

# Sorghum pathology: Kharif, 2011

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## EXECUTIVE SUMMARY

**Introduction:** Total 87 trials (grain cum, dual purpose, forage and sweet sorghum, were evaluated against ear head & foliar diseases in endemic areas (Palem, Coimbatore, Dharwad, Akola, Parbhani, Surat, Udaipur and Pantnagar) spread over three sorghum growing zones.

**General trend:** Grain mold incidence at Coimbatore was very high as compared to other places. On the contrary at Dharwad, Parbhani Coimbatore and Akola the grain mold appearance & incidence was optimum. At Surat ergot was recorded in all the trials but not in severe form but downy mildew was rampant at Dharwad. The severity of foliar diseases in test entries at Udaipur was not optimum though the checks contracted severe infection. At all the trial centres disease load was optimum as indicated by appearance of disease severity in susceptible checks as well as local checks. Target leaf spot was recorded at Dharwad, Coimbatore and Udaipur only and sooty mold at Akola.

**Grain and dual purpose sorghum:** Resistance against grain mold was lacking in all the trials but moderate resistance could be observed after pooling data of national trials. In advanced hybrid trial (AHT- GS & DP) moderate resistance to grain mold was observed in SPH 1641(2), SPH 1653, SPH 1668, SPH 1635(2), SPH 1685, and SPH 1680 (3.5-4). Under AVT- GS & DP advanced varietal (AVT- GS & DP) trial moderate resistance was recorded in SPV 2061, SPV 2000, CSV 15, SPV 1999 (2), and SPV 462 (3.5- 3.8). In Initial hybrid trial (IHT- GS & DP) the test entries SPH 1701, SPH 1709, LC, SPH 1708, and SPH 1707 (3.6-3.9) expressed moderate resistance whereas in initial varietal (IVT GS & DP) trial SPV 2117, SPV 2125, SPV 2122, CSV 17, and CSV 23 (3.6-3.9) showed moderate resistance. Menace of downy mildew was rampant at Dharwar, extent of ~41 per cent damages were recorded though etries like SH1655, SPH 1668, SPH 1675, SPH1679, SPH 1680, SPH 1684 and, SPH 1685 (AHT GS & DP) and SPV 2079 and SPV2061 (AVT- GS & DP) were free. Ergot was recorded at Surat but overall incidence was less than 10 per cent. Major foliar diseases were anthracnose, leaf blight and Zonate leaf spot with a severity index between 1.0 – 6. However, resistance to moderate resistance is available to these diseases as listed below in respective trials. Rust was confined to Parbhani, Dharwad and to certain extent to Udaipur. Target leaf spot was mainly recorded from Coimbatore, Dharwad and Udaipur and resistance was available to these diseases.

**Forage sorghum:** Two trials (AVHT MC & IAVT- SC) on forage sorghum were conducted at various places. Grain mold resistance was available in multi cut in entries SPV 2107, SPH 1699, SSG 59-3, and CSH 20 MF etc whereas moderate resistance was found in SPV 2058 only in single cut. Zonate leaf spot was recorded mainly at Dharwad, Udaipur & Pantnagar and resistance was recorded in SPV 2107, SPH 1698, SPH 1695, SPV 2108, SPH 1699, SPH 1700 and etc in multi cut whereas it was in SPV 2058, SPV 2129, SPV 2127, SPV 2026, SPV 2131 in single cut. None of the entry was resistant to leaf blight in multi cut and only moderate resistance could be found in SPH 1695 and resistance could be found in SPV 2058 in single cut. In multi cut resistance to anthracnose could be observed in SPH 1699, CSH 20MF, CSH 24 MF and SPH 1696 and in single cut they were SPV 2129, SPV 2158.

**Sweet sorghum:** Trials on sweet sorghum (IAVHT SS) were laid at five locations (Parbhani, Dharwad, Surat, Udaipur and Pantnagar). Resistance grain mold could not be recorded and moderate resistance was observed in SPH 1669 and SPH 1712 only. Resistance to downy mildew could be found in SPH 1669, SPH 2074, SPH 1670, SPV 2135 and CSH 22SS at disease hot spot i.e. Dharwad. None of the entries were resistant against anthracnose and leaf blight but moderate resistance was recorded in SPSSV 40, SPV 2136, SPV 2074, SPV 2075, SPH 1712 and SPV2074, SPSSV40, SPV 2075, SPH 1669, SPH1712 for respective diseases. Resistance to zonate leaf spot was recorded in SPV 2070, SPSSV40, SPV2135, SPH1669, and SPH1711. Rust was not a major problem at various locations.

Variability in anthracnose pathogen- Extreme variability in anthracnose pathogen *Colletotrichum sorghi* was recorded at Pantnagar using twelve differentials. There was a differential behaviour of isolates to age of the seedlings. Among the five isolate tested only one isolate could not infect differential PC 5 at both the leaf stages (3 and 6 leaf stage). However other all the isolate became more aggressive as the plant advanced.

**Overall conclusion:** It is important to locate resistance against grain mold in region I and II as these are prone zones. Downy mildew at Dharwad is emerging as threat and resistance is important in sorghum in this area. The data in all the trials indicates that multiple resistances in single cultivar is difficult but combination of resistance and moderate resistance can be achieved. .

**Looking ahead:** Concept of multiline varieties may be explored in view of absence of multiple resistances. Variability studies on anthracnose fungus can be up scaled looking results obtained this year.

## DETAILED REPORT

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

#### *Grain and dual purpose sorghum*

The grain sorghum entries in four trials (21 in AHT, 11 in AVT, 13 in IHT and 22 in IVT) were evaluated for grain mold resistance under natural conditions. Panicle grain mold rating (PGMR) was done using 1-9 rating scale in Zone I (Palem & Coimbatore), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat). Thresh Grain mold rating (TGMR) were recorded at Palem (Zone I), and Akola and Parbhani (Zone II)

#### All India summary results

No	Trial no	1	2	3	4
	Name	AHT- GS & DP	AVT- GS & DP	IHT- GS & DP	IVT GS & DP
1	Local check	5.3	4.7	3.8	5.4
2	Other check: CSH 16	4.4	-	-	-
3	Other check: CSH 23	4.9	-	4.5	-
4	Other. check: CSV 20	-	-	-	4.8
5	CSV 15	-	3.7	-	-
6	CSV 17	-	4.7	-	3.9
7	CSV 23	-	-	-	3.9
8	SPV 462	-	3.8	-	-
9	Mean	4.2	4.0	4.1	4.13
10	Minimum	3.5	3.5	3.6	3.6
11	Maximum	5.3	4.7	4.8	5.4
12	CD (0.05)	0.9	NS	NS	0.8
13	CV (%)	18.1	24.7	16.3	16.0
14	Lines with lowest value on 1-9 scale	SPH 1641(2), SPH 1653, SPH 1668, SPH 1635(2), SPH 1685, SPH 1680 (3.5-4)	SPV 2061, SPV 2000, CSV 15, SPV 1999 (2), SPV 462 (3.5- 3.8)	SPH 1701, SPH 1709, LC, SPH 1708, SPH 1707 (3.6-3.9)	SPV 2117, SPV 2125, SPV 2122, CSV 17, CSV 23 (3.6-3.9)
15	Lines with highest value on 1-9 scale	LC, CSH 23, SPH 1655(2), SPH 1682, SPH 1648(2)	LC, CSV 17 (4.7-4.7)	SPH 1703, , SPH 1706, SPH 1702, SPH 1705 SPH 1704(4.1- 4.4)	LC, CSV 20 (4.8-5.4)
16	Lines on par with LC values	CSH 23, SPH 1655(2), SPH 1682, SPH 1648(2)	All entries at par	All entries at par	CSV 20
17	Selected lines (value: ≤ trial mean)	5.3	4.0	4.1	4.13
18	Data from locations (no)	6	6	6	6
19	Locations considered for National average (no)	6	6	6	6
20	Comment 1	Res. check (IS 14332) used only at Parbhani.	Res. checks (IS 14338 & IS 14332) used only at Dharwad and Parbhani.	Res. checks (IS 14332) used only at Dharwad and Parbhani.	Res. checks (IS 14338, B 58586 & IS 14332) used only at Dharwad and Parbhani.
21	Comment 2	All the lines were highly susceptible at Coimbatore showing maximum rating 9			

#### 1.1 Advanced Hybrid Trial for grain and dual purpose sorghum (AHT-GS & DP)

The trial comprised of 21 entries that includes 18 test hybrids, two checks and one local check from respective centre.

**Panicle grain mold (PGMR):** PGMR was recorded at Six centres namely Palem, Coimbatore (Zone I), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat) (Table 1.1). Average data over the six centres indicated that PGMR (panicle grain mold rating) ranged between 3.5 to 5.3 (moderate resistance to susceptible reaction)

**Zone-I:** Trials were laid at two centres at Coimbatore & Palem in Zone I. Highest PGMR (rating 9) was observed at Coimbatore whereas it was 3.7 at Palem. At Palem 17 entries showed resistant reaction and 4 showed moderate resistance. Highly resistant was SH 1685 showing no mold (rating 1). At Coimbatore all the test entries including local check showed high susceptibility. However on zonal basis SPH 1685 was the only entry that could

be called as moderate resistant and the test reactions could not be compared with resistant checks such as B 58586 IS 14332 IS 14338 as these entries were not tested at these locations.

**Zone II:** Trials were carried at Akola, Parbhani and Dharwad in this zone. At Akola entries showed resistant to moderate resistance including local check. Sixteen entries showed resistance and other five moderate resistances. Entries showing least GMR ( $\leq 2$ ) were SPH 1668, SPH 1674, SPH 1675, SPH 1676, and SPH 1685. Highest GMR (4-4.7) was observed in CSH 23 and local check. At Parbhani twelve entries showed resistance reaction and other nine showed moderate resistance. SPH1641, SPH1653, SPH 1684, SPH 1635 and SPH 1647 showed lowest rating between 1.3 to 2.3. CSH 23 showed highest moderate resistance reaction (4.7). Local check also gave resistant reaction (2.7). At Dharwad three entries SPH 1653, SPH 1641 and SPH 1668 showed resistance and SPH 1651, SPH 1685, SPH 1675 and 1684 showed susceptibility. Local check (bulk Y) showed highly susceptible reaction. Considering results from all the three centres in Zone II, SPH 1641, SPH 1653, SPH 1668 and SPH 1647 showed resistance reaction ( $< 3$ ).

**Zone III:** At Surat, there were no significant differences in the entries tested but ten entries showed resistant reaction ( $< 3$ ) and rest showed moderate resistance. Entries showing lowest (2.7) PGMR were SPH 1651, SPH 1682, and SPH 1683., SPH1635 and SPH

**National:** Pooled data over locations analysed indicated that the entries SPH 1641(2), SPH 1653, SPH 1668, SPH 1635(2), SPH 1685 and SPH1680 behaved as moderate resistant (3.5-4.0) entries (Table 1.1).

**Thresh Grain mold rating (TGMR):** Grain mold on harvested grains was recorded at three places Palem (Zone I), and Akola and Parbhani (Zone II) using 1-9 rating scale (Table 1.1 and 1.2).

**Zone I:** At Palem harvested threshed grains of SPH 1684 and SPH 1682 had highest TGMR of 2.3-2.7 (Table 1.1). Lowest (1) TGMR was recorded in SPH 1635, 1641, 1678, 1685, CSH 16 including local check. Infection by grain mold fungi *Curvularia* ranged from of 19.7 (SPH 1668) to 35.9% ((SPH 1648). *Fusarium* infested grain in the range 20.5 (SPH 1647) to 31% (SPH 1679).

