

Contents

<i>Executive Summary</i>	3
<i>Sorghum Entomology - Detailed report</i>	5
Pest scenario in sorghum	5
1. Shoot fly (<i>Atherigona soccata</i>)	5
Grain sorghum	5
1.1 Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)	6
1.2: Initial Varietal Trial for grain sorghum (IVT-GS)	7
1.3: Initial Hybrid Trial for grain sorghum (IHT-GS)	7
Dual purpose sorghum	8
1.4: Advanced Varietal Trial for dual purpose (AVT-DP)	9
1.5: Initial Varietal Trial for dual purpose (IVT-DP)	9
Forage sorghum (single and multi cut)	10
1.6: Advanced Varietal Trial for forage single cut (AVT-FSC)	11
1.7: Initial Varietal Trial for forage single cut (IVT-FSC)	11
1.8: Advanced Varietal and Hybrid Trial for forage multi cut (AVHT-FMC)	11
1.9: Initial Varietal and hybrid Trial for forage multi cut (IVHT-FMC)	11
Sweet sorghum	12
1.10: Advanced Varietal & Hybrid Trial for Sweet Sorghum (AVHT-SS)	12
Germlasm lines	13
1.11: Testing of advanced germplasm lines for shoot fly resistance (AGP-SF)	14
Shoot fly resistant nursery (SFN) and R lines for shoot fly	14
1.12: Shoot fly resistance nursery (SFN-I)	15
1.13: Shoot fly resistance nursery (SFN-II)	15
R lines for shoot fly resistant (R lines-SF)	16
1.14: R lines for shoot fly resistance (R lines -SF)	16
Pest & disease resistant nursery for shoot fly (PDRN-SF)	16
1.15: Pest and disease resistance for multiple resistance (PDRN)	17
Marker assisted selected progenies for shoot fly resistance (MAS-SF)	17
1.16: Screening of BC2F4 MAS progenies against shoot fly resistance	17
Potential local checks from AICSIP (LC-SF)	18
Presentation across locations and genotypes	18
2. Stem borer (<i>Chilo partellus</i>)	19
Grain sorghum	19
2.1: Advanced Varietal & Hybrid Trial for grain sorghum (AVHT-GS)	20
2.2: Initial Varietal Trial for grain sorghum (IVT-GS)	20
2.3: Initial Hybrid Trial for grain sorghum (IHT-GS)	21
Dual purpose sorghum	21
2.4: Advanced Varietal Trial for dual purpose (AVT-DP)	22
2.5: Initial Varietal Trial for dual purpose (IVT-DP)	22
Forage sorghum (single and multi cut)	23
2.6: Advanced Varietal Trial for forage single cut (AVT-FSC)	23
2.7: Initial Varietal Trial for forage single cut (IVT-FSC)	24

2.8: Advanced Varietal and Hybrid Trial for forage multi cut (AVHT-FMC)	25
2.9: Initial Varietal and hybrid Trial for forage multi cut (IVHT-FMC)	26
Sweet sorghum	27
2.10: Advanced Varietal & Hybrid Trial for Sweet Sorghum (AVHT-SS)	27
Germplasm lines	27
2.11: Testing of advanced germplasm lines for stem borer resistance (AGP-SB)	27
Pest & disease resistant nursery for stem borer (PDRN-SB)	28
2.12: Pest and disease resistance for multiple resistance (PDRN-SB)	28
Stem borer resistance nursery (SBN) - Kharif 2008	28
R lines for stem borer resistant (R lines-SB)	29
2.13: R lines for stem borer resistance (R lines-SB)	29
Presentation across locations and genotypes:	29
3. Head bug (<i>Calocoris angustatus</i> Leth.)	30
Grain sorghum	30
3.1. Advanced varietal and hybrid trial - Kharif 2008	30
3.2. Initial varietal trial - Kharif 2008	30
3.3. Initial hybrid trial- Kharif 2008	31
4. Validation of IPM module	31
4.1. Indore	31
4.2. Parbhani	32
4.3. Palem	32
Annexure-I: Promising entries with less susceptibility to key pests of grain sorghum in different trials	33
Annexure II: Summary of fish meal technique used as a trap for shoot fly screening at AICSIP centers	34
Annexure-III: Compliance report on receipt of shoot fly screening trials data	34
Annexure-IV: Stem borer and other pests trials data-Compliance report	35

7. Sorghum Entomology

Evaluation of sorghum experimental varieties and hybrids for resistance to key pests

Executive Summary

Introduction

Total 10 trials (AVHT, IVT, SFN, SBN, R lines, and local checks) were evaluated for shoot fly, stem borer and other pests for resistance at the hot spot locations mainly Dharwad, Palem, Parbhani, Akola, Indore, Surat, and Udaipur. In northern part there was early heavy rains, resulted water logging and affected germination. Overall the shoot fly incidence was moderate to high and stem borer was low to moderate.

