum diseases

B lines of sweet sorghum were evaluated in a single trial under natural conditions.

No	Trial no	1	Comments
	Name	**SS B lines**	
3	Local check	27.0	
4	Mean	29.6	
5	Minimum	16.6	
6	Maximum	39.3	
7	CD (0.05)	12.5	
8	CV (%)	25.5	
9	No <10% ERGOT	0	
10	Next resistance lines (= trial mean)		
11	Most susceptible lines	39.3% (DMS 652)	
12	Selected lines (value: <10%)	0	
14	Data from locations (no)	1	
15	Locations considered for national average (no)	1	
16	Comment 1		

Ergot was recorded at Dharwad in Zone II (Table 10.1) . Trial comprised of 29 entries inclusive of one local check.

Zone II: None of the entry out of 29 found resistant to Ergot. Lowest incidence of ergot was observed in QL 3(LC) (16.6) followed by NSSB 1008 (24.4%). Majority of entries, at par with QL3, showed moderate resistance (11-30%); some of these entries were NSSB 1008 NSSB 1 NSSB 1001 NSSB 17 etc. Highest incidence (33 to 39%) was observed DMS 652 NSSB 19 NSSB 13 NSSB 11 & NSSB

4. Foliar diseases

Grain sorghum: The grain sorghum materials in three trials (23 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for foliar disease resistance under natural conditions. Foliar diseases were scored on 1 -9 rating scale. Material scoring less than 3 rating were considered as resistance as there is no standard check to compare resistance

Table with summary results

	Rust			Anthracnose			Comments
Trial no	1 **AVHT (GS)**	2 **IVT (GS)**	3 **IHT (GS)**	1 **AVHT (GS)**	2 **IVT (GS)**	3 **IHT (GS)**	
Local check	5.75	4.45	4.28	4.5	3.25	3.75	
Other check: CSH 16	1.67	-	1.33	1.56	-	1	
Other check: CSH 23	1.67	-	1.33	1.4	-	1	
Other check: CSV 15 Other check : CSV 17	1.5 1.5	1.22 1.44	- -	1.44 1.67	1 1	- -	
Other. check: SPV 462	1.5	1.33	-	1.67	1	-	
Mean	1.91	1.54	1.46	1.8	1.13	1.3	
Minimum	1.5	1	1.11	1.33		1	
Maximum	5.75 LC	4.45 LC	4.28	4.5		3.75	
CD (0.05)	1.4	1.37	0.99	1.18	1.75	1.97	
CV (%)	35.2	52.5	1.31	39.44	71.53	74.07	
Most resistance lines < 3 rating	23	20	21	25	20	25	Many Res lines
Next res lines (= trial mean)							
Most susceptible lines	2.83 Bulk Y, SPV 1786	Bulk Y (4.33), LC(4.45	LC (4.28)	LC (4.5)	LC (3.25)	LC (3.75)	
Data from locations (no)	2	3	2	3	2	2	
Loc. considered for national av.	2	3	2	4	2	2	
Comment 1							

Table with summary results

	ZLS			TLS			LB			Comments
Trial no	1	2	3	1	2	3	1	2	3	
	AVHT (GS)	**IVT (GS)**	**IHT (GS)**	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	**AVHT (GS)**	**IVT (GS)**	**IHT (GS)**	
Local check	4.48	4.22	3.83	3.11	3.45	3	2.86	2.24	2.72	Disease severity needs to be increased
Other check: CSH 16	2.92	-	2.83	1.56	-	1.44	1.84		2.02	needs stagered planting
Other check: CSH 23	2.75	-	2.89	1.44	-	1.76	2.14		1.88	
Other check: CSV 15	2.96	2.89	-	1.71	1.33	-	2.04	1.83	-	
Other check : CSV 17	3.17	2.56	-	1.67	1.44	-	1.83	1.54	-	
Other. check: SPV 462	2.42	2.89	-	1.33	1.22	-	1.78	1.93	-	
Mean	2.97	2.92	2.93	1.71	1.6	1.61	2.25	1.86	1.99	
Minimum Maximum	2.42 4.22	1 4.33	2.5 4.22	1.33 3.11	1.22 3.47	1.22 3	1.78 4.48 bulk y	1.54 2.24	1.7 2.77	
CD (0.05)	0.48	1.15	1.15	1.47	1.61	1.29	0.71	0.92	0.61	
CV (%)	11.5		23.9	51.55	59.29	48.92	19.06	28.19	18.29	
Most resistance lines < 3 rating Next resistance lines (= trial mean)	18	17	23	22	19	27	22	21	27	
Most susceptible lines	Bulk Y	LC (4.22), Bulk Y(4.33)	4	LC 3.11	LC (3.45), IS 14338 (3.47)	none	4.48 bulk y	0	0	
Data from locations (no)	4	3	3	3	3	3	3	3	3	
Loc. Consi . for national av (no)	4	4	3	3	3	3	3	3		
Comment 1					Low severity of disease				Low severity of disease	

4.1 Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)

The trials were carried at 8 centres namely Palem, Coimbatore (Zone I), Akola, Parbhani, Surat and Dharwad (Zone II), and in Zone III at Pantnagar & Udaipur (Table 1.1 to 1.5)

Rust: The disease was recorded at two centres Dharwad and Udaipur.

Zone II: The disease was recorded at Dharwad. Highest disease (rating 5) was noted in local check followed by bulk Y (4.67) & rest of 21 entries showed resistance rating <3.

Zone III: At Udaipur local check contracted highest disease giving 6.5 rating. Rest of the entries showed very low attack of the diseases.

National: Highest rating 5.75 (Dharwad & Udaipur together) was observed in local checks. And the lowest (1.5) was in entry SPH1615 followed by SPH 1596, SPH 1611, CSV17 & CSV 15. All the other entries were at par with SPH 1615 giving resistance rating below 3.