**Zone II.** At Akola harvested threshed grains of local check had highest (5) grain mold where as SPH 1635 and SPH 1685 had lowest TGMR rating 2 (Table 1.). Fungi- *Fusarium* & *Curvularia* were associated with grain mold. Infection by grain mold fungi *Curvularia* ranged from of 20.6 (SPH1635) to 31.3% (Local check). *Fusarium* infested grain in the range 14.1 (SPH1655) to 20.8 % (CSH23).

At Parbhani harvested threshed grains of CSH 16, CSH 23 and SPH 1682 had highest ( $> 5$ ) TGMR (Table 1.1). Lowest (1.7- 2.3) TGMR was recorded in SPH 1635, local check and SPH 1641. On zonal basis SPH 1641, SPH 1635, SPH 1653 and SPH 1685 recorded lowest TGMR (2-2.9) Fungi- *Fusarium* & *Curvularia* were associated with grain mold. Infection by grain mold fungi *Curvularia* ranged from of 15.7 (SPH 1641) to 27% (SPH 1682). *Fusarium* infested grain in the range 14.4 (SPH 1641) to 29.5% (SPH1678). In Zone II *Curvularia* infection ranged from ~18 to 27 per cent. Lowest (18.6%) infection was recorded in SPH 1635(2) (Table 1.1). In Zone II *Fusarium* infection ranged from ~16 to 24 per cent. Lowest (16.0%) infection was recorded in SPH 1641(2) and highest (24.2%) in CSH23 (Table 1.2)

**National:** Zone I and II are the prone areas for thresh GM. Data from two zones consisting of three centres indicated that SPH 1641 and SPH 1635 were least (1.7-1.8) affected by GM whereas SPH 1678, SPH 1682 and CSH 23 had highest TGMR (3.1-3.5). Infection of *Curvularia* ranged between ~19 to 28 per cent. Lowest (19.2) infection seen in SPH 1635(2) (Table 1.1). *Fusarium* infection ranged between ~18 to 24 per cent. Lowest (18.7%) infection of *Fusarium* seen in SPH 1685(2) and highest (24.5) in CSH23 (Table 1.2). Grain affected by mold fungi were ~25 to 39 per cent on all india basis. Lowest grain (24.6%) affected were in SPH 1635(2) and highest in SPH 1682 (38.9%) (Table 1.3).

## 1.2. Advanced Varietal Trial (AVT - Grain & DP)

The trial comprised of 11 entries that includes 5 test lines, five checks and one local check from respective centre.

**Panicle grain mold (PGMR):** PGMR was recorded at Six centres namely Palem, Coimbatore (Zone I), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat) (Table 2.1). Average data over the six centres indicated that PGMR (panicle grain mold rating) ranged between 3.5 to 4.7 (moderate resistance reaction)

**Zone-I:** Trials were laid at two centres at Coimbatore & Palem in Zone I. Highest PGMR (highly susceptible rating 9) was observed at Coimbatore whereas it was 2.1(resistance) at Palem. At Palem all the 11 entries including local check showed resistant reaction with no significant differences. Lowest (< 2) grain mold was contracted by CSV 23, CSV 20, CSV 15, SPV 2000 and SPV 2079 that showed resistance. At Coimbatore all the test entries including local check showed high susceptibility. However on zonal basis CSV 15 was the only entry that could be called as moderate resistant (4.7) and the test reactions could not be compared with resistant checks such as B 58586 IS 14332 IS 14338 as these entries were not tested at these locations.

**Zone II:** Trials were carried at Akola, Parbhani and Dharwad in this zone. At Akola entries showed resistant to moderate resistance including local check. Entries showing least GMR ( $\leq 3$ ) were SPV 2000, SPV 1999, SPV 2061, SPV 2083, and CSV 23. Highest PGMR with moderate resistance ( $> 3$ ) were CSV 15 and local check. At Parbhani entries showed resistant to susceptible reactions. Lowest resistant rating ( $< 3$ ) were recorded in SPV 2079, SPV 2061, CSV 20, CSV 23 and CSV 15, Local check also resistant reaction (2.0). Most susceptible was CSV 17(6). At Dharwad local check (bulk Y) showed highly susceptible reaction. Entries SPV 1999, SPV 2061 and SPV 262 showed resistance ( $< 3$ ). Considering results from all the three centres in Zone II, SPV 1999, SPV 2000 and, SPV 2061 showed resistance reaction ( $< 3$ ).

**Zone III:** At Surat, there was no significant differences in the entries tested however entries SPV 2000, SPV 2061 and SPV 2083 showed lowest grain mold with resistant reaction ( $< 3$ ).

**National:** Pooled data over locations analysed indicated that the entries SPV 2061, SPV 2000, CSV 15, SPV 1999 (2), SPV 462 behaved as moderate resistant entries showing lowest grain mold (3.5- 3.8) though there were no significant differences in entries tested (Table 2.1).

**Thresh Grain mold rating (TGMR):** Grain mold on harvested grains was recorded at three places Palem (Zone I), and Akola and Parbhani (Zone II) using 1-9 rating scale (Table 2.1 and 2.2).

**Zone I:** At Palem harvested threshed grains of all the entries showed resistant reactions with no significant differences though highest TGMR (1.3) was observed in SPV 2061 and CSV 15. Fungi- *Fusarium* & *Curvularia* were associated with grain mold. Infection by grain mold fungi *Curvularia* ranged from of 22.4 (CSV23) to 34.9 % (SPV2083) (Table 2.1). *Fusarium* infested grain in the range 20.2(CSV15) to 28.2 % (SPV 19999) (Table 2.2).

**Zone II.** At Akola entries showed significant differences in TGMR though they were resistant to moderate resistant. CSV 15 and SPV 262 showed moderate resistance and rest showed resistant reactions but with significant differences. At Parbhani SPV 2061, CSV 23 and local check were resistant ( $< 3$ ). On zonal basis SPV 2061, CSV 23, SPV 2083 and local check showed resistance ( $< 3$ ). *Fusarium* & *Curvularia* were associated with seed grain mold. *Curvularia* ranged from of 20.5(SPV2000) to 27.7 (CSV15) (Table 2.1). At Akola *Fusarium* infection ranged from ~14 to 20 per cent. Lowest (14.9%) infection was recorded in SPV 2083 (2) and highest in SPV 462 (19.6%) (Table 2.2).

**National:** Zone I and II are the prone areas for thresh GM. Data from two zones consisting of three centres indicated that SPV 2061 and CSV 23 were least affected (2.1-2.2) by grain mold.. On all India basis *Curvularia* infection ranged between ~20 to 28 per cent. Lowest (20.5) infection was seen in SPV 2000(2) and highest (27.7%) in CSV 15 (Table 2.1). *Fusarium* infection ranged between ~18 to 24 per cent. Lowest (18.6) infection was seen in SPV 2061 and highest (23.9%) in SPV 462 (Table 2.2). On national basis Grain affected by mold fungi were ~28 to 37 per cent. Lowest grain (28.1%) affected were in CSV 23 and highest in CSV 17 (37.1%) (Table 2.3)

### 1.3. Initial Hybrid Trial (IHT- GS & DP)

The trial comprised of 13 entries that includes 10 test hybrids, two checks and one local check from respective centres.

**Panicle grain mold (PGMR):** PGMR was recorded at Six centres namely Palem, Coimbatore (Zone I), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat) (Table 3.1). Average data over the six centres indicated that PGMR (panicle grain mold rating) ranged between 3.6 to 4.8 (moderate resistance reaction)

**Zone-I:** Trials were laid at two centres at Coimbatore & Palem in Zone I. Highest PGMR (rating 9) was observed at Coimbatore whereas it was 2.9 at Palem. At Palem 13 entries showed resistant reaction with no significant differences. Best among entries showing high resistance (<2) were SPH 1705, SPH 1706, SPH 1707, SPH 1709 and local check. At Coimbatore all the test entries including local check showed high susceptibility. However on zonal basis all the entries were susceptible to GM. Lowest susceptibility was recorded in SPH 1705, SPH1706, SPH1707, SPH1709 and local checks and the test reactions could not be compared with resistant checks such as B 58586 IS 14332 IS 14338 as these entries were not tested at these locations.

**Zone II:** Trials were carried at Akola, Parbhani and Dharwad in this zone. At Akola entries showed resistant to moderate resistance including local check. Entries showing moderate resistance were SPH 1702, SPH 1704, SPH 1710, and local check and rest of the entries showed resistance though there were significant differences. At Parbhani entries showed significant differences in reaction ranging from resistance to moderate resistance. Moderate resistance was recorded in SPH 1705 and CSH 23 and rest others were resistant. At Dharwad only one entry SPH 1701 showed resistance and SPH 1704,, SPH 1705, and SPH 1710675 showed susceptibility and rest were moderately resistant. Considering results from all the three centres in Zone II, SPH 1701, SPH 1708, and SPH 1709 showed resistance reaction including local check (<3) and the test entries did not show any significant differences as the entries showed resistance to moderate resistance.

**Zone III:** At Surat, there were no significant differences in the entries tested but entries SPH 1701, SPH 1709 and SPH 1710 showed resistant reaction and rest showed moderate resistance.

**National:** Pooled data over locations analysed indicated that the entries SPH 1701, SPH 1707, SPH 1708, SPH 1709 and behaved as moderate resistant showing least PGMR (3.6-3.9) entries (Table 3.1).

**Thresh Grain mold rating (TGMR):** Grain mold on harvested grains was recorded at three places Palem (Zone I) and Akola and Parbhani (Zone II) using 1-9 rating scale (Table 3.1 and 3.2).

**Zone I:** At Palem harvested threshed grains of SPH 1701 and SPH 1710 had highest TGMR of 2.0 (Table 3.1) and all entries showed similar grain mold as indicated by non significant differences. *Curvularia* infection ranged from of 22 (SPH1707) to 33.6 % (SPH1708) whereas *Fusarium* infestation was in the range 21.1 (SPH1709) to 29.4% (SPH1704).

**Zone II.** At Akola entries significantly varied in grain mold infestation on threshed grains. Moderate resistance was observed in SPH 1702, SPH 1704, SPH 1710 and CSH 23 and rest of the entries showed resistant reactions. At Parbhani (Table 3.1) resistance to grain mold on threshed grain could be recorded on SPH 1709 and local check only. Susceptible entries were SPH 1705 and CSH 23 (5.0-5.3). On zonal basis SPH 1709, SPH 1701, SPH 1706 and SPH 1707 (2.5-3.0) were the resistant. *Curvularia* infection at Parbhani ranged 15.3 (SPH 1709) to 21.4% (CSH23) and at Akola it ranged 21.4 (SPH1701) to 31.3 (local check) (Table 3.1). *Fusarium* infection at Parbhani ranged 18.1 (SPH 1709) to 28.0 (CSH23) and Akola 13.3 (SPH 1701)- 21.1% (local check). On the basis of zone (II) *Fusarium* ranged 16.8 (SPH1701)-23.2 (CSH23) and *Curvularia* 19.3 (SPH1701) to 24.9% (SPH 1710).

**National:** Zone I and II are the prone areas for thresh GM. Data from two zones consisting of three centres indicated that SPH 1710 and CSH 23 showed moderate resistance to mold on thresh grains and all others were resistant (Table 3.1) Infection by *Curvularia* ranged 20.4 (SPH 1706) to 26.8%(SPH 1710) and by *Fusarium* 18.5 (SPH 1709) to 24.7% (CSH23) (Table 3.1 and 3.2). Grain infected by mold ranged from 25.3 (SPH 1706) to 36.4(SP1710) (Table 3.3).

#### 1.4. Initial Varietal Trial (Grain & DP)

The trial comprised of 21 entries that includes 17 test varieties, four checks and one local check from respective centres.