Pest scenario in sorghum

Delay in south-west monsoon in Tamil Nadu caused late planting and mite infestation. PSV -1 was mostly planted in Mahboobnagar district of Andhra Pradesh. In Dharwad district of Karnataka there was high infestation of stem borer (35%). In Parbhani, Nanded, Hingoli, Akola district of Maharashtra high damage of shoot fly was recorded (60%). JK 22, CSH 16, Proagro Mahindra, PVK 809, and Mahyco 51 were found mostly grown by the farmers. Due to heavy monsoon rains farmers could not plant crop in time in Bundelkhand area of Madhya Pradesh. Low incidence of shoot fly was observed. In Gujarat, Surat district, the shoot fly incidence was high 40-83% and stem borer was ranged from 20-62%. Mostly CSV 17, SPV 1616, and CSV 23 were grown in Udaipur and Chittorgarh district of Udaipur. The incidence of shoot fly was moderate (<25%).

Shoot fly

General trend: The shoot fly incidence was moderate to high (45-95%) at Dharwad, Parbhani, Akola, Indore, Surat and Udaipur under artificial conditions. Delay in application of fish meal at Palem centre was resulted in low incidence of shoot fly (11.2 - 50.9%). The centers those who did not place fishmeal traps are: Coimbatore, Kanpur, Hisar and Ludhiana, since these centers are not hot spot for shoot fly infestation

Grain sorghum: In AVHT, AHT and AVT, none of the test entries found better than resistant check IS 2312. The entries SPV 1817, SPH 1604, SPH 1605, SPV 462, SPH 1611 SPH 1596, and SPH 1615 recorded low oviposition in AVHT (GS). In IVT (GS) entries SPV 1875, SPV 1874 and SPV 1880 were recorded moderate deadhearts (57.6 to 59.6 %) and in IHT (GS) the entries SPH 1642, SPH 1638, SPH 1646, SPH 1641, SPH 1628, and SPH 1629 recorded moderate deadhearts (< 65%).

Dual-purpose sorghum: In AVT, and IVT, none of the test entries found better than resistant check IS 2312. The entries SPV 1779, SPV 1782, SPV 1871, SPV 1873, and SPV 1862 found relatively moderate level shoot fly infestation but not better than resistant check.

Forage (single-cut): In AVT, the entries SPV 1848, SPV 1849, SPV 1852, and SPV 1853 recorded < 40% deadheart and on par with resistant check 2312. In IVT (forage single cut) none of the experimental varieties found resistant to shoot fly damage.

Forage (multi cut): In AVHT, the entries SPH 1624, SPV 1842, and local checks of respective centers were found relatively lower shoot fly infestation (<47.4%) than others with an average of 45.4 % which was on par with resistant check IS 2312 (23.0 %). In IVHT (multi cut) only SPV 1840 performed better (37.0 % DH) which was on par with resistant check IS 2312 (22.1 %).

Overall conclusions:

The three years data of shoot fly revealed that Dharwad, Parbhani, Akola and Udaipur centre may be considered for hot spot for shoot fly screening.

Looking ahead:

Newly sanctioned centre Jalna may be considered for shoot fly screening being in the heart of sorghum growing area both in Kharif and Rabi season.

Stem borer

General trend: The stem borer incidence was moderate to high (15-45 %). The highest damage was noticed at Coimbatore. At Kanpur, Hisar and Ludhiana very low to moderate population was observed, At Hisar and Ludhiana the initial rainfall was high, and hence could not germinated properly. The trial materials at these centers were evaluated for stem borer resistance (Annexure I).

Grain Sorghum: In AVHT: CSV 17, SPH 1605, SPH 1609, SPH 1604, CSH 16, SPH 1611, In IVT SPV 1874, SPV 1875, CSV 15 and in IHT CSH 16, SPH 1629 were found <10%v stem borer damage.

Dual Purpose: sorghum: In AVT: SPV 1781, SPV 1722, CSV 15, and IVT Local check, SPV 1870, SPV 1864 found less susceptible .

Forage (single-cut) : The entries SPVs 1845, 1846, 1847, 1848, 1849, 1851, 1853, CSV 21 F, HC 308, local check in AVT and in IVT the entries SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, and local check) found better/

Forage (multi-cut): In AVHT : SPH 1625, SPH 1626, SPH 1627, SPV 1844, SSG 59-3, and local check and IVHT the entries SPH 1622, and local check found lower stem borer damage.

Overall conclusions:

The data was not properly recorded due to early heavy rains in Zone-III (Hisar, Ludhiana) as a result, poor germination was recorded.

Looking ahead:

There is need to concentrate in northern region for stem borer screening.

Validation of IPM

An IPM module was evaluated at three locations (Palem, Parbhani and Indore). Intercropping sorghum with pulses, with seed treatment of Thiomethoxam (Cruiser) @ 3g/kg of seeds, followed by an application of enosulfan (0.07%) or NSKE (5%) at 30 and 45 DAE was found cost effective as well as reduced shoot fly and stem borer damage significantly.

Sorghum Entomology - Detailed report

Pest scenario in sorghum

Tamil Nadu: Very low infestation (< 5%) of shoot fly was observed. Stem borer infestation (25-30%) was moderate. Delay in south-west monsoon and poor rains resulted in delay of sorghum plantings. Late rains caused mealy bugs incidence (< 30%) in Coimbatore.

Andhra Pradesh: Mid-June planted PSV1 was planted in most of these areas. There was moderate infestation of shoot fly 20-45% while stem borer infestation was moderate to high (20-60 % DH) in Mehboobnagar district. The dry spell experienced incidence of sugarcane aphids and head bug in scattered forms.