Zonate leaf spot: The disease was recorded at Akola, Dharwad,(Zone II), Udaipur & Pantnagar (Zone III)

Zone II: Under this zone average rating in all the 23 entries were below 3. Highest rating of 2.67 was recorded in local check as well as in susceptible bulk Y.

Zone III: Local check and Bulk Y showed highest rating of 5-6.28 and all the test material showed moderate moderate reaction (<5)

National: Lowest rating (2.42) of zonate spot was recorded in SPV 1616. All the other entries were at par with SPV1616 except SPH 1609, CSH16, CSV15, CSV17, SPV1786 7 Bulk Y (2.92-4.22). Local checks in Zone II & Zone III recorded highest zonate leaf spot. Higher zonate leaf spot was recorded in Udaipur (Zone III) & Dharwad (Zone II). However higher rating >3 was shown by 5 entries including bulk Y.

Target leaf spot: The disease was recorded at Akola, Dharwad & Udaipur

Zone II: At Akola all the entries showed resistant reaction (rating <3). Highest disease (1.7) was recorded in SPV 1817. At Dharwad SPH 1596 had highest rating (3.67). Lowest rating of 2 was recorded in SPH Nos. 1603, 1605, 1616, and SPV 462. Other best entries having rating of 3-4 were SPH Nos. 1606, 1609, CSV 17, SPH 1611 & SPH 1616. In this zone all comprised test material showed resistance reaction i.e. below 3 rating.

Zone III: At Udaipur Local check had highest rating of 6.67 & all the other entries had rating lower than 3.

National: Over the all locations SPV462, SPH1603, SPH1605, SPH 1616 performed well with lowest rating of 1.33. Other at par entries were CSH23, SPH1611, SPH1596, SPH1606 and etc. As such 22 entries showed resistant reaction.

Leaf blight- Leaf blight was recorded at Akola, Coimbatore & Udaipur.

Zone I: At Coimbatore all the entries showed resistant to LB.

Zone II: At Akola highest disease was recorded in Local check (2.27) and SPV1817 (rating 1.77). These along with other showed resistance i.e. below 3 rating.

Zone III: At Udaipur lowest rating was 3 in entries SPH1605, SPV462 & CSV 17. All the other entries were statistically par with these entries.

National: On national basis SPV 462 had lowest rating of 1.78. Rest of the entries were at par except SPV1817 with rating of 2.51. Bulk Y showed moderate resistance i.e. 4.48 rating.

Anthracnose: Anthracnose was recorded in Zone II & III at Akola, Udaipur & Pantnagar.

Zone II: At Akola highest anthracnose was observed in test entry CSH23 (rating 1.20). Rest all other entries had lower rating than 1.20.

Zone III: At Udaipur highest rating 1.67 was observed in SPH 817 & SPH 1603 & rest had lower rating. At Pantanagar resistant reaction (rating2) was obtained in SPH 1596, SPV 1616, SPH1616, SPH 1611, CSV15, SPH16107 and others. Local check had highest anthracnose rating 5.

National: On national basis lowest rating of 1.33 was recorded on SPV1616 & SPH1596. Other all the entries were at par except local checks with rating of 4.5.

Sooty stripe: The disease was recorded in Zone II at Akola & Dharwad. All the entries recorded resistant reaction and highest ratings (2.17-2.33) were recorded SPH1609, SPH1609, CSH16 & CSV 15 had lowest rating (1-1.5) at both the places.

Gray leaf spot & rough leaf spot: These leaf spot were recorded at Akola only. Gray LS spot was recorded on SPV 1786 with rating of 1.5. All the other entries were at par & highest disease was recorded on SPV 1817 (rating 2.10). Highest intensity of rough leaf spot was 1.83 on SPH 1604. Rest of the entries had lower intensity than 1.83.

4.2 Initial Varietal Trial (IVT- GS)

The trials were carried at Palem &Coimbatore (Zone I), Akola, Parbhani, Surat & Dharwad (Zone II), Udaipur & Pantnagar (Table 2.1 to 2.4). The trial comprised of 22 entries,

Rust: Rust was recorded at Akola, Dharwad, and Udaipur.

Zone II: All the entries at Akola showed resistance rating below 3. Highest rating was 1.90 in SPV 1884. At Dharwad local check showed susceptible reaction >5, but none of the other entry showed susceptible reaction.

Zone III: At Udaipur all the material tested showed resistance.

National: All the 23 entries showed resistant reaction except bulk y that had rating of 4.33 i.e. moderate resistance.

Zonate leaf spot: The disease was recorded at Akola, Dharwad, &Udaipur.

Zone II: At Akola the disease was recorded only on single entry SPV 1880 and rating had been <2. At Dharwad entries CSV 17, SPV 1882, SPV 1878 & SPV 1876 showed resistance & moderate resistance (<4 rating) could be recorded in SPV 1883, SPV 1879, SPV 1884, SPV 1880, SPV 1874.

Zone III: At Udaipur only moderate resistance (4-5 rating) was recorded in number of entries & better entries were CSV 17, SPV 1616, SPV 1877, SPV 1875, SPV 1880 and SPV 1879. National: Averaged rating for all location revealed that entries CSV 17, SPV 1616, SPV 1877, SPV 1882, SPV 1878, SPV 1876 etc could exhibit resistance (<3 rating).

Target leaf spot- The disease was recorded at Akola, Dharwad & Uadaipur.

Zone II: In this zone SPV 462, SPV1886, CSV15, SPV1881 & SPV 1879 had low (= 3) attack of Target L spot. At Akola the diseases was recorded on only few lines (SPV 1616, & 1882) and was minor in nature (rating = 2). At Dharwad SPV 1886 & SPV 462 and more entries showed resistance (<3). All test material showed resistance except IS 14338 that had higher disease.

Zone III: At Udaipur all the material lowest rating of 1.

National: All the entries were resistant. Highest rating was observed in local check (3.45).

Leaf blight- Leaf blight was recorded at Akola, Coimbatore &Udaipur.