**Panicle grain mold (PGMR):** PGMR was recorded at Six centres namely Palem, Coimbatore (Zone I), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat) (Table 4.1). Average data over the six centres indicated that PGMR (panicle grain mold rating) ranged between 3.6 to 5.4 (moderate resistance to susceptible reactions)

**Zone-I:** Trials were laid at 2 centres: Coimbatore & Palem. Highest PGMR (rating 9) was observed at Coimbatore whereas it was 3.3 (Palem). At Palem test entries showed no significant differences towards grain mold and all of them showed resistant reaction except CSV 20 which was moderate resistant (3.3). At Coimbatore all the test entries including local check showed high susceptibility. However, on zonal basis all the entries were susceptible to GM. Lowest susceptibility was recorded in SPV Nos. 2125, 2117 & 2115 (5.2-5.3).

**Zone II:** Trials were carried at Akola, Parbhani and Dharwad in this zone. At Akola entries showed resistant to moderate resistance including local check. Entries showing moderate resistance were CSV 17, SPV2115 and local check and rest of entries showed resistant reaction though there were significant differences. At Parbhani entries showed significant differences in reaction ranging from resistance to moderate resistance. Moderate resistance was recorded in SPV2119, SPV 2122, CSV 20 and local check and rest were resistant. At Dharwad SPV 2112, SPV 2117, CSV 15 and CSV 17 showed resistant and all the others were moderately resistant except local check showing highest susceptibility (rating 9). Considering results from all the three centres in Zone II, SPV 2117, CSV 17, CSV 15, SPV2112, SPV 2122, SPV 2123, SPV 2125, and CSV 23 showed resistance reaction (<3) and the test entries did not show any significant differences as the entries showed resistance to moderate resistance except local check.

**Zone III:** At Surat, there were no significant differences in the entries tested but entries SPV2110, SPV 2112, SPV 2117, SPV 2118, SPV 2121, SPV 2123, and SPV 2125 showed resistant reaction and rest showed moderate resistance.

**National:** Pooled data over locations analysed indicated that the entries tested showed moderate resistance with significant differences and best among them were SPV 2117, 2122, 2125 CSV 17 and CSV 23 showing least grain mold (Table 4.1).

**Thresh Grain mold rating (TGMR):** Grain mold on harvested grains was recorded at three places Palem (Zone I), and Akola and Parbhani (Zone II) using 1-9 rating scale (Table 4.1 and 4.2).

**Zone I:** At Palem harvested threshed grains of all entries showed resistant reaction (Table 4.1 and 4.2). Highest grain mold (1.7) was observed SPV 2110, SPV 2116, SPV 2118 and CSV 20. *Curvularia* infection ranged from of 17.6 (SPV2112) to 33.6% (CSV15) whereas *Fusarium* infestation was in the range 22.7 (CSV23) to 30.8%(CSV20).

**Zone II.** At Akola entries significantly varied in grain mold infestation on threshed grains. Moderate resistance (3.7-4.0) was observed in SPV2116, SPV2124, CSV 17, CSV 23 and local check and rest of the entries showed resistant reactions. At Parbhani (Table 4.1) all the entries showed resistance except CSV 20 that was susceptible (5.0). Lowest mold (2.3-2.7) was recorded on SPV 2120, SPV 2123, SPV 2124, CSV 17 and CSV 23 and there were significant difference in reaction. On zonal basis SPV 2123, SPV 2117, SPV 2109, SPV 2113, SPV 2120, SPV 2125, SPV2118 and CSV 23 showed resistance (<3). On zonal basis *Curvularia* infection ranged 18.4 (SPV 2117 & SPV 2109) to 24.3%(SPV2116) and that of *Fusarium* ranged 15.5(SPV2123) to 23.5(CSV20)

**National:** Zone I and II are the prone areas for thresh GM. Data from two zones consisting of three centres indicated that CSV 20 was moderate resistant to thresh grain mold and rest were resistant. On national basis *Curvularia* infection ranged 18.8 (SPV 2109) to 27.2%(CSV15) and that of *Fusarium* ranged 17.5(CSV15) to 25.9(CSV20) (Table 4.1 & 4.2). Grain affected by mold fungi ranged 19.9(SPV2123) to 25.3 (CSV20).

### ***Forage sorghum***

Multi cut forage sorghum trials were conducted in Zone II (Akola and Dharwad) and Zone III (Surat, Udaipur and Pantnagar) and single cut forage sorghum trials were evaluated in Zone I (Palem & Coimbatore), Zone II (Akola, Dharwad & Parbhani) and Zone III (Surat Udaipur and Pantnagar) against Grain mold. PGMR (panicle grain mold rating) was done using 1-9 rating scale.

## All India summary results

No	Trial no	1	2
1	Name	AVHT- MC (GM)	IAVT- SC (GM)
2	Local check	2.2	5.2
3	SSG 59-3	2.2	-
4	Other check: CSH 20 MF	1.9	-
5	Other check: CSH 24 MF	2.4	-
6	HC 308	-	4.7
7	CSV 21F	-	5.2
10	Mean	2.3	4.5
11	Minimum	1.9	3.9
12	Maximum	2.8	5.2
13	CD (0.05)	NS	NS
14	CV (%)	20	16.0
15	Lines with lowest value on 1-9 scale	SPV 2107, SPH 1699, SSG 59-3, CSH 20 MF, LC etc (1.9-2.2)	LC, SPV 2058, SPV 2129, SPV 2131, SPV 2132 (3.9 - 4.4)
16	Lines with highest value on 1-9 scale	SPV 2108, SPH 1696, SPH 1700 (2.7-2.8)	HC 308, CSV 21F, SPV 2057 (4.7-5.2)
17	Lines on par with LC values	All entries at par	All entries at par
18	Selected lines (value: $\leq$ trial mean)	2.3	4.5
19	Data from locations (no)	2	5
20	Locations considered for National average (no)	Dharwad, Surat	Palem, Coimbatore, Parbhani, Dharwad, Surat

### 1.5. Initial & Advanced Varietal & Hybrid Trial (Multi cut)

The trial consisted 12 test entries that includes three checks SSG 59-3, CSH 20 and CSH 24 and local check.

**Panicle grain mold (PGMR):** PGMR was recorded at Dharwad (Zone II), and Surat (Zone III) (Table 5.1).

**Zone II:** At Dharwad highest PGMR (1.7) was recorded on CSH 24 MF and all the test lines showed resistance however there were significant difference in recorded PGMR.

**Zone III:** Trials at Surat indicated that there was no significant difference in the entries tested however only CSH 20 MF and CSH 24MF showed resistance whereas all the other test lines were moderate resistant to grain mold.

**National:** Statistically analysed data for PGMR ratings from Zone II and Zone III showed that all entries were resistant to grain mold with no significant differences though check CSH 20 MF contracted lowest disease..

### 1.6. Initial and Advanced Varietal Trial (Single cut)

The trial consisted 14 test entries that includes two checks HC 308 and CSV 21 F and local check.

**Panicle grain mold (PGMR):** PGMR was recorded at five centres namely Palem, Coimbatore (Zone I), Zone II (Parbhani & Dharwad) and Zone III (Surat) (Table 6.1). Average data over the five centres indicated that PGMR (panicle grain mold rating) ranged between 3.9 to 4.9 (moderate resistance)

**Zone-I:** Trials were laid at two centres at Palem & Coimbatore. Highest PGMR (rating 9) was observed at Coimbatore whereas it was 4.6 at Palem . At Palem test entries SPV 2058, SPV 2056, LC, SPV 2131, SPV 2132, HC 308,SPV 2129, , and SPV 2133 showed resistance and rest were moderately resistant and there were no significant differences in test lines. towards grain mold. At Coimbatore all the test entries including local check showed high susceptibility. However on zonal basis all the entries were susceptible to GM. Lowest susceptibility was recorded in local check, and SPV 2058, SPV 2056 and local check (5.5-5.6).

**Zone II:** Trials were carried at Parbhani and Dharwad in this zone. At Parbhani entries showed significant differences in reaction ranging from resistance to moderate resistance. Moderate resistance was recorded in SPV2133 and rest were resistant. At Dharwad SPV 2127, and local check showed resistance and all the others were either moderately resistant or susceptible with significant differences. Considering results from both the

centres a test line SPV 2127 emerged as resistant entry besides local check and rest were moderate to resistance. The test entries did not show any significant differences.

Zone III: At Surat, there were no significant differences in the entries tested but entries SPV2058, HC 308 and CSV 21F showed resistant reaction and rest showed moderately resistant.

National: Pooled data over locations analysed indicated that the entries tested showed moderate resistance with no significant differences and best among them were local check and SPV 2058 showing least grain mold (3.9-4) (Table 6.1).

Thresh Grain mold rating (TGMR): Grain mold on harvested grains was recorded at Palem (Zone I) , and Parbhani (Zone II) using 1-9 rating scale (Table 6.1).

Zone I: At Palem harvested threshed grains of all entries showed resistant reaction (Table 6.1). *Curvularia* infection ranged from of 19.5 (SPV2131) to 31.4% (SPV2128) whereas *Fusarium* infestation was in the range 17.6 (SPV2130) to 31.4% (SPV2127). Grain affected at Palem were 28.6 (SPV2058) to 46.7% (CSV21F).

Zone II. At Parbhani (Table 6.1) resistance to grain mold on threshed grain could be recorded on SPV 2126 and SPV 2128 and rest were moderately resistant and there were significant difference in reaction.

National: Zone I and II are the prone areas for thresh GM. Data from two zones consisting of two centres indicated that SPV 2057, SPV 2130, SPV 2131, SPV 2132, SPV 2133, HC 308, CSV 21F and LC were resistant to mold on threshed grain

### *Sweet sorghum*

Sweet Sorghum 21 genotypes including 2 checks and one local checks were evaluated in , Zone II (Parbhani and Dharwad) and Zone III (Surat) against Grain mold. PGMR (panicle grain mold rating) was done using 1-9 rating scale. TGMR ratings were only recorded at Parbhani (Zone II) (Table 7.1)

Table with summary result

No	Trial no	1
	Name	IAVHT-SS
1	Local check	3.8
2	CSV19 SS	germination failed at few places
3	CSH22SS	germination failed at few places
4	Mean	3.8
5	Minimum	3.6
6	Maximum	4.8
7	CD (0.05)	NS
8	CV (%)	16.3
9	Lines with lowest value on 1-9 scale	SPSV 40, SPH 1669, SPH 1712, SPH 1713, SPV 2074
10	Lines with highest value on 1-9 scale	SPV 2134, SPV 2135, SPV 2136, SPSV 39 (4.1-4.8)
11	Lines on par with LC values	All entries at par
12	Selected lines (value: $\leq$ trial mean)	3.8
13	Data from locations (no)	3
14	Locations considered for National average (no)	Parbhani, Dharwad, Surat

## 1.7 Initial and Advanced Varietal and Hybrid Trial - Sweet sorghum

### Panicle grain mold (PGMR)

Zone II: Trials were conducted at Parbhani and Dharwad. At Parbhani PGMR ranged between 2 to 4. Entries SPH 1669, SPH 1670, SPH 1711, SPH 1712 were resistant and were as good as local check and. there were significant differences among the entries tested.. At Dharwad PGMR rating ranged from 1.3 to 6.3. There was significant differences in PGMR rating among the entries however lowest PGMR was recorded in CSH22SS and CSV 19 SS, in the range of 1.3 to 3. Highly susceptible was SPV 2070.

Zone III: At Surat, there were no significant differences in the entries tested but only entry SPV2137 showed resistance and rest of the entries were moderate or susceptible to grain mold.

National: Combined data for Zone II & III reveals that test entries SPH 1669 and SPH 1712 recorded minimum grain mold (3.5 to 3.6) showing the moderate resistance. Highest grain mold was observed in SPSSV 39.