Karnataka: In Dharwad district, the incidence of shoot fly ranged from 12.5 to 24.3% deadheart. The per cent damage due to stem borer ranged from 15.8 to 34.4% with an average of 26.7%.The population of armyworm, head bug and ear midge were negligible during the cropping season. The incidences of *Helicoverpa armigera* and *Stenochroia elongella* were moderate.

Maharashtra Total 124 farms have been surveyed in Parbhani, Nanded, Latur and Hingoli district. In Parbhani district, shoot fly dead hearts (10-60 %) stem borer (<7%) and 1-7 % of shoot bug incidence was recorded. In Akola region, heavy infestation (30-50%) of shoot fly was observed. Mostly JK 22, CSH 16, Proagro Mahindra, PVK 809 , and Mahyco 51 were cultivated by the farmers.

Madhya Pradesh: In Indore, most of crops were damaged due to heavy rains at initial stages. However, the infestation of shoot fly was moderate (20%). In Bundelkhand area, there was heavy rainfall during June-July, hence most of farmers could not sow the crop, while those who have planted has been vitiated.

Gujarat: In Deesa district of Gujarat, moderate to heavy incidence of (40-65%) shoot fly and stem borer, low infestation (< 10 %) of midge was recorded. White grub incidence was moderate during mid-June. In Surat district, the shoot fly incidences was high 40-83% and stem borer was ranged from 20-62%. The incidence of mite and *Pyrilla* was slight, sporadic and partial. The other pest incidence was negligible.

Rajasthan In Udaipur and Chittorgarh the shoot fly (5-25 %), stem borer (<10%), and shoot bug (3-7 %) infestation was recorded. The head bug population was low 4-5 scale. Most of the popular varieties: CSV 17, SPV 1616, and CSV 23 were grown by the farmers.

1. Shoot fly (*Atherigona soccata*)

Grain sorghum

The grain sorghum materials in three trials (24 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for shoot fly resistance under forced conditions by placing fish meal traps to attract shoot fly for uniform infestation. The shoot fly infestation were measured in number of deadhearts at 28 DAE at Palem, Coimbatore in zone-I, Parbhani, Akola, Dharwad, Indore, Surat in zone -II and Udaipur, Kanpur in zone III.

Table with summary results

No	Trial no	1	2	3	Comments
	Name	AVHT (GS)	IVT (GS)	IHT (GS)	
1	Res. check :IS 2312	36.8	31.8	31.2	
2	Res. check :IS 18551	38.1	39.4	35.9	
3	Res. check :IS 2205	40.7	39.1	34.1	
4	Res. check :ICSV 705	38.9	Not tested	Not tested	
5	Sus. check : DJ 6514	84.3	83.0	82.0	
6	Local check	61.6	62.6	70.3	

No	Trial no Name	1 AVHT (GS)	2 IVT (GS)	3 IHT (GS)	Comments
7	Other check: CSH 16	73.3	Not tested	73.6	
8	Other check: CSH 23	71.8	Not tested	65.8	
9	Other check: CSV 15	70.6	61.9	Not tested	
10	Other check :CSV 17	68.4	64.6	Not tested	
11	Other. check: SPV 462	70.0	60.9	Not tested	
12	Mean	66.3	60.1	64.2	
13	Minimum	36.8	31.8	31.2	
14	Maximum	84.3	83.0	82.0	
15	CD (0.05)	11.1	11.2	10.4	
16	CV (%)	13.3	16.3	14.2	
17	Most resistance lines (on par with IS 2312)	Nil	Nil	Nil	No resistant found
18	Next resistance lines (= trial mean)	2	6	5	
19	Most susceptible lines (on par with DJ 6514)	CSH 16, SPH 1604, SPH 1606, SPH 1610, SPH 1611, SPH 1616	SPV 1877	SPH 1631, CSH 16, SPH 1640	On par with susceptible check
20	Selected lines (value: on par with IS 2312)	Nil	Nil	Nil	No resistance found
21	Selected lines (value: = trial mean)	Local check (61.6), SPV 1817 (63.6)	SPV 1874 (58.3), SPV 1875 (58.3), SPV 1876 (57.6), SPV 1880 (59.6), SPV 462 (60.9), SPV 1881 (61.0)	SPH 1642 (60.4), SPH 1638 (62.5), SPH 1646 (62.7), SPH 1641 (63.5), SPH 1629 (64.1)	These lines need to be retested for its confirmation
22	Data from locations (no)	9	9	9	
23	Locations considered for national average (no)	5	6	6	Palem, Indore need to strengthen for shoot fly screening
24	Comment 1				
25	Comment 2				

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

The trial comprised of 24 entries includes 19 test varieties, three resistant checks, (1S 18551, 1S 2312, and 1S 2205), one susceptible check (DJ6514) and one local checks from respective centre.

Shoot fly deadhearts at 28 DAE: The shoot fly deadhearts at 28 DAE was recorded at Palem, Coimbatore, in zone-I, Parbhani, Akola, Dharwad, Indore, Surat in zone -II and Udaipur, Kanpur in zone III (Table 1.1).