Zone I: All the entries including local checks had showed resistant reaction against LB at Coimbatore

Zone II: All the entries including local checks had showed resistant reaction against LB at Akola

Zone III: At Udaipur entries CSV17, SPV1616, SPV 1882, SPV1879, SPV1877 showed resistance against LB (rating <3) & susceptibility was shown by entries SPV 462, CSV15, SPV81, SPV1874, SPV 1875 (rating >3).

National: All the data from different zones indicated none of the test entry was susceptible to leaf blight.

Anthracnose: Anthracnose was recorded at Akola & Udaipur.

Zone II: At Akola maximum rating recorded on any entry was 1. Therefore resistance.

Zone III: Kekri local (local check) at Udaipur showed susceptible reaction but none of the test entries Udaipur showed notable susceptibility to anthracnose

Sooty stripe & gray leaf spot: Sooty stripe was recorded in Zone II at Akola & Dharwad. None of the entry showed susceptible reaction and the maximum disease scaled was 1.95 in CSV18 when the data was pooled from the both the centres. At Akola maximum rating was 2.43 & at Dharwad it was 2 in SPV 1880 & SPV 1874. Gray mold (<2 rating) was recorded only on SPV 1876, SPV 1883, SPV 1884 at Akola.

Rough leaf spot: At Akola rough leaf was recorded on few entries e.g. SPV 1886, SPV 1885, SPV 1616, SPV 1882, SPV 1879, SPV 1876, SPV 1874 (rating <3).

4.3 Initial Hybrid Trial (IHT –GS)

The trials were carried at Palem & Coimbatore (Zone I), Akola, Parbhani, Surat & Dharwad (Zone II), & Pantnagar & Udaipur (Zone III) (Table 3.1 to 3.4). Trial consisted 27 entries.

Rust: The disease was recorded at Akola, Dharwad, and Udaipur.
Zone II: At Akola highest rating (1.73) was observed in SPH 1630 and rest of all the entries had lower than rating 1.73. At Dharwad all the entries showed resistant reaction (<3). Entry SPH 1633 had rating of 1.33. Highest rating (2.33) was recorded in entries SPH 1644 & SPH 1634.

Zone II: At Udaipur all the entries showed resistant reaction (<3). Only local check showed 6. 67 rating.

National: Pooled data from all locations revealed that all the entries were resistant (<3). Highest rating could be recorded in entries SPH 1630 & SPH 1638 (1.53-1.47).

Zonate leaf spot: The disease was recorded at Akola, Dharwad, & Udaipur.

Zone II: At Akola the disease was recorded on entries SPH 1637, SPH 1638 & CSH 16 & rating was 1.17 only. Rest of the entries showed less than 1.17 rating. At Dharwad least (rating 2.67) of zonate leaf spot was recorded in entries SPH 1635, SPH 1636, & SPH 1630. At par resistance was also recorded in entries SPH 1633, SPH 1634, SPH 1642, SPH 1640 etc & highest ratings were observed in SPH 1641, SPH 1639, SPH 1643, SPH 1638 (4- 4.67).

Zone III: At Udaipur all the entries had shown moderate resistant reaction (rating 4-5). Lowest rating (3.83) was in SPH 1636 and statistically at par resistance was seen in SPH 1629, SPH 1632, SPH 1633, SPH 1637, CSH16, CSH23 & others. Local check had 7.17 rating.

National: Computing resistance against zonate leaf spot over three locations indicated that all the entries had lower rating than 3 except SPH 1641, SPH 1639, SPH 1638 had 3.17 to 4.22 rating. Statistically all the entries were at par indicating resistance.

Target leaf spot: The disease was recorded at Akola, Dharwad & Udaipur.

Zone II: All the entries showed resistance (<3) against TLS in zone II, entries SPH 1639, SPH 1635, & CSH 23 had highest rating of 2.08- 2.13. Location, Akola & Dharwad, specific data also revealed that entries were resistant however at Akola, entries SPH 1643, SPH 1646, SPH 1645, CSH 23, SPH 1631, SPH 1639, & SPH 1635 had highest rating of 1.17- 1.93 whereas at Dharwad entries SPH 1633, SPH 1630, SPH1640, CSH 23, SPH 1629 had highest rating of 2.67-3.

Zone III: at Udaipur all the entries showed resistance (<3). Only local check had rating of 6.33.

National: On national basis all the entries showed resistance (<3), yet entries SPH 1635, SPH 1639 had moderate rating of 1.72 to 1.76.

Anthracnose: The disease was recorded at Akola and Udaipur

Zone II: At Akola SPH 1632, IS 14332 & Bulk Y had highest anthracnose in the range of 1.17 to 1.70

Zone III: At Udaipur entries - local check, IS 14332, IS14338 & Bulk Y recorded highest disease in the range of 2.5 to 3.75.

National : All the entries showed resistance (rating<3) except Bulk y (3.75) and Local check 3.02.

Leaf blight: Leaf blight was recorded at Akola, Coimbatore & Udaipur.

Zone I: All entries were resistant at Coimbatore. Entries SPH 1646, SPH1645 & CH23 recorded LB in the range of 1.57 to 1.83.

Zone II: At Akola resistant entries having highest (1.27- 1.6) rating were SPH 1635, 1636,1633, CSH 16, 1629, 1630, 1638,1567, 1642, 1643,1644.

Zone III: At Udaipur entries showing resistance (<3) were SPH 1646,1637,1636,1635, 1632, 1631 etc. Highest rating (3.17 to 5) was observed in 1640, 1634, 1643.

National : None of 27 entries showed rating over resistance (<3).

Sooty stripe & gray leaf spot: Sooty stripe was recorded in Zone II at Akola & Dharwad. At Akola all the entries showed resistance against Sooty stripe. Highest rating (3) was observed in SPH 1628. At Dharwad all have shown resistance. Highest rating 1.33 was observed in SPH 1637 & SPH 1629. Pooled evaluation, at Akola & Dharwar revealed that all the entries were resistant (= 3) to sooty mold. Highest rating (1.6 to 2) was recorded in entries SPH 1628, SPH 1637, SPh1638, SPH1639, and Local check. gray leaf spot was recorded at Akola. All the entries were resistant (=3). Highest rating (1.27-2.87) was recorded in entries SPH 1628, SPH 1632, SPh1636 and SPH1638.