Thresh Grain mold rating (TGMR): Grain mold on harvested grains was recorded at Parbhani only using 1-9 rating scale. Entries SPH 1669 and local check had lowest TGMR in the range of 2.7 to 3. Infection by grain mold fungi *Curvularia* ranged from of 12.8 (Local check) to 18% (SPV2135) and *Fusarium* ranged from 15.9 (SPH1669) to 29.3(SPSSV39) %. Grain affected ranged 21.7 (SPH1712) to 35.3%(SPSSV39)

## 2. Downy mildew (*Peronosclerospora sorghi*)

### Grain and dual purpose sorghum

The grain sorghum entries in four trials (21 in AHT, 11 in AVT, 13 in IHT and 22 in IVT) were evaluated for for downy Mildew resistance under natural conditions under Zone II. Incidence of downy Mildew was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % DM; MR = 11-30% DM was followed.

Table: All India summary results

No	Trial no	1	2	3	4
	Name	DM- AHT(GS & DP)	DM -AVT(- GS & DP)	DM-IHT( GS &DP)	DM(IVT GS & DP)
1	Resistant check QL3	0.0	Not used	0.0	Not used
2	Local check	23.0	21.8	0.0	15.4
3	Other check: CSH 16	1.4	-	2.1	-
4	Other check: CSH 23	0.8	-	1.5	-
5	Other. check: CSV 20	-	5.0	-	4.4
6	CSV 15	-	0.7	-	8.1
7	CSV 17	-	0.0	-	6.7
8	CSV 23	-	15.0	-	2.4
9	SPV 462	-	1.6	-	-
10	Mean	4.1	6.5	7.3	8
11	Minimum	0.0	0.0	0.0	0.0
12	Maximum	40.9	21.8	29.4	20.5
13	CD (0.05)	8.70	12.6	8.74	8.8
14	CV (%)	84.3	70.9	42.9	36.8
15	Lines with lowest value on % basis	SH1655, SPH 1668,SPH 1675, SPH1679, SPH 1680, SPH 1684, SPH 1685 (0)	SPV 2079, SPV2061, CSV 15, CSV 17,SPV 462 (0.0-3.7)	SPH 1702, LC, SPH 1707, CSH 23, CSH 16(0.0- 2.1)	SPV 2123, CSV 23, CSV 20, SPV 2110,SPV 2121 (0-4.7)
16	Lines with highest value on % basis	SPH 1641, SPH 1674, SPH 1682, LC, DMS652 (3.4-40.9)	H 112, LC, CSV 23, SPV 2083,SPV 2000, SPV 1999 (5.7-17.8)	H 112, SPH 1706, SPH 1701, SPH 1704, SPH 1703 (9.9-29.4)	SPV 2122, LC, SPV 2109, SPV2124, SPV 2112 (13.2-20.5)
17	Data from locations (no)	1	1	1	
18	Comment 1	DM Recorded on % basis at Dharwad only			

### 2.1 Advanced Hybrid Trial for grain and dual purpose sorghum (AHT-GS & DP)

The trial comprised of 21 entries that includes 18 test hybrids, two checks and one local check from respective centre (Table 1.3).

Zone II: Maximum 40.9 % downy Mildew was recorded on DMS 652. Among the test entries, the entries showing no downy mildew were SH1655, SPH 1668,SPH 1675, SPH1679, SPH 1680, SPH 1684, SPH 1685 and there were significant difference between the entries tested .

### 2.2 Advanced Varietal Trial (AVT - Grain & DP)

The trial comprised of 11 entries that includes 5 test lines , five checks and one local check from respective centre (Table 2.3).

Zone II: Maximum ~ 22 % downy Mildew was recorded on local check followed by H 112 (~18%). Entries showing lowest DM were SPV 2079, SPV2061, CSV 15, CSV 17,SPV 462 (0.0-3.7) and there were significant difference between the entries tested .

### 2.3. Initial Hybrid Trial (IHT- GS &DP)

The trial comprised of 13 entries that includes 10 test hybrids, two checks and one local check from respective centres (Table 3.3).

Zone II: Maximum ~ 29 % downy Mildew was recorded on H 112 followed by SPH 1706 (~19%). Entries showing lowest DM were SPH 1702, LC, SPH 1707, CSH 23, CSH 16(0.0- 2.1) and there were significant difference between the entries tested .

### 2.4. Initial Varietal Trial (Grain & DP)

The trial comprised of 21 entries that includes 17 test varieties, four checks and one local check from respective centres (Table 4.3).

Zone II: Maximum ~ 29 % downy Mildew was recorded on SPV 2122, local check, SPV 2109 (14.7-20.5%). Entries showing lowest DM were SPV 2123, CSV 23, CSV 20, SPV 2110,SPV 2121 (0-4.7) and there were significant difference between the entries tested.

### *Forage sorghum*

Multi cut forage sorghum trials were conducted in Zone II (Akola and Dharwad ) and Zone III (Surat, Udaipur and Pantnagar) and singal cut forage sorghum trials were evaluated in Zone I (Palem & Coimbatore), Zone II (Akola, Dharwad & Parbhani) and Zone III (Surat Udaipur and Pantnagar) against downy mildew. Incidence of downy Mildew was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % DM; MR = 11-30% DM was followed. The disease was recorded only at Dharwad

### All India summary results

No	Trial no Name	1 AVHT- MC	2 IAVT- SC
1	Resistant check QL3	0	0
2	Local check	48.4	0
3	SSG 59-3	25.0	-
4	Other check: CSH 20 MF	4.9	
5	Other check: CSH 24 MF	34.1	
6	HC 308	-	15.8
7	CSV 21F	-	57.2
8	Mean	22.5	15
9	Minimum	0	0
10	Maximum	48.4	90.7
11	CD (0.05)	0.51	21.3
12	CV (%)	23.7	76.10
13	Lines with lowest value on % basis	QL3, SPH 1700, CSH 20MF, SPH 1699, (0-6.1)	SPV 2058, SPV2132, SPV2057, SPV2127, SPV2131 (2.3-6.5)
14	Lines with highest value on % basis	LC, H 112, CSH 24MF, SPV2108, SPH 1696 (48.4-30.0%)	SPV 2128, SPV2129, HC 308, CSF21F, SPV2133 (10.6-90.7)
15	Data from locations (no)	1	1
16	Comment	Downy mildew was recorded at Dharwad only	

### 2.5. Initial & Advanced Varietal & Hybrid Trial (Multi cut)

The trial consisted 12 test entries that includes three checks SSG 59-3, CSH 20 and CSH 24 and local check (Table 5.1).

Zone II: Maximum ~ 30-48 % downy Mildew was recorded on LC, H 112, CSH 24MF, SPV2108, SPH 1696. Entries showing lowest DM were QL3, SPH 1700, CSH 20MF, SPH 1699, (0-6.1) and there were significant difference between the entries tested.

## 2.6. Initial and Advanced varietal Trial (Single cut)

The trial consisted 14 test entries that includes two checks HC 308 and CSV 21 F and local check (Table 6.1).

Zone II: Maximum ~ 10.6-90.7% downy Mildew was recorded on SPV 2128, SPV2129, HC 308, CSF21F, SPV2133. Entries showing lowest DM were SPV 2058, SPV2132, SPV2057, SPV2127, SPV2131 (2.3-6.5)) and there were significant difference between the entries tested.

### *Sweet sorghum*

Sweet Sorghum 21 genotypes including 2 checks and one local checks were evaluated in , Zone II (Parbhani and Dharwad) and Zone III (Surat) against Downy mildew. Incidence of downy Mildew was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % DM; MR = 11-30% DM was followed. The disease was recorded only at Dharwad

### All India summary results

	Trial Name	IAVHT-SS
1	Resistant check QL3	24.3
2	Local check	23.8
3	CSV19 SS	8.2
4	CSH22SS	2.6
5	Mean	7.1
6	Minimum	0.7
7	Maximum	24.3
8	CD (0.05)	NS
9	CV (%)	76.7
10	Lines with lowest value on % basis	SPH 1669, SPH 2074, SPH 1670, SPV 2135 and CSH 22SS (0.7-2.6%)
11	Lines with highest value on % basis	SPSSV 39, SPV 2070, SPV 2133, LC and QL3 (10.2-24.3%)
12	Data from locations (no)	1
13	Comment	DM was recorded at Dharwad only

## 2.7 Initial and Advanced Varietal and Hybrid Trial - Sweet sorghum

Zone II: Maximum 10.2-24.3 Downy mildew was recorded on SPSSV 39, SPV 2070, SPV 2133, LC including resistant QL3. There was no significant difference between the entries tested. Entries with lowest (0.7-2.6%) DM were SPH 1669, SPH 2074, SPH 1670, SPV 2135 and CSH 22SS.

## 3. Ergot (*Claviceps sorghi*)

### *Grain and dual purpose sorghum*

The grain sorghum entries in four trials (21 in AHT, 11 in AVT, 13 in IHT and 22 in IVT) were evaluated for ergot resistance under natural conditions. Incidence of ergot was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % ergot; MR = 11-30% ergot was followed. The disease was recorded at Surat only.

Table: All India summary results

No	Trial no	1	2	3	4
	Name	Ergot- AHT(GS & DP)	Ergot -AVT(- GS & DP)	Ergot-IHT( GS &DP)	Ergot (IVT GS & DP)
1	Local check	4.3	3	3.3	3.7
2	Other check: CSH 16	4.3	-	3.3	
3	Other check: CSH 23	3.7	-	3.3	
4	Other. check::CSV 20	-	2.7		4.0
5	Other. check: CSV 15	-	3.7		3.3
6	Other. check: CSV 17	-	3.3		3.0
7	Other. check: CSV 23	-	3.3		3.7
8	Other. check: SPV 462	-	3.3		-
9	Mean	3.4	3.1	3.3	3.5
10	Minimum	2	2.7	2.3	2.0
11	Maximum	4.3	3.7	4	4.7
12	CD (0.05)	NS	NS	NS	NS
13	CV (%)	15	14.0	15.7	15.3
14	Lines with lowest value on % basis	SPH 1674, SPH 1635 (2), SPH	SPV 2000 (2), SPV 2061, CSV 20, SPV	SPH 1701, SPH 1705 (2), SPH 1703, SPH	SPV 2112, SPV 2121. SPV 2112,

No	Trial no	1	2	3	4
	Name	Ergot- AHT(GS & DP)	Ergot -AVT(- GS & DP)	Ergot-IHT( GS &DP)	Ergot (IVT GS & DP)
		1685, SPH 1641 (2), SPH 1682 (2-3)	1999, SPV 2083 (2.7-3)	1710,, SPH 1702 (2.3-3.3)	SPV 2125, SPV 2109 (2-3.0)
15	Lines with highest value on % basis	CSH 23, SPH 1655 (2), SPH 1675, CSH 16, LC (3.7-4.3)	SPV 2079 (2), CSV 17, SPV 462, CSV 23, CSV 15 (3.3-3.7)	CSH 16,CSH 23, LC, SPH 1708, SPH 1704 (3.3 -4.0)	SPV 2122, CSV20, SPV 2116. SPV 2113, SPV 2120 (4-4.7)
16	Data from locations (no)	1			
17	Comment 1	ERGOT Recorded on % basis at Surat only			

### 3.1 Advanced Hybrid Trial for grain and dual purpose sorghum (AHT-GS & DP)

The trial comprised of 21 entries that includes 18 test hybrids, two checks and one local check from respective centre (Table 1.3).

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 2 to 4.3 per cent. Minimum was recorded in SPH 1674, SPH 1635 (2), SPH 1685, SPH 1641 (2), SPH 1682 (2-3 per cent).

### 3.2. Advanced Varietal Trial (AVT - Grain & DP)

The trial comprised of 11 entries that includes 5 test lines , five checks and one local check from respective centre (Table 2.3).