Zone-I: The data from Palem and Coimbatore could not be considered due to low infestation in susceptible check (<70%). This may be because of no or untimely application of fish meal particularly at Palem, whereas Coimbatore centre has very low natural infestation (<40% in susceptible check).

Zone-II: All locations except Indore recorded > 70% deadhearts in susceptible check. Across the location and genotypes the deadhearts recorded 40.4 to 83.5%. Across the locations (except Surat), none of the entries were on par with resistant check; however the local check recorded 65% deadhearts. At Dharwad, the highest range of deadhearts (47.4 to 93.4%) recorded with an average of 74.0% and followed by Parbhani, (55-95.6%) with highest mean deadheart 83.9%. At Indore, lowest mean of shoot fly damage (46.2%) was recorded. At Akola, shoot fly damage range was 14.8-84.2% with average 63.8 % deadheart. In Surat, SPH 1605, CSH 16, SPV 1616, CSH 23, SPH 1615, and SPV 1786 and local check recorded < 57 % DH and are comparable with resistant check IS 2312 (34.5% DH)

Zone-III: Udaipur and Kanpur reported shoot fly infestation. Udaipur centre recorded highest shoot fly infestation in susceptible check 87.5% in DJ 6514. At Kanpur the percentage was low 8.8 to 36.4 % with a mean of 14.4%. The susceptible check recorded < 70% DH and hence did not consider for discussion. None of the test entries performed better or equal than resistant check. Across the locations none of the entries performed better than resistant check.

National level: None of the test entries found better than resistant check (Table 1.1).

Shoot fly oviposition: The entries SPV 1817, SPH 1604, SPH 1605, SPV 462, SPH 1611 SPH 1596, and SPH 1615 recorded lowest oviposition (<2.3 eggs/plant) are equal to IS 2312 (1.5 eggs/ plant). However the CV is higher than 30% (Table 1.2).

1.2: Initial Varietal Trial for grain sorghum (IVT-GS)

The trial comprised of total 22 entries (17 test entries, one local check, three resistant checks (IS 2312, IS 18551, IS 2205), and one susceptible check (DJ6514) and one local check from respective centre.

Shoot fly deadhearts at 28 DAE: The shoot fly deadhearts at 28 DAE was recorded at Palem, Coimbatore, in zone-I, Parbhani, Akola, Dharwad, Indore, Surat in zone -II and Udaipur, Kanpur in zone III (Table 2.1).

Zone-I: The data from Palem and Coimbatore could not be considered due to low infestation (<70%) in susceptible check.

Zone-II: All locations recorded > 70% shoot fly deadhearts in susceptible check (DJ 6514). Across the locations the deadhearts ranged was 35.8 to 83.0% with an average of 61.2%. Across the locations (except Parbhani and Indore), none of the entries were on par with resistant check (IS 2312). At Dharwad, the highest range of deadhearts (57.0 to 98.3 %) was recorded with an average of 69.3 % and followed by Parbhani, (52.5-81.7.6%) with highest mean deadheart 81.7.9%. At Indore, lowest mean of shoot fly damage (45.3%) was recorded. Across the location in zone-II, the entries SPV 1874, SPV 1875, SPV 1876, SPV 1880, and SPV 462 recorded moderate deadhearts (58.1-61.9%).

Zone-III: Two centers (Udaipur and Kanpur) reported shoot fly infestation at 28 DAE. Udaipur centre recorded highest shoot fly infestation in susceptible check 83.1% in DJ 6514 with a range of 11.5 to 83.6%, whereas, at Kanpur the percentage was low (38.2 %) in DJ 6514 with a mean of 14.6%. None of the test entries performed better or equal than resistant check. Across the locations none of the entries performed better than resistant check.

National level: The entries SPV1875, SPV 1874 and SPV 1880 were recorded moderate deadhearts (57.6 to 59.6 %) however, none of the test entries were better than resistant check (Table 2.1)

Shoot fly oviposition: Only Palem centre recorded oviposition. The CV was high (>30%). The entries SPV 1874, local check (PSV 2), SPV 1881, SPV 1882, SPV 1885, SPV 462, and SPV 1886 recorded lowest oviposition (< 2 eggs/plant) and are comparable with resistant check IS 2312 (1.3 eggs/plant) (Table 2.2).

1.3: Initial Hybrid Trial for grain sorghum (IHT-GS)

The trial comprised of total 27 entries with 22 experimental hybrids, one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514). The data on shoot fly deadhearts were recorded Coimbatore (zone-I), Parbhani, Akola, Indore and Surat (zone-II) and Udaipur (zone-III).

Shoot fly deadhearts at 28 DAE: The shoot fly deadhearts at 28 DAE was recorded at Palem, Coimbatore, in zone-I, Parbhani, Akola, Dharwad, Indore, Surat in zone -II and Udaipur, Kanpur in zone III (Table 3.1).

Zone-I: The data from Palem and Coimbatore could not be considered due to low deadhearts in susceptible check (<70%) at 28 DAE.

Zone-II: All locations recorded > 70% deadhearts in susceptible check except Indore. Across the location the deadhearts recorded 31.2-82.0%. Across the locations (Akola and Indore), none of the entries were on par with resistant check. At Dharwad, the highest range of deadhearts (60 to 93.5) recorded with an average of 75.8 % and followed by Parbhani, (47.5-90.3%) with mean deadheart 76.0%. At Indore, lowest mean of shoot fly damage (50.0%) was recorded. The entries SPH 1646, SPH 1638, SPH 1641, SPH 1642 recorded CSH 23, and SPH 1628 recorded <65% deadhearts.