Rough leaf spot: These leaf spots were recorded at Akola only. All the entries were resistant (<3). Highest disease (rating 1.17- 1.83) was recorded in the entries SPH 1638, SPH 1630, CSH 23, SPH 1633, SPH 1631, SPH 1629, SPH 1645, CSH 16 and SPH 1634.

Dual purpose sorghum: Dual purpose sorghum materials in two trials (13 in AVT - DP, and 20 in IVT-DP) were evaluated for foliar disease resistance under natural conditions. Foliar diseases were scored on 1 -9 rating scale. Material scoring less than 3 rating were considered as resistance as there is no standard check to compare resistance. The trials were carried at Palem & Coimbatore (Zone I), Akola, Parbhani, Surat & Dharwad (Zone II), & Pantnagar & Udaipur (Zone III) (Table 4.1 to 4.4)

Table with summary results

	Rust		Anthracnose		ZLS		TLS		LB		Comments
Trial no	1 AVT (DP)	2 IVT (DP)	1 AVT (DP)	2 IVT (DP)	1 AVT (DP)	2 IVT (DP)	1 AVT (DP)	2 IVT (DP)	1 AVT (DP)	2 IVT (DP)	
Local check	4.39	4.17	6.67	6.67	5.92	5.75	2.78	3.06	3.47	3.63	Excessive Resistant entries
Other check: CSH 23	1.33	1.33	1	1	3.25	3.17	1.22	1.11	1.89	1.73	Need rigoruos screening to avoid escape
Other check: CSV 15	1.53	1.44	1	1	3.25	3	1.11	1.22	1.94	1.59	
Mean	1.73	1.64	1.63	1.35	3.74		1.57	1.48	2.01	1.94	
Minimum	1.27	1.22	1	1	3.25	2.67	1	1.11	1.33	1.23	
Maximum	4.39	4.17	6.6 (LC)	6.6 (LC)	5.92	5.75	2.87	3.06	3.4 (LC)	3.6 (LC)	
CD (0.05)	2.27	1.6	0.2	0.13	2.12	2.32	2.26	1.76	1.93	1.5	
CV (%)	67.1	55.5	5.9	5.33	20.4	30.4	73.44	67.64	48.33	42.2	
Most resistance lines < 3 rating	11	19	8	15	none	SPV 1861,CSV 15,B 58586, Bulk y	12	19	11	18	
resistance lines (= trial mean)					none	15					
Most susceptible lines	4.39 (LC)	4.17 (LC)	6.67 (LC)	6.67 (LC)	5.92 (LC)	5.75 (LC)	IS 14332	3.06 (LC)	3.47 (LC)	3.63 (LC)	
Data from locations	3	3	1	1	2	3			3	3	
Loc'tions cons'ered for national average	3	3	not conside red	not conside red	2	3	3	3	3	3	
Com'ent 1										Very less disease presure	

4.4 Advanced varietal trial for dual purpose (AVT- DP)

Rust was recorded at Akola, Dharwad, and Udaipur.

Zone II: All the entries at Akola and Dharwad shown resistance to rust. Local check at Dharwad showed susceptible rating 5.67.

Zone III: All the test material had shown resistance to rust at Udaipur though local check recorded susceptible reaction i.e 6.5

National: Local checks on national level recorded an average of 4.4 rating. However all the tes t material was resistant (<3).

Zonate leaf spot: The disease was recorded at Dharwad, & Udaipur.

Zone II: At Dharwad entry SPV 1823 recorded lowest ZLS (2) & at par entries were CSV15, CSV23, SPV 1782, SPV 1779, SPV 1820 & SPV 1822.

Zone III: At Udaipur all the entries showed moderate resistance (<5). Highest ZLS at these location ranged between 4- 7.8.

National: Pooled data over all the locations indicated that all the entries behaved equally well. Entries SPV 1823, CSV 15, SPV 1782, SPV 1779, & CSV 23 had lowest rating between 3.2- 3.5. Local check had highest rating of 5.92.

Leaf blight: Leaf blight was recorded at Akola, Coimbatore & Udaipur

Zone II: At Akola all the entries showed resistant reaction including resistant check.

Zone I: At Coimbatore all the entries were resistant to the disease. No local check was used to know the disease pressure.

Zone III: At Udaipur entries SPV 1782, CSV 23, SPV 1779, SPV 1820 & CSV 15 had lowest rating between 2.6 to 3 but all the test material was statistically at par.

National level: All the test entries were resistant and the local check behaved as moderate resistant and showed highest rating 3.47..

Target leaf spot & anthracnose- Among these diseases, target leaf spot was recorded at Akola, Dharwad & Udaipur. The disease rating at these centres ranged to 2 - 5.3 Local checks & all the test entries showed resistance. CSV 15, CSV 23, SPV 1823 & SPV 1779 had lowest rating between 1.1 -1.3. Anthracnose was recorded at Udaipur; local check recorded highest disease (rating 6.67) but no other entry showed disease more than rating 1.

Sooty stripe & gray leaf spot: Sooty stripe was recorded in Zone II at Akola & Dharwad. None of the entry showed susceptible reaction and the maximum disease scaled was ~ 3 in local checks at Akola. SPV 1822, SPV1782, SPV 1779, SPV 1781, SPV 1820, & CSV 15 were affected by the disease giving rating between 1.2 - 1.80 only. Gray spot (rating 1.3 to 1.7) at Akola was noticed on entries SPV 1822, SPV 1781 & CSV 23 only.

Rough leaf spot - At Akola rough leaf was recorded on few entries e.g. SPV 1882, SPV 1883, CSV 15 & CSV 23 (rating <3).