Zone II: Maximum 3.3 to 3.7 in SPV 2079 (2), CSV 17, SPV 462, CSV 23, CSV 15 (3.3-3.7%) and therefore all the entries were resistant this disease

### 3.3. Initial Hybrid Trial (IHT- GS &DP)

The trial comprised of 13 entries that includes 10 test hybrids, two checks and one local check from respective centres (Table 3.3).

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 2 to 4.3 per cent. Minimum was recorded in SPH 1701, SPH 1705 (2), SPH 1703, SPH 1710,, SPH 1702 (2.3-3.3).

### 3.4. Initial Varietal Trial (Grain & DP)

The trial comprised of 21 entries that includes 17 test varieties, four checks and one local check from respective centres (Table 4.3).

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 2 to 4.3 per cent. Minimum was recorded in SPV 2112, SPV 2121. SPV 2112, SPV 2125, SPV 2109 (2-3.0%).

### Forage sorghum

Multi cut forage sorghum trials were conducted in Zone II (Akola and Dharwad ) and Zone III (Surat, Udaipur and Pantnagar) and singal cut forage sorghum trials were evaluated in Zone I (Palem & Coimbatore), Zone II (Akola, Dharwad & Parbhani) and Zone III (Surat Udaipur and Pantnagar) against ergot. Incidence of ergot was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % ergot; MR = 11-30% ergot was followed. The disease was recorded at Surat only.

### All India summary results

No	Trial no	1	2
	Name	AVHT- MC	IAVT- SC
1	Local check	3.7	3.3
2	SSG 59-3	3.3	-
3	Other check: CSH 20 MF	3.0	-
4	Other check: CSH 24 MF	3.0	-

No	Trial no	1	2
	Name	AVHT- MC	IAVT- SC
5	HC 308	-	4.0
6	CSV 21F	-	3.3
7	Mean	3.5	3.5
8	Minimum	3.0	2.7
9	Maximum	4.0	4.0
10	CD (0.05)	NS	NS
11	CV (%)	14.5	16.8
12	Lines with lowest value on % basis	SPH 1698, CSH 20MF, CSH 24MF, SPV 2107, SSG 59-3 (3 to 3.3 %)	SPV 2058, SPV2129, SPV2126, SPV2127, SPV2130 (2.7 to 3.3 %)
13	Lines with highest value on % basis	SPH 1697, SPH 1699, LC, SPV 2108, SPH 1700 (3.7 to 4 %)	SPV 2057, SPV2128, SPV2133, SPV2132, HC 308(3.7 to 4.0 %)
14	Data from locations (no)	1	1
15	Comment	Ergot was recorded at Surat only	

### 3.5. Initial & Advanced Varietal & Hybrid Trial (Multi cut)

The trial consisted 12 test entries that includes three checks SSG 59-3, CSH 20 and CSH 24 and local check.

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 3 to 4 per cent. Minimum was recorded in SPH 1698, CSH 20MF, CSH 24MF, SPV 2107, SSG 59-3 (3 to 3.3 %)

### 3.6. Initial and Advanced Varietal Trial (Single cut)

The trial consisted 14 test entries that includes two checks HC 308 and CSV 21 F and local check.

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 2.7 to 4.0 per cent. Minimum was recorded in SPV 2058, SPV2129, SPV2126, SPV2127, SPV2130 (2.7 to 3.3 %)

### *Sweet sorghum*

Sweet Sorghum 21 genotypes including 2 checks and one local checks were evaluated in , Zone II (Parbhani and Dharwad) and Zone III (Surat) against ergot . Incidence of ergot was recorded in per cent. Standard method of resistance grading i.e. resistance =10 % ergot; MR = 11-30% ergot was followed. The disease was recorded at Surat only.

### All India summary results

	Trial Name	IAVHT-SS
1	Local check	3.7
2	CSV19 SS	5.3
3	CSH22SS	3.3
4	Mean	3.9
5	Minimum	2.7
6	Maximum	5.3
7	CD (0.05)	NS
8	CV (%)	15.0
9	Lines with lowest value on % basis	SPH 1713SPV 2074SPH 1670SPH 1712SPV 2070 (2.7-3.3%)
10	Lines with highest value on % basis	SPV 2136SPV 2068SPV 2069SPH 1669CSV 19SS (4.3- 5.3%)
11	Data from locations (no)	1
12	Comment	Ergot was recorded at Surat only

### 3.7 Initial and Advanced Varietal and Hybrid Trial - Sweet sorghum

Zone III: Trials under Zone III at Surat, revealed that ergot is not a problem disease and all the entries recorded less than 10% incidence and it ranged between 2.7 to 5.3 per cent. Minimum was recorded in SPH 1713SPV 2074SPH 1670SPH 1712SPV 2070 (2.7-3.3%)



#### 4. Foliar diseases

##### *Grain and dual purpose sorghum*

The grain sorghum entries in four trials (21 in AHT, 11 in AVT, 13 in IHT and 22 in IVT) were evaluated for foliar diseases resistance under natural conditions. The diseases were scored on 1-9 rating scale in Zone I (Palem & Coimbatore), Zone II (Akola, Parbhani & Dharwad) and Zone III (Surat, Udaipur and Pantnagar).

##### All India summary results

No	Trial no	1			
		AHT- GS & DP- Foliar diseases			
	Name	Rust	Anthraco-nose	Leaf blight	Zonate Leaf spot
		1.5	1.5	1.5	1.2 tble
1	Local check	4.7	6.5	5.3	4.3
2	Other check: CSH 16	2.0	3.9	3.7	3.4
3	Other check: CSH 23	2.7	4.2	4.1	3.9
4	Mean	2.4	4	3.9	3.6
5	Minimum	1.7	3.3	3.3	2.9
6	Maximum	4.7	6.5	5.3	4.5
7	CD (0.05)	NS	NS	NS	NS
8	CV (%)	37.9	24.5	14.7	19.2
9	Most resistance lines < 3 rating	SPH 1648, SPH 1680, SPH 1674, SPH 1641, SPH 1683 (1.7-1.9)	None	None	SPH 1647 (2)
10	Next resistance lines (≤ trial mean)	SPH 1635, SPH 1675, SPH 1682 (2-2)	SPH 1679, SPH 1683, SPH 1653, SPH 1668, SPH 1684 (3.3-3.7)	SPH 1676, SPH 1675, SPH 1668, SPH 1684, SPH 1679 (3.3-3.6)	SPH 1651 (2), SPH 1674, SPH 1680, SPH 1679 etc (3.2-3.4)
11	Most susceptible lines	LC (4.7)	SPH1641, CSH 23, SPH 1655, SPH 1676, LC (4.2-6.5)	SPH 1674, CSH 23, SPH 1641, SPH 1647, LC (4.1-5.3)	SPH 1678, CSH23, SPH 1641, LC, SPH 1635 (3.7-4.5)
12	Data from locations (no)	3	4	4	4
13	Locations considered for National average (no)	Parbhani, Dharwad, Udaipur	Coimbatore, Udaipur, Pantnagar, Surat	Palem, Parbhani, Udaipur, Surat	Palem, Dharwad, Udaipur, Pantnagar

##### 4.1. Advanced Hybrid Trial for grain and dual purpose sorghum (AHT-GS & DP)

The trial comprised of 21 entries that includes 18 test hybrids, two checks and one local check from respective centre. The data on foliar diseases was recorded at Palem, Coimbatore (Zone I), Akola, Parbhani, and Dharwad (Zone II), and in Zone III at Surat, Pantnagar & Udaipur (Table 1.2 and 1.5)

4.1.1 Rust: The disease was recorded at three centres Parbhani, Dharwad and Udaipur (Table 1.5).

Zone II: The disease was recorded at Parbhani and Dharwad. Highest disease (rating 3.8) was noted in local check & rest of entries showed resistance or moderate resistance with no significant differences. Resistance with lowest rust (rating <3) were recorded in SPH 1680,, SPH 1674, SPH 1648, SPH 1647 and SPH 1641 and others..

Zone III: At Udaipur local check contracted highest disease giving 6.5 rating. Rest of the entries showed very low attack of the disease and could be rated as resistant.

National: Local check recorded moderate resistance (4.7) when the data was pooled over the three centres. The entries showing resistance were SPH 1648, SPH 1680, SPH 1674, SPH 1641 and SPH 1683 (1.7-1.9)

4.1.2 Zonate leaf spot: The disease was recorded at Palem (Zone I), Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 1.2)

Zone I. At Palem the SPH 1635 was the only susceptible to the disease and rest were resistant to the disease with no significant differences

Zone II: At Dharwad 11 entries out of 21 showed resistance. Lowest (<3) rating could be recorded in SPH 1647, SPH 1641, SPH 1648, SPH 1651, SPH 1668 and others.

Zone III: The disease was recorded at Udaipur and Pantnagar. None of the entry was resistant but moderate resistance could be obtained in SPH 1651, CSH 16, SPH 1647 and SPH 1685 (<4).

National: Lowest rating (2.9) resistance to zonate leaf spot was recorded ponly in SPH 1647. Other entries showing the moderate resistance were SPH 1651 (2), SPH 1674, SPH 1680, SPH 1679 etc., (3.2 -3.4) and there were no significant difference in entries tested.

#### 4.1.3 Leaf blight: Leaf blight was recorded at Palem (Zone I), Parbhani (Zone II) & Surat & Udaipur (Zone III)

Zone I. At Palem CSH 23 had highest (5.7) disease and was susceptible to the disease . Eleven entries showed resistance and few of them were SPH 1641, SPH 1648, SPH 1684, SPH 1635 and local check .

Zone II: At Parbhani all the entries showed resistance except SPH 1682 that showed moderate resistance

Zone III: In Zone III local check recorded highest (6.8) blight. None of entry showed resistance. Moderate resistance (<5) could be obtained in SPH 1668, SPH 1676, SPH 1684, SPH 1651 and SPH 1653

National: On National basis none entry was found resistant to leaf blight. SPH 1676, SPH 1675, SPH 1668, SPH 1684, SPH 1679 (3.3-3.6) showed moderate resistance and there was no significant differences between the entries tested.

#### 4.1.4 Anthracnose- Anthracnose was recorded in Zone I (Coimbatore) and Zone III (Surat, Udaipur & Pantnagar).

Zone I: At Coimbatore none of the entry was resistant. All of them showed either susceptible to highly susceptible reaction to anthracnose. Minimum disease was shown by SPH 1668 ( 5.0)

Zone III: In this zone none of the entry showed resistance and all of them were moderate resistant and local check showed high susceptibility. Lowest disease was recorded in SPH 1679, SPH 1683, SPH 1653, SPH 1668 and SPH 1684 (Table 1.5).

National: All the entries behaved at par. However none of the entry was found to be resistant to anthracnose. Moderate resistance showing entries were SPH 1679, SPH 1683, SPH 1653, SPH 1668, SPH 1684 (3.3-3.7)..

#### 4.1.5 Sooty stripe– The disease was recorded in Zone II at Akola. All the entries recorded resistant reaction (≤3) except SPH 1684 and local check which were moderately resistant.

### 4.2. Advanced Varietal Trial (AVT - Grain & DP)

The trial comprised of 11 entries that includes 5 test lines, 5 checks and 1 local check from respective centre.