Zone-III: Two centers (Udaipur and Kanpur) reported shoot fly infestation at 28 DAE. Udaipur centre recorded highest shoot fly infestation in susceptible check 75.5 % in DJ 6514 with a range 9.5 -77.5 %. At Kanpur the percentage was low 9.9 to 45.8 % with a mean of 18.1%. None of the test entries performed better or equal than resistant check. Across the locations none of the entries performed better than resistant check.

National level: None of the test entries found better than resistant check. The deadhearts ranged was 31.2 to 82% with an average of 64.2%. The entries SPH 1642, SPH 1638, SPH 1646, SPH 1641, SPH 1628, and SPH 1629 recorded < 65% DH (Table 3.1).

Shoot fly oviposition: Only Palem centre recorded oviposition. The CV was high (>30%). The entries SPH 1630, 1631, 1632, 1634, 1635, 1636, 1638, CSH 16, SPH 1639, SPH 1567, 1640, SPH 1567, 1642, and SPH 1644 recorded lowest oviposition (<1.6 eggs/plant) and are on par to IS 18551 (1.3 eggs/plant) (Table 3.2).

Conclusion:

1. The three years data of shoot fly revealed that Dharwad, Parbhani, Akola and Udaipur centre may be considered for hot spot for shoot fly screening.
2. None of the test entries were performed better or equal than resistant check IS 2312 at 28 DAE.
3. Only Akola centre recorded shoot fly deadhearts at 14 DAE.

Follow-up for Kharif 2009

1. The promising entries SPV 1817, SPH 1604, SPH 1605, SPV 462, SPH 1611 SPH 1596, and SPH 1615 showed low oviposition preferences in AVHT (GS) may be suggested for further antibiosis studies.
2. The entries SPH 1605, CSH 16, SPV 1616, CSH 23, SPH 1615, and SPV 1786 performed significantly better than other test entries at Surat may be used at Surat for further development and testing programme.
3. The Dharwad, Parbhani, Akola and Udaipur centre may be considered for hot spot for shoot fly screening and further studies may be intensified on shoot fly at these centers.

Dual purpose sorghum

The dual purpose sorghum materials in two trials (14 entries in AVT and 21 entries in IVT) were evaluated for shoot fly resistance under forced conditions by placing fish meal traps to attract shoot fly for uniform infestation. The data on shoot fly deadhearts were recorded at Coimbatore (zone-I), Dharwad, Rahuri, Akola, and Surat (zone-II) and Kanpur (zone-III).

Table with summary results

No	Trial no Name	1 AVT (DP)	2 IVT (DP)	Comments
1	Res. check :IS 2312	34.9	25.3	
2	Res. check :IS 18551	35.4	29.2	
3	Res. check :IS 2205	34.9	34.4	
4	Res. check :ICSV 705	34.0	32.0	
5	Sus. check : DJ 6514	84.6	83.3	
6	Local check	60.3	55.0	Check from Rahuri may be utilized for crossing programme.
7	Other check :CSV 15	66.3	63.2	
8	Other check :CSV 23	65.0	63.9	
9	Mean	56.9	58.6	
10	Minimum	34.0	25.3	
11	Maximum	84.6	83.3	
12	CD (0.05)	16.4	13.8	
13	CV (%)	20.2	18.7	
14	Most resistance lines (on par with IS 2312)	Nil	Nil	No resistance to shoot fly
15	Next resistance lines (= trial mean)	1	2	
16	Most susceptible lines (on par with DJ 6514)	Nil	SPV 1868 (70.0)	
17	Selected lines (value: on par	Nil	Nil	No resistance to shoot fly

No	Trial no Name	1 AVT (DP)	2 IVT (DP)	Comments
	with IS 2312)			
18	Selected lines (value: = trial mean)	SPV 1782 (58.6)	SPV 1873 (53.7), Local check (55.0)	Moderate resistant to shoot fly
19	Data from locations (no)	6	7	
20	Locations considered for national average (no)	4	5	
21	Comment 1			
22	Comment 2			

1.4: Advanced Varietal Trial for dual purpose (AVT-DP)

The trial comprised of total 14 entries with 6 experimental varieties, two commercial checks (CSV 15, CSV 23), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded Coimbatore (zone-I), Dharwad, Rahuri, Akola, and Surat (zone-II) and Kanpur (zone-III) (Table 4.1).

Zone-I: The data from Coimbatore could not be considered due to low infestation (<70%) in susceptible check.

Zone-II: All locations recorded > 70% shoot fly deadhearts in susceptible check (DJ 6514). Across the locations and genotypes, the deadhearts ranged was 34.0 to 84.6% with an average of 56.9%. None of the entries were on par with resistant check (IS 2312) at Rahuri and Akola. The entries SPV 1820, 1781, and local check were found at par with resistant check at Dharwad. The highest range of deadhearts (54.0 to 90.0 %) was recorded with an average of 71.3 % at Dharwad. At Parbhani the entry SPV 1779 was equally good as that of resistant check. The range was 31.9- 75.4% with an average of 48.7 % at Surat. Across the locations and genotypes in zone-II, none of the entries found superior to equal to resistant check.