4.5 Initial Varietal Trial for dual purpose (IVT – DP)

Rust was recorded at Akola, Dharwad, and Udaipur.

Zone I: All the entries at Akola were resistant to rust (Table 4.1 to4.5)

Zone II: All the entries at Dharwad were resistant to rust though local check scored rating 5.

Udaipur: All the entries at Udaipur were resistant to rust though local check scored 6.5 rating.

National: The lowest rust was recorded in SPV 1861, SPV 1873, SPV 1870, SPV 1866 & CSV 23 (rating 1.2 to 1.3). The disease score was 4.17 in local check & Bulk Y showed 3.67 disease score.

Zonate leaf spot: The disease was recorded at Dharwad, & Udaipur.

Zone II: At Dharwad entry SPV 1861, CSV 15, SPV 1868, SPV 1864 & CSV23 recorded lowest ZLS (<3).

Zone III: At Udaipur all the entries showed moderate resistance (<5). Highest ZLS at these location ranged between rating range of 3.7- 7.8.

National: Pooled data indicated that the entries SPV 1861 & CSV 15 were resistant (<3).

Target leaf spot & anthracnose: The disease target leaf spot was recorded at Akola, Dharwad & Udaipur. The disease rating at these centres ranged 2.3 to 6.53 & all the test entries showed resistance. CSV 23, SPV 1861, SPV 1872, & SPV 1867 had lowest rating (<3). Anthracnose was recorded at Udaipur, local check recorded highest disease (rating 6.67) but no other entry had shown disease more than rating 1.

Leaf blight: Leaf blight was recorded at Akola, Coimbatore & Udaipur (highest rating rabged from 1.9 - 5.3). All the entries showed resistant reaction against LB at Coimbatore, Akola & Udaipur. Entries CSV15, SPV 1862, CSV23 & SPV 1866 had lowest rating ranged from 1.2 to 1.8.

Sooty stripe & gray leaf spot: Sooty stripe was recorded in Zone II at Akola & Dharwad. None of the entry showed susceptible reaction and the maximum disease scaled was 2.3 in SPV 1868 at Akola. Gray spot (rating 1.3) at Akola was noticed on entries SPV 1872, & CSV 15.

Rough leaf spot: At Akola rough leaf was recorded on few entries e.g. SPV 1861, SPV 1862, SPV 1871 & SPV 1873 (rating <2).

Forage sorghum: The trial consisted 16 entries including CSV 21 F. The trial entries were assessed for resistance 1-9 rating score under natural conditions. Material scoring less than 3 rating were considered as resistance. The trials were carried at Palem & Coimbatore (Zone I), Akola, Surat & Dharwad (Zone II), & Pantnagar & Udaipur (Zone III) (Table 6.1 to 6.4)

Table with summary results

	Trial no	1					
		AVT (SC)					
		Rust	ZLS	TLS	Anth	LB	Comment
1	Local check	4.17	no	3.22	5.17	5.33	
2	Other. check: CSV21F	2.71	2.33	2.11	1.08	2.43	
3	Mean	2.36	2.33	1.82	1.19	25	
4	Minimum	1	1	1	1	1.27	
5	Maximum	4.17 (LC)	3.93	3.22 (LC)	5.17 (LC)	5.33(LC)	
6	CD (0.05)	2.58	1.43	2.78	1.93	1.94	
7	CV (%)	67.2	35.6	81.62	68.9	2.63	
8	Most res.< 3	12	12	14	14	14	
9	Next res lines (= trial mean)						
10	Most susceptible lines	SPV 1849, SPV 1853, LC (3.13-4.17)	SPV 1852, SPV 1848, HC 308 (3.40-3.93)	3.22 (LC)	5.17 (LC)	5.33(LC)	
11	Data from locations (no)	4	4	3	2	3	
12	Locations considered for national average (no)	4		3		3	
13	Comment 1		not considered, defective rating Hisar		not considered because zone variation		

4.6 Advanced Varietal Trial for forage single cut (AVT- SC)

Rust was recorded at Coimbatore, Akola, Dharwad, and Udaipur.

Zone I: At Coimbatore SPV 1849, HC 308 & & SPV 1853 showed moderate resistance (<5) and rest entries behaved as well as SPV 1846 showing 1.3 rating.

Zone II: At Akola all the entries showed resistance rating (<3) & highest rating 2.3 was observed in SPV 1851. At Dharwad SPV 1853 was heavily (rating 6) infested followed by SPV 1849 & local check (rating 5-5.3). Other entries SPV 1851, SPV 1847, SPV 1845, SPV 1850 & SPV 1848 showed resistance <3.

Zone III: All the entries at Udaipur expressed resistance though local check was infested with rating of 6.5
National: All the data for four location averaged together revealed, SPV 1846, SPV 1847, SPV 1845 were the lowest in rating (1.6 -1.79) followed by other all entries that were also resistant as equalled to SPV 1846.

Zonate leaf spot: Zonate leaf spot was recorded at Akola, Dharwad, & Udaipur.

Zone II: At Akola all entries were resistant to ZLS. At Dharwad entry SPV 1851 showed least ZLS (2) & other at par entries were SPV 1847, SPV 1850, SPV 1845 & SPV 1846 (rating 2.3 to 3).

Zone III: At Udaipur all the entries showed moderate resistance (<5). Highest ZLS at these location ranged between rating range of 7.8 - 1.7.

National: Pooled data indicated that the entries SPV 1847, SPV 1852, HC 308, SPV 1850 & SPV 1851 are at par in respect of resistance(<3).

Target leaf spot & anthracnose: The disease target leaf spot was recorded at Akola, Dharwad & Udaipur. The disease rating at these centres ranged 1.7 to 7. Entry SPV 1849 at Akola & Local check at Udaipur contracted TLS giving rating of ~1.7 to 7 & all the other entries had lower rating of 1. At Dharwad HC 308, CSV21F, SPV 1853 showed moderate resistance & rest were resistant. Averaged data for these centres indicated that SPV 1847 had lowest (rating 1.2) TLS & all the other entries were statistically par indicating resistance in all the entries against TLS.