#### All India summary results

No	Trial no Name	2 AVT- GS & DP			
		Rust	Anthracnose	Leaf blight	Zonate Leaf spot
		2.5	2.5	2.5	
1	Local check	4.4	6.3	3.8	4.1
2	CSV 15	1.3	4.4	3.4	3.7
3	CSV 17	1.9	4.9	4.8	3.4
4	CSV 20	2.1	-	4.1	2.9

No	Trial no Name	2 AVT- GS & DP			
		Rust	Anthracoese	Leaf blight	Zonate Leaf spot
5	CSV 23	2.0	-	3.4	3.0
6	SPV 462	1.3	3.9	3.5	3.2
7	Mean	1.9	4.6	3.8	3.3
8	Minimum	1.6	3.9	3.1	2.8
9	Maximum	4.4	6.3	4.8	4.1
10	CD (0.05)	1.3	NS	NS	NS
11	CV (%)	40.6	25.3	30.6	26.0
12	Most resistance lines < 3 rating	SPV 2079, CSV 15, SPV 462, SPV 2000, SPV 1999 etc (1.3-1.6)	None	None	SPV 2079, CSV 15, SPV 462, SPV 2000, SPV 1999 etc (1.3-1.6)
13	Next resistance lines ( ≤ trial mean)	Rest 5 entries (1.6-2.1)	SPV 462, SPV 2061, SPV2083, SPV 1999, SPV 2000( 3.9- 4.2)	SPV2083, SPV 2079, CSV 15, CSV 23, SPV ( 3.1- 3.5)	SPV 462, SPV 2083, CSV 17 etc (3.2-3.4)
14	Most susceptible lines	LC (4.4)	LC (6.3)	CSV 17 (4.80)	LC (4.1)
15	Data from locations (no)	3	4	4	4
16	Locations considered for National average (no)	Parbhani, Dhar, Udaipur	Coimbatore, Udaipur, Pantnagar and Surat	Palem, Parbhani, Udaipur, Surat	Palem, Dharwad, Udaipur, Pantnagar
17	Comment 1				

The data on foliar diseases was recorded at Palem, Coimbatore (Zone I), Akola, Parbhani and Dharwad (Zone II), and in Zone III at Surat, Pantnagar & Udaipur (Table 2.2 and 2.5).

4.2.1 Rust: The disease was recorded at three centres Parbhani, Dharwad and Udaipur (Table 2.5).

Zone II: The disease was recorded at Parbhani and Dharwad. Highest disease (rating 3.8) was noted in local check & rest of entries showed resistance with no significant differences. Lowest rust (rating <3) showing entries were SPH 2079, CSV 15, SPV 462, SPV 2000 and others.

Zone III: At Udaipur local check contracted highest disease giving 5.5 rating. Rest of the entries showed very low attack of the disease and could be rated as resistant.

National: High susceptibility rating 4.4 was recorded on LC when the data was pooled over the three centres. The entries showing resistance were SPV 2079, CSV 15, SPV 462, SPV 2000, SPV 1999 etc (1.3-1.6)

4.2.2 Zonate leaf spot: The disease was recorded at Palem (Zone I), Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 2.2)

Zone I. At Palem the SPV 2083 and CSV 15 showed moderate resistance (3.3) and rest were resistant to the disease with no significant differences

Zone II: At Dharwad local check and CSV 23 showed moderate resistance and all others were resistant and entries significantly differed in reaction. Lowest rating could be recorded in SPV 1999, SPV 2061, CSV 15, SPV 462 (2-2.3) and others.

Zone III: The disease was recorded at Udaipur and Pantnagar. None of the entry was resistant but moderate resistance could be obtained in SPV 2061, SPV 2083, SPV 1999, and SPV 2000 (3.7-3.9).

National: Lowest rating (2.8-3.0) resistance to zonate leaf spot was recorded in SPV 2079, CSV 15, SPV 462, SPV 2000, SPV 1999 etc (1.3-1.6). Other entries showing the moderate resistance were SPV 462, SPV 2083, CSV 17 etc (3.2-3.4) and there were no significant difference in entries tested.

4.1.3 Leaf blight- Leaf blight was recorded at Palem (Zone I), Parbhani (Zone II) & Surat & Udaipur (Zone III)

Zone I: At Palem CSV 17 had highest disease (6.3) and was susceptible to the disease. SPV 2079, SPV 2061, SPV 2083, CSV 15 along with LC showed resistance (1) and entries differed significantly.

Zone II: At Parbhani SPV 1999, SPV 2083, SPV 462, LC and all other showed resistance(<3) with no significant differences.

Zone III: In Zone III local check recorded highest (6.0) blight . None showed resistance. Moderate resistance could be obtained in SPV 1999, CSV 23, SPV 2083 and.

National: On National basis none entry was found resistant to LB. SPV2083, SPV 2079, CSV 15, CSV 23, SPV ( 3.1- 3.5) showed moderate resistance and there was no significant differences between the entries tested.

4.1.4 Anthracnose- Anthracnose was recorded in Zone I (Coimbatore) and Zone III (Surat, Udaipur & Pantnagar).

Zone I: At Coimbatore none of the entry was resistant. All of them showed either susceptible to highly susceptible reaction to anthracnose. Minimum disease was shown by SPV462 followed by SPV 1999 (4.7-5.7)

Zone III : In this zone none of the entry showed resistance and all of them were moderate resistant and local check showed high susceptibility (6.3). Lowest disease was recorded in SPV 2061, CSV 23 (3.2-3.5) (Table 2.5).

National: None of the entry was found to be resistant to anthracnose. Moderate resistance showing entries were SPV 462, SPV 2061, SPV2083, SPV 1999, SPV 2000(3.9- 4.2). Most susceptible was local checks (6.3).

4.1.5 Sooty stripe: The disease was recorded in Zone II at Akola. All the entries recorded resistant reaction ( $\leq 3$ ).

#### 4.3. Initial Hybrid Trial (IHT- GS &DP)

The trial comprised of 13 entries that includes 10 test hybrids, 2 checks and 1 local check from respective centres.

No	Trial no	1	2	3	4
		3.5	3.5	3.5	3.2
1	Name	Rust	Anthracnose	Leaf blight	Zonate Leaf spot
5	Local check	4.6	3.9	3.9	3.2
6	Other check: CSH 16	2.0	-	4.2	3.7
7	Other check: CSH 23	2.3	5.0	3.5	4.2
13	Mean	2.2	4	3.8	3.6
14	Minimum	1.7	2.9	3.1	2.7
15	Maximum	4.6	5.0	4.2	4.4
16	CD (0.05)	NS	NS	NS	NS
17	CV (%)	46.1	51.7	26.7	43.3
18	Most resistance lines < 3 rating	SPH 1710, SPH1705,SPH1710 ,SPH1708,SPH1703 etc (1.7-1.9)	SPH 1709 (2.9)		SPH 1709, SPH1702,SPH1710 (2.7-3.0)
19	Next resistance lines ( $\leq$ trial mean)		SPH1701,SPH1706 ,SPH1707,SPH1710 etc (3.4-3.7)	None	
20	Most susceptible lines	LC, CSH23, SPH 1707, CSH16,SPH1709 (2-4.6)	none	LC, SPH 1706, SPH 1702,SPH1709, CSH16 (3.9-4.2)	SPH 1707, CSH23, SPH1704,SPH1708 ,SPH1706 (3.8-4.4)
21	Data from locations (no)	3	5	4	4
22	Locations considered for National average (no)	Parbhani, Dharwad, Udaipur	Coimbatore, Akola, Udaipur, Pantnagar, Surat	Palem, Parbhani, Udaipur, Surat	Palem, Dharwadi, Udaipur,Pantnagar
27	Comment 2				All the lines were highly susceptible at Coimbatore showing maximum rating 9

4.3.1 Rust: The disease was recorded at three centres Parbhani, Dharwad and Udaipur (Table 3.5)

Zone II: The disease was recorded at Parbhani and Dharwad. Highest disease (rating 3.7) was noted in local check & rest of entries showed resistance with no significant differences. Lowest rust (rating <3) showing entries were SPH 1701, SPH 1705, SPH 1710 (2).

Zone III: At Udaipur local check contracted highest disease giving 6.3 rating. Rest of the entries showed very low attack of the disease and could be rated as resistant.

National: High susceptibility rating 4.6 was recorded on LC when the data was pooled over the three centres. The entries showing resistance were SPH 1710, SPH1705, SPH1710, SPH1708, SPH1703 etc (1.7-1.9).

4.3.2 Zonate leaf spot: The disease was recorded at Palem (Zone I), Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 1.2)

Zone I. At Palem the SPH1705 and 1701 were moderately resistant and all other were resistant (<3) with no significant differences

Zone II: At Dharwad local check, CSH23, SPH 1706, SPH 1704 and SPH 1705 showed moderate resistance and rest were resistant with significant differences.

Zone III: The disease was recorded at Udaipur and Pantnagar. None of the entry was resistant but moderate resistance could be obtained with lowest ratings in SPH 1702, CSH 23, SPH 1710 (4.2-4.3) and there were no significant differences in test entries.

National: Lowest rating (2.7-3.0) resistance to zonate leaf spot was recorded in SPH 1709, SPH 1702, SPH 1710 (2.7-3.0) Other entries showing the moderate resistance were SPH 1707, CSH 23, SPH 1704, SPH 1708, SPH 1706 (3.8-4.4) SPV 462, SPV 2083, CSV 17 etc (3.2-3.4) and there were no significant difference in entries tested.

4.1.3 Leaf blight- Leaf blight was recorded at Palem (Zone I), Parbhani (Zone II) and Surat & Udaipur (Zone III)

Zone I. At Palem all the entries either were resistant or moderate in resistance. SPH 1703, SPH 1704, SPH 1705 showed highest resistance (1). Moderately resistant were SPH 1709 and CSH16.

Zone II: At Parbhani all the entries were resistant and lowest to contract disease were SPH 1703, SPH 1708 and local check (2) with no significant differences.

Zone III: In Zone III local check recorded highest (6.3) blight. None showed resistance. Moderate resistance could be obtained in SPH 1708, SPH 1703, SPH 1709 and CSH 23 (4.7) and there were no significant differences in test entries.

National: On National basis none entry was found resistant to LB. SPH 1703, SPH1708, SPH1701, CSH 23, SPH 1710 (3.1-3.7) showed moderate resistance and there was no significant differences between the entries tested.

4.1.4 Anthracnose- Anthracnose was recorded in Zone I (Coimbatore) and Zone III (Surat, Udaipur & Pantnagar).

Zone I: At Coimbatore none of the entry was resistant. All of them showed either susceptible to highly susceptible reaction to anthracnose. Minimum disease was shown by SPH 1710 followed (5.7).

Zone II: At Akola all the entries showed resistance except SPH 1705 that showed moderate resistance (3.3).

Zone III: In this zone none of the entry showed resistance and all of them were moderate resistant. Lowest disease was recorded in SPH 1701 followed by SPH 1709 and SPH 1710 (3.1-3.5). (Table 3.5).

National: None of the entry was found to be resistant to anthracnose except SPH 1709 (2.9). Moderate resistance showing entries were SPH1701,SPH1706,SPH1707,SPH1710etc (3.4-3.7).

4.1.5 Sooty stripe: The disease was recorded in Zone II at Akola. All the entries recorded resistant reaction ( $\leq 3$ ).

#### 4.4. Initial Varietal Trial (Grain & DP)

The trial comprised of 21 entries that includes 17 test varieties, four checks and one local check from respective centres.