Zone-III: Kanpur center reported low shoot fly infestation at 28 DAE (10.9-39.0 %). The percentage was very low (39.0 %) in DJ 6514 with a mean of 16.9%. Hence could not be considered for discussion.

National level: None of the test entries found better than resistant check. The entries SPV 1782 and local checks were recorded moderate deadhearts (58.6 to 60.3 %) (Table 4.1)

1.5: Initial Varietal Trial for dual purpose (IVT-DP)

The trial comprised of total 21 entries with 13 experimental varieties, two commercial checks (CSV 15, CSV 23), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded Coimbatore (zone-I), Dharwad, Rahuri, Akola, and Surat (zone-II), and Udaipur, Kanpur (zone-III) (Table 5.1).

Zone-I: The data from Coimbatore could not be considered due to low infestation (<70%) in susceptible check. The range was 0.0 to 42.9%.

Zone-II: All locations recorded > 70% shoot fly deadhearts in susceptible check (DJ 6514). Across the locations and the genotypes, the deadhearts ranged was 28.1 to 84.2% with an average of 59.2%. The entries SPV 1864 and SPV 1873 and local check were on par with resistant check (IS 2312) at Rahuri, but the CV was high (>30%). The entries CSV 23, SPV 1865, and SPV 1871 were found at par with resistant check at Dharwad. The entries SPV 1862, SPV 1873 and CSV 15 had relatively lower deadhearts at Surat. Across the locations and genotypes in zone-II, none of the entries found superior to equal to resistant check.

Zone-III: Kanpur center reported low shoot fly infestation at 28 DAE (10.9-39.0 %). The percentage was very low (46.5 %) in DJ 6514 with a mean of 21.4%. Hence could not be considered for discussion. At Udaipur, none of the entries were lower or equal to resistant check. The range of infestation was 14.1 to 79.6 with a mean of 56.4%. This was also hold true with across the location in zone II.

National level: None of the test entries found better than resistant check. The entries SPV 1873 and local checks were recorded moderate deadhearts (55.9 to 53.7 %) (Table 5.1)

Conclusion:

1. None of the test entries were performed better or equal than resistant check IS 2312 at 28 DAE.
2. Only Akola centre recorded shoot fly deadhearts at 14 DAE.

Follow-up for Khairif 2009:

1. The promising entries SPV 1782 and local checks may be promoted for further testing programme in AVT (DP)
2. The entries SPV 1873 may be considered for promotion for advanced Varietal trial.

Forage sorghum (single and multi cut)

The forage sorghum (single and multi cut) in four trials comprised of 16 entries in AVT -single cut, 14 entries in IVT-single cut, 14 entries in AVHT-multi cut and 12 entries in IVHT-multi cut trial. These materials were evaluated for shoot fly resistance under forced conditions by placing fish meal traps to attract shoot fly for uniform infestation. The data recorded at Coimbatore, Surat, Udaipur, Kanpur, and Ludhiana.

Table with summary results

No	Trial no	1	2	3	4	Comments
	Name	AVT (F-SC)	IVT (F-SC)	AVHT (M-SC)	IVHT(M-SC)	
1	Res. check :IS 2312	24.5	21.9	24.0	22.1	
2	Res. check :IS 18551	21.7	19.0	23.0	24.4	
3	Res. check :IS 2205	19.5	23.7	22.3	26.3	
4	Sus. check : DJ 6514	77.0	78.9	78.8	81.9	
5	Local check	42.0	42.1	32.7		Local checks from Surat and Udaipur may utilized for crossing
6	Other check: CSV 21F	43.1	47.9	Not tested	Not tested	
7	Other check: HC 308	38.2	45.6	Not tested	Not tested	
8	Other check: SSG 59-3	Not tested	Not tested	47.8	58.4	
9	Other check :CSH 20 MF	Not tested	Not tested	57.8	55.0	
10	Mean	39.7	45.3	45.4	47.2	
11	Minimum	19.5	19.0	22.3	22.1	
12	Maximum	77.0	78.9	78.8	81.9	
13	CD (0.05)	17.9	23.8	23.1	18.2	
14	CV (%)	21.2	24.3	23.6	17.5	
15	Most resistance lines (on par with res check)	4	1	1	1	
16	Next resistance lines (= trial mean)	Nil	Nil	Nil		No resistance
17	Most susceptible lines (on par with DJ 6514)	Nil	Nil	Nil		No resistance
18	Selected lines (value: on par with res check)	SPV 1852 (27.9), SPV 1853 (29.4), SPV 1849 (35.4), SPV 1848 (37.1)	Local check (42.1)	SPH 1624, SPV 1842, and local checks	SPV 1840 (37.0)	Need to retested for shoot fly
19	Selected lines (value: = trial mean)	Nil	Nil	Nil	Nil	No resistance
20	Data from locations (no)	5	5	5	5	
21	Locations considered for national average (no)	2	2	2	2	
22	Comment 1					
23	Comment 2					

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

The trial comprised of total 16 entries with 9 experimental varieties, two commercial checks (CSV 21F, HC 308), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Coimbatore, Surat, Udaipur, Kanpur, and Ludhiana (Table 6.1).