Anthracnose: Anthracnose was recorded at Akola & Udaipur. Highest disease rating was at Udaipur in local check & it was 1.2 at Akola in SPV 1853. Testing of entries at both the locations revealed that all the entries are resistant to anthracnose & highest rating (~1.1) could only be obtained in entries CSV21F, SPV 1849 & SPV 1853.

Leaf blight - Leaf blight was recorded at Akola, Coimbatore & Udaipur

Zone I: At Coimbatore SPV 1853 showed moderate resistance (<4) & rest were at par with SPV 1847 having rating of ~ 2.2 only

Zone II: At Akola all the entries were found resistance (rating<3 except SPV 1853 that was moderate resistant.

Zone III: At Udaipur local check contracted highest disease (5.33). However all the other entries showed resistance.

National: Pooled data over all location indicated that SPV 1850 had lowest LB (rating 2.1) and other entries were at par except local checks

Sooty stripe & Gray leaf spot: Sooty stripe was recorded in Zone II at Akola & Dharwad. None of the entry showed susceptible reaction at Dharwad. Highest rating was recorded in SPV 1853 (1.1). At Akola moderate resistance (rating <5) was noted in SPV 1852, SPV 1845, SPV 1848 & HC 308 & rest were resistant. Gray spot (rating 1.3) at Akola was noticed on entries SPV 1845, SPV 1846 & SPV 1853.

Rough leaf spot: At Akola rough leaf was recorded on few entries e.g. SPV 1853, SPV 1852, SPV 1849 SPV 1851 & CSV21F (rating <3).

Pest & disease nursery for resistance against diseases: The trial was carried at Dharwad (Zone II) and Udaipur (Zone III) (Table 7.1 to 7.2) consisting of 17 entries. The trial entries were assessed for resistance 1-9 rating score under natural conditions. Material scoring less than 3 rating were considered as resistance.

Table with summary results

Trial no Name	PDRN				
	Rust	ZLS	TLS	Anthr	LB
Local check	4.88	6	3	7.25	5.25
Mean	2.58	3.47	1.81	3.15	3.28
Minimum	1.67	3	1.17	1	2.33
Maximum	6(QL3)	6	2.5	7.25	5.25(LC)
CD (0.05)	2.01	3.47	1.5	3.26	1.54
CV (%)	35.48	32.5	37.81	57.52	25.98
Most resistance lines < 3 rating	13	QL3 (3)	17	8	10
Next resistance lines (= trial mean)		8			5.25(LC)
Most susceptible lines	QL3,H112,LC,IS2312 (3.33-6)	9 (5-6)	0	IS 2312 (5), LC(7.25)	1
Data from locations (no)	2	2	2	1	
Loc. considered for national average (no)	2	2	2	not considered	not considered

4.7 Pest & disease resistant nursery

Rust was recorded at Dharwad as well as at Udaipur.

Zone II: At Dharwad only QL3, local check & IS 2312 rated (~6) high disease & rest of all the entries showed at par resistance with GMRP 96 having a rating 2.

Zone III: All the entries at Udaipur were resistant except local check having moderate rust rating (3.7).

Zonate leaf spot: The diseases was recorded at Dharwad, &Udaipur

Zone II: At Dharwad all the entries were rated (3- 4.3) resistant at par with QL3 having resistance rating 3.

Zone III: At Udaipur local check recorded very high ZLS (8). All other entries were moderate in resistance (4-5; B 58586 (R-GM), GMRP 90, GMRP 112 & PBY (S-GM)) but highly susceptible were GMRP 12 & SUENT 9 (>7).

National: Averaged data for both the centres indicated moderate resistance in entries tested.

Target leaf spot: Target leaf spot was recorded at Dharwad & Udaipur.

Zone II: All the entries could classified as resistant as rating in all test material was 3.

Zone III: At Udaipur except local check no other entry showed rating greater than 1.

National: The highest disease rating at these centres ranged 3 to 4. All the entries could be classified as resistant to the disease. Lowest disease rating could be recorded in GMRP 90, B 58586 (R-GM), & GMRP 108 (1.1- 1.5).

Leaf blight: Leaf blight was recorded at Udaipur.

Zone III: The disease rating at the centre ranged 2.3 to 5.2. Resistant entries were B 58586 (R-GM), BY (S-GM), NRCSFR06-1, DJ 6514, IS 2312 & all the rest of entries were moderate in resistance

Sooty stripe & anthracnose: Sooty stripe was recorded at Dharwad . None of the entry showed susceptible reaction. Anthracnose was very high (rating > 7) in local check at Dharwad. Under this disease pressure resistance reaction was recorded in entries B 58586 (R-GM), GMRP 90, GMRP 112 & at par were SUENT 8 & BY (S-GM) (rating (1 - 2.3).

Germ plasm: Trial was carried at Dharwad comprising of 29 entries

Table with summary result

Trial no	1			
Name	**SSB line**			
Foliar Disease	Rust	ZLS	TLS	Comment
Local check	5	4	2.33	Test entry NSSB 26 was more affected by ZLS
Mean	2.77	3.48	2.4	
Minimum	2	2.33	1.33	
Maximum	6 (DMS 652)	NSSB 26 (4.33)	NSSB 5 (4.33)	
CD (0.05)	1.09	0.96	1.49	
CV (%)	24	16.8	37.9	
Most resi. lines < 3 rating	23	7	26	
Next resistance lines (= trial mean)				
Most susceptible lines	6	NSSB 26 (4.33)	NSSB 5 (4.33)	
Data from locations (no)	1	1	1	
Locations considered for national average (no)	no	no	no	
Comment 1		NSSB 26 rated more than LC		

4.8 Sweet sorghum (B-Lines) against sorghum diseases

Following diseases were observed in Zone II (Dharwad) (Table 9.1).