No	Trial no	4			
		IVT GS & DP			
	Name	Rust	Anthracnose	Leaf blight	Zonate Leaf spot
		4.5	4.5	4.5	4.2
1	Local check	4.1	6.5	4.2	4.9
2	Other. check: CSV 20	2.1	4.8	4.2	4.1
	CSV 15	1.4	-	3.9	4.0
3	CSV 17	1.7	4.1	2.8	4.0
4	CSV 23	1.8	4.1	3.8	4.0
5	Mean	1.8	4.3	3.7	3.9
6	Minimum	1.2	1.2	2.8	3.6
7	Maximum	4.1	4.1	4.4	4.9
8	CD (0.05)	NS	1.2	NS	0.6
17	CV (%)	40.0	20.1	26.0	10.5
9	Most resistance lines < 3 rating	SPV 2112, SPV 2116,SPV 2117,, SPV 2125, CSV 15(1.2-1.4)	None	CSV17, SPV 2119 (2.8-3),	None
10	Next resistance lines ( $\leq$ trial mean)		SPV2110, SPV2113,SPV 2119, SPV 2125, SPV 2111(3.8-4.0)	SPV 2125,SPV 2123, SPV 2114(3.1-3.3)	SPV 2116, SPV 2117,SPV 2125, SPV 2111, SPV 2112(3.6-3.7)
11	Most susceptible lines	SPV 2118, SPV 2109,CSV 20,SPV 2111, LC (1.9-4.1)	SPV 2115, SPV 2124,SPV 2116,, CSV 20, LC(4.4-6.5)	CSV20, SPV 2109,LC, SPV 2124,SPV 2121(4.2-4.4)	CSV17, CSV15, CSV23,CSV20, SPV 2123,LC, (4.0-4.9)
12	Data from locations (no)	3	4	4	4
13	Locations considered for National average (no)	Parbhani, Dharwad, Udaipur	Coimbatore, Udaipur, Pantnagar, Surat	Palem, Parbhani, Udaipur, Surat	Palem, Dharwad, Udaipur, Pantnagar

4.3.1 Rust: The disease was recorded at three centres Parbhani, Dharwad and Udaipur (Table 4.5).

Zone II: The disease was recorded at Parbhani and Dharwad. All the tesy entries were resistant and highest disease intensity was recorded on local check (rating 3.0) & rest of entries showed resistance with no significant differences. Lowest rust (rating <2) showing entries were SPV2112, SPV 2116, SPV 2117, SPV 2125 and CSV 15.

Zone III: At Udaipur local check contracted highest disease giving 6.3 rating. Rest of the entries showed very low attack of the disease and could be rated as resistant.

National: High moderate resistant rating 4.1 was recorded on LC when the data was pooled over the three centres. The entries showing resistance were SPV 2112, SPV 2116,SPV 2117,, SPV 2125, CSV 15(1.2-1.4) with no significant differences

4.3.2 Zonate leaf spot: The disease was recorded at Palem (Zone I), Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 1.2)

Zone I. At Palem the LC, SPV 2113, SPV 2125, CSV 23 and SPV 2123 were moderately resistant (3.1-3.5) and rest of the entries were resistant and lowest to record the disease was SPV 2120. There were significant differences in entries tested.

Zone II: At Dharwad SPV 2116, SPV 2117, SPV 2119, SPV 2125 and CSV 23 expressed resistance (<3) and rest of other showed moderate resistance with significant differences. local check, CSH23, SPH 1706, SPH 1704 and SPH 1705 showed moderate resistance and rest were resistant with significant differences.

Zone III: The disease was recorded at Udaipur and Pantnagar. None of the entry was resistant but moderate resistance could be obtained with lowest ratings 4 in SPV 2111, SPV 2113, SPV 2125.

National: No resistance in any entry was recorded. Lowest rating (3.6-3.7) moderate resistance to zonate leaf spot was recorded in SPV 2116, SPV 2117, SPV 2125, SPV 2111, SPV 2112 and there were significant difference in entries tested.

4.1.3 Leaf blight- Leaf blight was recorded at Palem (Zone I), Parbhani (Zone II) and Surat & Udaipur (Zone III)

Zone I. At Palem all the entries either were resistant or moderate in resistance. SPV 2112, SPV 2114, SPV 2116, SPV 2118 and SPV 2119 showed highest resistance (1). Zone II: At Parbhani all the entries were resistant and lowest(2) to contract disease were SPV 2113, SPV 2115, SPV 2120, SPV 2123 and SPV 2125 with no significant differences.

Zone III: In Zone III none showed resistance. Moderate resistance could be obtained in SPV 2117, CSV 17, SPV 2119, SPV 2125 and SPV 2123 (4-4.9) and there were no significant differences in test entries.

National: On National basis CSV 17 and SPV 2119 were found resistant (2.8-3) to LB. Rest of the entries showed moderate resistance and there were no significant differences between the entries tested.

4.1.4 Anthracnose- Anthracnose was recorded in Zone I (Coimbatore) and Zone III (Surat, Udaipur & Pantnagar).

Zone I: At Coimbatore none of the entry was resistant. All of them showed either moderate resistance or susceptible to anthracnose. Minimum disease was shown by SPV 2120 (4) followed by SPV 2113 and 2119 (4.3).

Zone III: In this zone none of the entry showed resistance and all of them were moderate resistant. Lowest disease was recorded in SPV 2110, SPV 2125, SPV 2111, SPV 2113, 2119 (3.2-3.7). (Table 3.5).

National: None of the entry was found to be resistant to anthracnose. Moderate resistance showing entries were SPV 2125, SPV 2123, SPV 2114 (3.1-3.3) and others with significant differences.

### *Forage sorghum*

Multi cut forage sorghum trials were conducted in Zone II (Akola and Dharwad ) and Zone III (Surat, Udaipur and Pantnagar) and single cut forage sorghum trials were evaluated in Zone I (Palem & Coimbatore), Zone II (Akola, Dharwad & Parbhani) and Zone III (Surat Udaipur and Pantnagar) against foliar diseases using 1-9 rating scale.

### All India summary results

No	Trial no Name	5			
		MC			
		Rust	Anthracnose	Leaf blight	Zonate Leaf spot
1	Local check	4.1	5.6	6.0	2
2	SSG 59-3	2.2	3.9	5.0	4.4
3	Other check: CSH 20 MF	2.2	2.7	4.9	3.0

No	Trial no Name	5			
		MC			
		Rust	Anthracnose	Leaf blight	Zonate Leaf spot
4	Other check: CSH 24 MF	2.4	2.9	4.5	2.0
5	Mean	2.3	3.7	4.9	2.5
6	Minimum	1.5	2.7	4.4	1.5
7	Maximum	4.1	5.6	6.0	4.4
8	CD (0.05)	NS	NS	NS	NS
9	CV (%)	62.7	31.4	18.0	53
10	Most resistance lines < 3 rating	SPH 1695, SPH 1696, SPV 2108, SPV 2107, SPH 1698 (1.5-2)	SPH 1699, CSH 20MF, CSH 24MF, SPH 1696 (2.7-3)	SPH 1695, SPH 1698, SPV 2108, SPH 1699, SPH 1700 (4.4-4.5)	SPV 2107, SPH 1698, SPH 1695, SPV 2108,, SPH 1699, SPH 1700 etc (1.5-2)
11	Most susceptible lines	LC (4.1)	LC (5.6)	LC (6.0)	SSG 59-3 (4.40)
12	Data from locations (no)	2	3	2	3
13	Locations considered for National average (no)	Dharwad, Udaipur	Udaipur, Pantnagar, Surat	Udaipur, Surat	Dharwad, Udaipur, Pantnagar

#### 4.5. Initial & Advanced Varietal & Hybrid Trial (Multi cut)

4.3.1 Rust: The disease was recorded at two centres namely Dharwad and Udaipur (Table 5.2).

Zone II: The disease was recorded at Dharwad. Entries SPH 1695, SPH 1696, were lowest (2) to show rust infection and all other were moderately resistant with highest disease in SPH 1697 (4.7).

Zone III: At Udaipur local check contracted highest disease giving 6.2 and all the other were resistant.

National: Pooled data over the centres showed that entries SPH 1695, SPH 1696, SPV 2108, SPV 2107, SPH 1698 (1.5-2) were resistant to the disease

4.3.2 Zonate leaf spot: The disease was recorded at Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 1.2)

Zone II: At Dharwad SPH 1696 was the only entry showing the resistance (<3). Rest showed moderate resistance and susceptible were CSH 24MF and SPH 1697 showing disease in the range of 5-3-5.7. Significant differences were obtained in test entries.

Zone III: The disease was recorded at Udaipur and Pantnagar. None of the entry was resistant but moderate resistance could be obtained with lowest ratings 3.4 in SPH 1695, SPH 1696 and SPH 1698. Significant differences were obtained in test entries and highest disease was seen in local check.

National: Lowest resistance rating (1.5-2) to zonate leaf spot was recorded in SPV 2107, SPH 1698, SPH 1695, SPV 2108, SPH 1699, SPH 1700 etc. Highest disease could be seen in SSG 59-3 (4.4).

4.1.3 Leaf blight- Leaf blight was recorded at Udaipur and Surat only (Zone III)

Zone III: In Zone III none of test entries showed resistance. Moderate resistance could be obtained in SPH 1695 with lowest disease rating of 4.4. Highest disease could be seen SPH 1696, SPV 2107 and local check (5.2-6.0) and there were no significant differences in test entries.

4.1.4 Anthracnose- Anthracnose was recorded in Zone III (Surat, Udaipur & Pantnagar).

Zone III: In this zone SPH 1699, CSH 20MF, CSH 24 MF and SPH 1696 entries showed resistance (<3). Highest disease was recorded in local check (5.6) (Table 5.2).



#### 4.6. Initial and Advanced Varietal Trial (Single cut)

Single cut forage sorghum trials were evaluated in Zone I (Palem & Coimbatore), Zone II (Akola, Dharwad & Parbhani) and Zone III (Surat Udaipur and Pantnagar) against foliar diseases using 1-9 rating scale. The trial consisted 14 test entries that included two checks HC 308 and CSV 21 F and local check (Table 6.1).

#### All India summary results

No	Trial no Name	6 IAVT- SC			
		Rust	Anthraco	Leaf blight	Zonate Leaf spot
1	Local check	5.4	5.6	5.0	3.9
2	HC 308	2.4	3.8	3.6	3.4
3	CSV 21F	1.7	3.5	3.3	3.7
4	Mean	2.1	3.8	4.0	3.3
5	Minimum	1.5	2.3	2.9	2.5
6	Maximum	5.4	5.6	5.0	3.9
7	CD (0.05)	1.9	1.4	NS	NS
8	CV (%)	39.8	30.6	21.9	20.4
9	Most resistance lines < 3 rating	SPV 2058, SPV 2128, SPV 2127, CSV 21F, SPV 2057 etc (1.5-1.9)	SPV 2129, SPV 2158 (2.2-2.7)	SPV2058 (2.9)	SPV 2058, SPV 2129, SPV 2127, SPV 2026, SPV 2131 (2.5-3.0)
10	Most susceptible lines	LC (5.4)	LC (5.6)		LC (3.9)
11	Data from locations (no)	2	5	3	4
12	Locations considered for National average (no)	Dharwad, Udaipur	Coimbatore, Palem, Udaipur, Pantnagar, Surat	Palem, Udaipur, Surat	Palem, Dharwad, Udaipur, Pantnagar
13	Comment 1				

4.3.1 Rust: The disease was recorded at two centres namely Dharwad and Udaipur (Table 5.2).

Zone II: The disease was recorded at Dharwad. Entries SPV 2058 and SPV 2128 were lowest (2) to show rust infection and all other were moderately resistant with highest (4.3) disease in local check.

Zone III: At Udaipur local check contracted highest disease giving 6.5 and all the other were resistant.

National: Pooled data over the centres showed that entries SPV 2058, SPV 2128, SPV 2127, CSV 21F, SPV 2057 etc (1.5-1.9) were resistant to the disease. Local check recorded highest disease (5.4)

4.3.2 Zonate leaf spot: The disease was recorded at Palem (Zone I), Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 6.2)

Zone I: At Palem all the test entries showed resistance. SPV 2056, SPV 2057, SPV 2058, SPV 2126 etc showed resistance with lowest rating (1).

Zone II: At Dharwad SPV 2127, SPV2131 and SPV 2058 (2.7-3) were the only entries showing the resistance (<3). Highest disease was recorded in CSV 21F and LC (4.3)

Zone III: The disease was recorded at Udaipur and Pantnagar. Entries SPV 2058 and SPV 2129 were resistant (<3) and local check recorded highest disease (5.1).