National level: The data from Coimbatore, Kanpur and Ludhiana could not consider due to low shoot fly infestation in susceptible check (<70%). Hence, the highlight of results has been discussed on the basis of two qualified centers viz, Udaipur and Surat. The shoot fly infestation range in these centers was 14.5 to 80.1 % with an average of 39.7%. But at both the centre, the CV was lower than 25%. The entries SPV 1848, SPV 1849, SPV 1852, and SPV 1853 recorded < 40% deadheart and on par with resistant check IS 2312. The resistant check recorded 24.5 % DH (Table 6.1).

1.7: Initial Varietal Trial for forage single cut (IVT-FSC)

The trial comprised of total 14 entries with 7 experimental varieties, two commercial checks (CSV 21F, HC 308), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Coimbatore, Surat, Udaipur, Kanpur, and Ludhiana (Table 7.1).

National level: The data from Coimbatore, Kanpur and Ludhiana could not consider due to low shoot fly infestation in susceptible check (<70%). Hence, the highlight of results has been discussed across the zones and genotypes on the basis of two qualified centers (Udaipur and Surat). The shoot fly infestation range in these centers was 19.0 to 78.9 % with an average of 45.3%. Only local checks of respective centers were found relatively low to moderate shoot fly infestation (9.9 to 45.5 %) with an average of 42.1 % which was on par with resistant check IS 2312 (19.0 %). None of the experimental varieties found resistant to shoot fly damage (Table 7.1).

1.8: Advanced Varietal and Hybrid Trial for forage multi cut (AVHT-FMC)

The trial comprised of total 14 entries with 4 experimental hybrids, 3 experimental varieties, two commercial checks (CSH 20F, SSG 59-3), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Coimbatore, Surat, Udaipur, Kanpur, and Ludhiana (Table 8.1).

National level: The data from Coimbatore, Kanpur and Ludhiana could not consider due to low shoot fly infestation in susceptible check (<70%). Hence, the highlight of results has been discussed at national level on the basis of two qualified centers (Udaipur and Surat). The shoot fly infestation range in these centers was 15.4 to 86.3 % with an average of 45.4%. The entries SPH 1624, SPV 1842, and local checks of respective centers were found relatively lower shoot fly infestation (<47.4%) with an average of 45.4 % which was on par with resistant check IS 2312 (23.0 %). None of the other experimental varieties/hybrids performed better than resistant check (Table 8.1).

1.9: Initial Varietal and hybrid Trial for forage multi cut (IVHT-FMC)

The trial comprised of total 12 entries with 2 experimental hybrids, 2 experimental varieties, two commercial checks (CSH 20F, SSG 59-3), one local check, four resistant checks (IS 18551, IS 2512, IS 2205, ICSV 705) and one susceptible check (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Coimbatore, Surat, Udaipur, Kanpur, and Ludhiana (Table 9.1).

National level: The data from Coimbatore, Kanpur and Ludhiana could not consider due to low shoot fly infestation in susceptible check (<70%). Hence, the highlight of results has been discussed across the zones

and genotypes on the basis of two qualified centers (Udaipur and Surat). The shoot fly infestation range in these two centers was 12.1 to 83.3 % with an average of 47.2%. Only SPV 1840 performed better (DH 37.0%) which was on par with resistant check IS 2312 (22.1 %). None of the other experimental varieties/hybrids performed better than resistant check (Table 9.1).

Conclusions

1. None of the centre recorded shoot fly deadhearts at 14 DAE.
2. None of the experimental varieties found resistant to shoot fly damage in IVT (single cut forage).

Follow-up for Kharif 2009:

1. The entries SPV 1848, SPV 1849, SPV 1852, and SPV 1853 in AVT (single cut), SPH 1624, SPV 1842, in AVHT (multi cut forage) and SPV 1840 in IVHT (multi cut forage) may be considered for further testing.
2. The local checks from Surat and Udaipur may be suggested for further use in breeding for shoot fly resistance and may be further tested rigorously for shoot fly resistance at hot spot locations.

Sweet sorghum

The sweet sorghum advanced varieties and hybrids (24 entries) were evaluated for shoot fly resistance under forced conditions by placing fish meal traps to attract shoot fly for uniform infestation. The data on shoot fly deadhearts were recorded at Rahuri, Akola, and Surat (zone-II).

Table with summary results

No	Trial no Name	1 AVHT (SS)	Comments
1	Res. check :IS 2312	21.9	
2	Res. check :IS 18551	23.7	
3	Res. check :IS 2205	21.9	
4	Res. check :ICSV 705	21.4	
5	Sus. check : DJ 6514	83.1	
6	Local check	45.4	
7	Other check: SSV 84	52.1	
8	Other check :RSSV 9	41.9	
	Other check :CSH 22SS	60.8	
9	Mean	50.8	
10	Minimum	21.4	
11	Maximum	83.1	
12	CD (0.05)	19.5	
13	CV (%)	23.3	
14	Most resistance lines (on par with IS 2312)	2	
15	Next resistance lines (= trial mean)	3	
16	Most susceptible lines (on par with DJ 6514)	5	
17	Selected lines (value: on par with IS 2312)	SPSSV 27 (34.4%), SPSSV 34 (36.3%)	May be utilized for crossing program for shoot fly
18	Selected lines (value: = trial mean)	RSSV 9 (41.9%), SPSSV 37 (45.2%), Local checks (45.4%)	Moderate resistant to shoot fly
19	Data from locations (no)	3	
20	Locations considered for national average (no)	3	
21	Comment 1		
22	Comment 2		