Rust: Best (<3) resistant entries against rust were NSSB 1008, NSSB 1005, NSSB 1003, NSSB 1002 & NSSB 19. All the other entries were at par except DMS 652 H 112 (LC), QL 3(LC), NSS1 NSSB 26, NSSB 1006 & NSSB 7 that had rating above 3.

Zonate leaf spot: Lowest ZLS was observed in NSSB 4 (rating 2.3) & at par resistant entries were NSSB 4, NSSB 17, NSSB 15, NSSB 11, NSSB 5, NSSB 14 , NSSB 1005 & QL 3. Moderate resistant with highest rating (~4-5) was observed in NSSB 26, NSSB 1, NSSB 6, NSSB 7 & NSSB 1002

Target leaf spot: Resistant (<3) entries were NSSB 1005, NSSB 15, NSSB 4, NSSB 2, DMS 652 and highest rating with moderate resistance was NSSB 5 (4.3). Rest of the entries showed resistant reaction (<3) or were at par with NSSB 1005.

Sweet sorghum: The trial was carried at Coimbatore (Zone I) and Udaipur (Zone III) (Table 8.1)consisting of 19 entries. The trial entries were assessed for resistance against foliar diseases on 1-9 rating scale under natural conditions. Material scoring less than 3 rating were considered as resistance

Summary table with results

Trial no			**1**			
Name				AVHT SS		
Foliar Disease	Rust	ZLS	TLS	Anthra	LBS	Comment
Local check	6.5	7.67	6.5	6.67	5.67	LC not used at Coim
Mean	2.09	5.86	1.29	3.03	3.74	
Minimum	1.18	4	1	1	2.57	
Maximum	6.5 (LC)	7.67	6.5	6.67	5.67(LC)	
CD (0.05)	3.7	0.72	0	not given	2.53	
CV (%)	82.67	7.38	0.1	not given	31.69	
Most resistance lines < 3 rating	17	none	18	18	SPSSH 30 (2.57)	
Next resistance lines (= trial mean)	0	8	0	0	7	
Most susceptible lines	6.5 (LC)	7.67(LC)	6.5 (LC)	6.67 (LC)	5.67(LC)	
Data from locations (no)	2	1	1	1	2	
Locations considered for national average (no)	2				2	
Comment1						

4.9 Advanced Varietal & Hybrid Trial Sweet sorghum (AVHT – SS)

Rust: The disease was recorded at Coimbatore as well as at Udaipur

Zone I: Highest disease score was 5.2 at Coimbatore. . But entries differed in response. Entries SPSSV 27, SPSSV 37, SPSSV 34 & SPSSH 27 showed moderate resistance.

Zone III: The highest disease intensity was rated in 6.5 at Udaipur. At Udaipur all the test entries showed resistance Lowest rating (<2) & resistance could be observed in SPSSH 24.

National: All the entries were resistant except SPSSV 27 and SPSSV 37 that had csore of 3.08 and 3.03 respectively.

Leaf blight: Leaf blight was recorded at Coimbatore and Udaipur.

Zone I: At Coimbatoreentries resistant were SPSSH 24, SPSSH 28, SPSSH 29, SSV 84 & SPSSH 30. Highest score was observed in SPSSV 37 (3.53)

Zone III: At Udaipur SPSSH 30 was resistant. Moderate resistant could be seen in SPSSV 34, SPSSV27, SPSSV 37 &SPSSV 36. Highest score was observed in local check (5.67).

National: Averaged data indicated lowest disease in SPSSH 30 followed by at par entries were SPSSH 24, SPSSH 28, SPSSH 29 etc

Zonate leaf spot, Target & Anthracnose- These diseases were recorded only at Udaipur.

Zone II: At Udaipur no resistant entry was found against zonate leaf spot but only moderate resistance could be observed in SPSSH 30. Rest of the entries were susceptible. Target leaf spot highly infected local check giving susceptible rating >6 but none of the other test entry showed susceptibility & disease rating remained below 2. Local check Kekri was highly susceptible (6.7) to Anthracnose & rest entries were resistant. Some of the entries having resistance rating below 3 were SPSSH 30, SPSSV 33, SPSSH 24, and SPSSV 36 & SPSSH 31.

Leaf blight nursery

4.10 Sorghum leaf blight virulence nursery

The nursery with 22 entries was laid at Coimbatore. The leaf blight affected all the entries & highest LB rating was recorded in entry IS 10284 (~5) & lowest in IS 26863 (~1.5). Resistant entries were IS 15745, IS 10775, IS 26866, IS 12466, IS 25069, IS 18668,IS 13904, IS 9303, & IS 13057 (Table 10).

5. Screening of forage sorghum against foliar diseases at Pantnagar

Four trials, two on single cut (Initial Varietal Trial-SC and Advanced Varietal Trial-SC) & two on multicult (Initial Varietal/Hybrid-MC and Advanced Multicut Varietal/Hybrid) were screened against Anthracnose and Zonate leaf spot diseases at Pantnagar. Observations on severity of diseases were recorded on 1 to 9 severity scale at 50% flowering for single cut and at the time of 1st and 2nd cutting for multicut entries. In Single cut trials the entries SPV 1616 and UTFS 45 were found resistant against Anthracnose and Zonate leaf spot diseases in AVT- SC). The entries GFS 5 and NFS 2 were found resistant against Anthracnose and Zonate leaf spot diseases in IVT-SC. In Multi cut Initial Varietal screening trial the entries UTMCH 1304, CSH 20 MF and HH 293 were found resistant against Anthracnose and Zonate leaf spot diseases whereas in advanced trial the entries UTM CH 1302, UTMC 532, GK-938, UTMC 533, CSH 20 MF and HH 273 showed resistant reaction against Anthracnose and Zonate leaf spot diseases.