National: Lowest resistance rating (2.5-3) to zonate leaf spot was recorded in SPV 2058, SPV 2129, SPV 2127, SPV 2026, SPV 2131 considering data from four centres namely Palem, Dharwad, Udaipur, and Pantnagar

4.1.3 Leaf blight- Leaf blight was recorded at Palem (Zone I), Udaipur and Surat only (Zone III)

Zone I: At Palem all the test entries showed resistance except SPV 2126, LC, SPV 2128, SPV 2132 that showed moderate resistance. SPV 2131 and SPV 2127 showed highest disease (4.3-4.7).

Zone III: In Zone III none of test entries showed resistance. Moderate resistance could be obtained in SPV2058 with lowest disease rating of 3.8. Highest disease could be seen SPV 2127, SPV 2132, SPV2126 and local check (5.2-6.2). There were no significant differences between the test entries.

National: Lowest resistance rating (2.9) to leaf blight was recorded in SPV 2058 only. SPV 2129, SPV 2133, SPV 2130, CSV 21F, HC 308, SPV 2057 and SPV 2056 showed moderate resistance considering data from three centres namely Palem, Udaipur, and Surat reporting the disease

4.1.4 Anthracnose- Anthracnose was recorded in Zone I (Coimbatore and Palem) and Zone III (Surat, Udaipur & Pantnagar).

Zone I: In this zone SPV 2129, SPV 2132, SPV 2058 and SPV 2131 showed resistance (<3). Highest disease was recorded in SPV 2057, SPV 2056 and SPV 2130 (5.3-6.5) (Table 6.3).

Zone III : In this zone SPV 2129 and SPV 2058 showed resistance (<3). Highest disease was recorded in SPV 2057 and Local check (4.5-6.7) (Table 6.3).

National: Lowest resistance rating (2.3-2.7) to leaf blight was recorded in SPV 2129 considering data from five centres namely Coimbatore, Palem, Udaipur, Pantnagar and Surat reporting the disease.

#### *Sweet sorghum*

Sweet Sorghum 21 genotypes including 2 checks and one local checks were evaluated in , Zone II (Parbhani and Dharwad) and Zone III (Udaipur, Pantnagar and Surat) against foliar diseases using 1-9 rating scale. Entries scoring less than 3 rating were considered as resistance as there is no standard check to compare resistance (Table 7.1)

#### All India summary results

Trial no	7				
Name	IAVHT-SS				
		Rust	Anthracnose	Leaf blight	Zonate Leaf spot
1	Local check	4.7	4.2	4.7	5
2	CSV19 SS	-	-	-	4.4
3	CSH22SS	-	-	-	4.1
4	Mean	4.0			4.33
5	Minimum	3	3.1	3.5	3.7
6	Maximum	4.7	5.0	4.8	5
7	CD (0.05)	NS	NS	NS	NS
8	CV (%)	52.2	18.1	19.9	11.2
9	Most resistance lines < 3 rating	SPSSV 40, SPV 2134 (3)	None	None	None
10	Next resistance lines		SPSSV 40, SPV 2136, SPV 2074, SPV 2075, SPH 1712 (3.1-3.7)	SPV2074, SPSSV40, SPV 2075, SPH 1669, SPH1712(3.5-3.8)	SPV 2070, SPSSV40,SPV2135,S PH1669,SPH1711 etc (3.7-4)
11	Most susceptible lines	SPV 2075, SPV2135, SPV2074, SPH1713, LC(4.3-4.7)	SPV 1711 , LC, SPH1669,SPV 2135, SPSSV 39 (4.1-5.0)	SPH 1670, SPV2136,SPV2134, LC, SPSV 39 (4.3-4.8)	SPV 2076, SPV 2136, SPV2068, SPV 2069,LC (4.5-5)
12	Data from locations (no)	2	4	3	3
13	Locations considered for National average (no)	Dharwad, Parbhani	Parbhani, Udaipur, Pantnagar, Surat	Parbhani, Udaipur, Surat	Dharwad, Udaipur, Pantnagar

#### 4.7 Initial and Advanced Varietal and Hybrid Trial SS

4.3.1 Rust: The disease was recorded at two centres namely Parbhani and Dharwad and not other places (Table 7.2).

Zone II: The disease was recorded at Parbhani Dharwad. Entries SPSSV 40 and SPV 2134 were lowest (3.0) to show rust infection and highest (4.7) disease in SPH 1713 and local check.

4.3.2 Zonate leaf spot: The disease was recorded at Dharwad (Zone II), Udaipur & Pantnagar (Zone III) (Table 7.3)

Zone II: At Dharwad SPH 1711 and SPV 2070 were the only entries showing lowest moderate resistance (3.3) and all the test entries were moderately resistant to the disease. Highest disease was recorded in SPV 2069 (5.0).

Zone III: The disease was recorded at Udaipur and Pantnagar. Entries SPV 2070 and SPV 2135 were moderately resistant (3.9) showing lowest disease and local check recorded highest disease (5.6).

National: Lowest moderate resistance rating (3.7-4) to zonate leaf spot was recorded in SPV 2070, SPSSV40, SPV2135, SPH1669, SPH1711 etc and no entry was resistant considering data from three centres namely Dharwad, Udaipur, and Pantnagar

4.1.3 Leaf blight- Leaf blight was recorded at Parbhani (Zone II), Udaipur and Surat (Zone III) only (Table 7.2)

Zone II: At Parbhani all the test entries showed resistance and the disease rating ranged from 2 to 2.3.

Zone III: In Zone III none of test entries showed resistance. Moderate resistance with lowest disease (4.0) was SPV 2137. Highest disease could be seen SPSSV 39 and local check (6.1). There were no significant differences between the test entries.

National: Lowest moderate resistance rating (3.5-3.8) to leaf blight was recorded in SPV2074, SPSSV40, SPV 2075, SPH 1669, SPH1712 with no resistance in any test entry considering data from three centres namely Palem, Udaipur, and Surat reporting the disease

4.1.4 Anthracnose- Anthracnose was recorded in Zone II (Parbhani) and Zone III (Surat, Udaipur & Pantnagar).

Zone II: In this zone at Parbhani all the test entries including local check showed resistance (<3) to disease (Table 7.2).

Zone III : In this zone none of the entry showed resistance but SPSSV40, SPH 1713 and SPV 2135 were moderately resistant and showed lowest disease (3.7-4) and. highest disease was recorded in SPSSV 39, CSV19SS and local check (5.7-6.5) (Table 7.2).

National: Lowest moderate resistance rating (3.1-3.7) to anthracnose was recorded in SPSSV 40, SPV 2136, SPV 2074, SPV 2075 and SPH 1712 considering data from four centres namely Parbhani, Udaipur, Pantnagar, Surat reporting the disease.

4.5.8 Target Leaf spot: The disease was recorded at Dharwad and Udaipur only. At Dharwad all the entries were resistant. However at Udaipur SPSSV39 and local check were highly susceptible giving disease rating of 6 to 8.3 and resistant entries were SPSSV40 and SPV 2069 ( Table 7.2).

### 5. Study on variability in anthracnose pathogen using differentials

Variability in sorghum anthracnose pathogen *Colletotrichum graminicola* was studied at Pantnagar. Pathogenic behaviour of five isoates P1 to P5 (Pantnagar) were tested on leaves of twelve differentials varieties namely including locals. Isolates were inoculated at two stages (3 leaf stage and 6 leaf stage) of crop growth.

#### Variability in *Colletotrichum sorghi* on foliage at 3 leaf stage

S. No	Differential	Isolates/severity					Average Susceptibility of Differentials
		P1	P2	P3	P4	P5	
1	PC5	0	35	0	30	0	13.0
2	H112	0	30	44	37	37	29.6
3	SSS21	36	44	48	56	51	47.0
4	PC4	30	37	51	48	48	42.8
5	IS3089	39	30	37	0	37	28.6
6	CSV21F	0	30	0	44	0	14.8
7	PC23	53	51	0	51	48	40.6
8	CSV17	0	33.3	33.3	0	0	13.3
9	PC1002	44.4	0	0	0	30	14.9
10	SSV9	36	0	51	37	44	33.6
11	UP Chari 2	30	30	30	0	44	26.8
12	R. Local	37	44	33.3	0	0	22.9
	Av Severity by isolate	25.5	30.4	27.3	25.3	28.3	
	Cultivar affected	8	10	9	7	9	

#### Variability in *Colletotrichum sorghi* on foliage at 6 leaf stage

S. No	Differential	Isolates/severity					Average Susceptibility of Differentials
		P1	P2	P3	P4	P5	
1	PC5	0	44.4	37	44	30	31.1
2	H112	51	37	56	51	48	48.6
3	SSS21	44.4	64	59	67	61	59.1
4	PC4	59	61	61	61	64	61.2
5	IS3089	56	56	56	37	59	52.8
6	CSV21F	30	48	51	61	44	46.8
7	PC23	72	70	59	67	59	65.4
8	CSV17	37	51	51	44	48	46.2
9	PC1002	56	56	56	44	54	53.2
10	SSV9	56	51	61	59	61	57.6
11	UP Chari 2	48	59	51	37	51	49.2
12	R. Local	59	61	59	44	56	55.8
	Av Severity by isolate	47.4	54.9	54.8	51.3	52.9	
	Cultivar affected	11	12	12	12	12	

Table indicates that isolates differed in causing the disease. At 3 leaf stage isoates P1, P2, P3, P4 and P5 caused disease in 8, 10, 9, 7, and 9 differentials respectively but at 6<sup>th</sup> leaf stage the same isolates caused disease in 11, 12, 12, 12, 12 and 12 differentials. Only one isolate P1 did not cause disease at both the leaf stage in differential PC5. This shows that plant age affects disease causing ability of the *Colletotrichum* and also indicates that plants become more susceptible as the plant becomes old. Activity of isolates also deferred with age of plants. Isolate P2 caused highest severity at both the plant age but not others isolates; P4 caused least severity (25.3) at 3 leaf stage but it was P1 at 6<sup>th</sup> leaf stage (47.4). These differences reflect the variability in *Colletotrichum* isolates.

## Annexure I: Performance of the Centres

		AHT GS&DP	AVT GS&DP	IHT GS&DP	IVT GS&DP	IAVHT MC	IAVT SC	IAVHT SS
1	Parbhani	Y	Y	Y	Y	-	Y	Y
2	Akola	Y	Y	Y	Y	Y	Y	-
3	Dhar	Y	Y	Y	Y	Y	Y	Y
4	Coim	Y	Y	Y	Y	-	Y	-
5	Palem	Y	Y	Y	Y	-	Y	-
6	Surat	Y	Y	Y	Y	Y	Y	Y
7	Pantnagar	Y	Y	Y	Y	Y	Y	Y
8	Udai	Y	Y	Y	Y	Y	Y	Y

Data recd dates- Palem 29/11/2011, Surat 30/11/2011,Dharwad- 03/12/2011,, Coimbatore- 03/12/2011, Pantnagar- 12/12/2011, Akola- 15/12/2011, Parbhani-21/01/2012, Udaipur- 29/11/2011.

## Annexure II: Details of collaborator

Centre	Collaborator, Address
Akola	Prof.HSGahukar, Sorghum Pathologist,Research Unit, Dr. Panjabrao krishi Vidyapeeth Akola Maharashtra -444104
Coimbatore	Dr. Shikumar, Hd AICSIP, 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. Vithoba Mulekar, Pathologist, AICSIP, Marathawada Agriculture University, Parbhani-413722, Maharashtra.
Surat	Dr G R Bhandari, 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 1.1: Diseases along with causal organism under study

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

## Appendix 1.2: 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 (TG): Thread grade is recorded on 1-9 scale.