6. Epidemiological studies

Survival of anthracnose pathogen *C. graminicola* on seed was studied in laboratory using standard blotter method at periodical intervals. Pathogen was found to be associated with seed even after 12 months however percentage of infected seed reduced from 90 to 10 on unsterilized seeds.

Annexure I: Performance of the centres

	Centres	AVHT	IVT	IHT	AVT-DP	IVT-DP	AVHTSS	AVTSC	SPV	PDRN	GMN	SLBV	Blines SS	Valid data
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Palem	y	y	y	y	y		Y	y					7
2	Coimb	y	y	y	y	y	y	y				Y		8
3	Pantn	y	Z	Z	Z	Z		Z						1
4	Akola	y	y	y	y	y		Y	y					7
5	Parbh	XX	XX	XX	Y						XX			1
6	Surat	x	x	X	X	X		X						0
7	Dhar	y	y	y	y	y	y	Y	y	y			y	10
8	Udai	y	y	y	y	y	y	Y	y	y		Z		9
												Total		43

Z - Trial planted but No data communicated,

XX= Defective data i.e. codes not given, all entries serially numbered, difficult to identify identical entries. Not considered for report, X = Not used 1 to 9 rating scale, marked - resistant, mod R, Susc,.

Data recd dates - Palem, Surat & Dharwad- 2/12/08, Coimbatore- 3/12/08, Pantnagar- 4/12/08, Akola- 12/12/08, Parbhani- 6/12/08, Udaipur- 1/12/08

Annexure II: Details of collaborator

Centre	**Collaborator, Address**
Akola	Prof.HSGahukar, Sorghum Pathologist,Research Unit, Dr. Panjabrao krishi Vidyapeeth Akola Maharastra -444104
Coimbatore	Dr. R. Velazazhan, Dept of Pl Path., Tamil Nadu Agricultra University,Coimbatore-641003
Dharwad	Dr.YD Narayana, Sorghum Pathologist, Main Sorghum Research Station, U A S Dharwad-580005
Palem	Dr. Ameer Basha, Asst. Research Officer (Plant Pathology) ANGRAU Regional Agricultural Research Station, Palem-509125, Mahaboobnagar Distrit, AP
Pantnagar	Dr. Yogendra Singh, Senior Research Officer, CAS in Plant Pathology, College of Agricultural GB Pant University of Agriculture&Technology, PANTNAGAR-263145.(Uttaranchal)
Parbhani	Dr. RB Solenkhe, Sorghum Pathologist, Marathawada Agriculture University, Parbhani-413722, Maharastra.
Surat	Dr BD Jadhav, Sorghum Pathologist, Main Sorghum Research Station, SURUT-397007, Gujarat
Udaipur	Dr. Kusum Mathur, Sorghum pathologist, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture &Technology, Udaipur-313001
Solapur	Dr Ashok v Gadewar, Centre for Rabi Sorghum, NH 9, Selgi, Solapur, Maharashtra-413006

Appendix I: Diseases along with casual organism under study

Grade	Disease	Causal organism
1	Grain molds	*Fusarium moniliforme,* J. Sheld; *Curvularia lunata, Phoma sorghina &* other
2	Downy mildew	*Peronosclerospora sorghi* (W. Weston & Uppal) C. G. Shaw
3	Ergot/Sugar diseases	*Sphacelia sorghi* Mc Rae
4	Charcoal rot	*Macrophomina phaseolina* Tassi. Goindanich
5	Rust	*Puccinia sorghi* Cooke
6	Anthracnose	*Colletotrichum graminicola* (Ces G.W. Wils)
7	Leaf blight	*Exserohilum turcicum*
8	Zonate leaf spot	*Gloeocercospora sorghi* Bain & Edgertom ex Deighton
9	Rough leaf spot	*Aschochyta sorghi* Sacc
10	Gray leaf spot	*Cercosspora sorghi Ellis & Everh*
11	Sooty stripe	*Ramulispora sorghi (Ellis & Everh)* Olive & Lefebvre in Olive et.al.
12	Target leaf spot	*Bipolaris sorghi (Sacc)* Shoemaker.

Grades & estimation of diseases: *Gran mold: Field grade/ panicle grain mold (FG/PGMR), threshed grade / threshed grain mold (TG/TGMR)*

Severity grade	Description (% grains molded on panicle)	Reaction class
1	0 to <1	Highly Resistant
2	1-5	Resistant
3	6-10	Resistant
4	11-20	Moderately resistant
5	21-30	Moderately resistant
6	31-40	Susceptible
7	41-50	Susceptible
8	51-75	Highly Susceptible
9	>75	Highly Susceptible

Foliar Diseases (rust, sooty stripe, zonate leaf spot, leaf blight, rough leaf spot, target leaf spot, anthracnose

Grade	Description	Reaction
1	No symptoms seen on the leaf and perfectly healthy	Highly Resistant
2	1-5% of the leaf area is affected by spot	Resistant
3	6-10% of the leaf area is affected by spot	Resistant
4	11-20% of the leaf area is affected by spot	Moderately resistant
5	21-30% of the leaf area is affected by spot	Moderately resistant
6	31-40% of the leaf area is affected by spot	Susceptible
7	41-50% of the leaf area is affected by spot	Susceptible
8	51-75% of the leaf area is affected by spot	Highly Susceptible
9	>75% of the leaf area is affected by spot	Highly Susceptible

Downy mildew/Ergot= calculate in per cent term.

Charcoal rot

1. Charcoal rot (%) i.e., Number of plants infected/ total number of plants in a row.
2. Lodging due to charcoal rot (%)
3. Mean number of nodes crossed by the pathogen (number)
4. Mean length of spread of lesion (cm)

Transformations: All percentage is in arcsine transformations

Threshed grade (T G): Thread grade is recorded on 1-9 scales as follows. That panicles will be threshed & a sample is taken in a Petri plate & the amount of surface area covered by the fungus is rated on 1-5 scale where 1= seeds are white & no infection seen; 5 is > about 50% of the grain covered with mold fungi.