1.10: Advanced Varietal & Hybrid Trial for Sweet Sorghum (AVHT-SS)

The trial comprised of total 24 entries, (8 varieties, 7 hybrids, three commercial checks, one local check, four resistant checks (IS 2312, IS 18551, IS 2205, ICSV 705) and one susceptible check (DJ 6514). The trial was conducted at three locations Rahuri, Akola, Surat.

Shoot fly deadhearts at 28 DAE The data on shoot fly deadhearts were recorded at Rahuri, Akola, Surat (Table 14.1). The shoot fly deadhearts at Rahuri ranged from 14.8 – 90.9 %, the mean being 45.6 %. The entry ICSV 705, local check recorded damage less than the resistant checks (IS 2312 and IS 2205). The entries SPSSV 27, SPSSV 34 and SPSSV 37 were on par with resistant check IS 2312.

At Akola, deadhearts ranged from 18.4 - 85.3 %, the mean being 61.7 % indicating high infestation. The entry ICSV 705 was on par with the resistant checks IS 2312 and 18551. The entry ICSV 705 recorded damage less than the resistant checks (IS 2312, IS 18551, IS 2205). The entries, SPSSV 34, SPSSV 32, RSSV 9, SSV 84, SPSSV 27 and SPSSH 26 were on par with resistant checks.

The shoot fly deadhearts at Surat ranged from 29.2 - 78.1 % with mean damage of 45.1 %. The entry ICSV 705 recorded damage less than the resistant checks (IS 2312). The data was not considered as infestation in DJ 6514 was below 70 % DH.

National level: The mean damage was 50.8 % with range of 21.4 - 83.1 %. The entry ICSV 705 was better than checks IS 2312, IS 2205 and IS 18551. The entries SPSSV 27 and SPSSV 34 were on par with resistant check, IS 2312 (Table 10.1).

Conclusion: The entries SPSSV 27, SPSSV 34 were on par with resistant checks IS 2312, IS 2205 and IS 18551.

Follow-up for Kharif 2009:

1. The two promising varieties (SPSSV 27, SPSSV 34) may be utilized in breeding programme of sweet sorghum for shoot fly resistance.
2. The check from Rahuri RSE 03 may be utilized for its potential for further use.

Germplasm lines

One trial for confirmation of shoot fly resistance comprised of total 21 entries having 15 germplasm lines, 1 pop line, 1B line, 1 local check, two resistant checks (IS 2312, IS 18551) and one susceptible check (DJ 6514). The trial was conducted at three locations Hyderabad, Dharwad and Udaipur. The second trial consists of 178 new germplasm lines, evaluated at three locations Dharwad, Parbhani and Akola for collecting preliminary data on shoot fly resistance levels.

Table with summary results

No	Trial no	1	2	Comments
	Name	GP advanced lines	GP new lines	
1	Res. check :IS 2312	54.4		
2	Res. check :IS 18551	58.6		
3	Res. check :IS 2205	No		
4	Res. check :ICSV 705	No		
5	Sus. check : DJ 6514	80.8		
6	Local check	45.3		
7	Other check	Nil		
8	Other check	Nil		
10	Mean	55.6		
11	Minimum	40.1		
12	Maximum	80.8		
13	CD (0.05)	18.6		
14	CV (%)	20.3		
15	Most resistance lines (on par with IS 2312)	7		
16	Next resistance lines (= trial mean)	5		
17	Most susceptible lines (on par with DJ 6514)	3		
18	Selected lines (value: on par with IS 2312)	EP 58, EP 60, EP 94, EP 117, EP 133, POP 52, Local check		
19	Selected lines (value: = trial mean)	EP 57, EC 8, EC 19, EC15, EC 19		
20	Data from locations (no)	3		
2	Locations considered for national average (no)	3		

No	Trial no Name	1	2	Comments
		GP advanced lines	GP new lines	
22	Comment 1			
23	Comment 2			

1.11: Testing of advanced germplasm lines for shoot fly resistance (AGP-SF)

A trial for confirmation of shoot fly resistance consists of total 21 entries having 15 advanced germplasm lines, one pop line, one B line, one local check, two resistant checks (IS 2312, IS 18551) and one susceptible check (DJ 6514). The trial was conducted at three locations Hyderabad, Dharwad and Udaipur. The deadhearts at 28 DAE was recorded at Dharwad and Udaipur. At Hyderabad, the DH was recorded at 14, 21 and 28 DAE along with glossiness, vigor and oviposition.

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Hyderabad, Dharwad, and Udaipur (Table 11.1). The shoot fly deadhearts at Hyderabad ranged from 43.8 – 80.5 %, the mean being 58.9 %. The entries EP 60, EP-133, EP-117, E-25, EC-15, EP-94, Local check, E-73, EC19, EC-12 recorded damage less than the resistant check (IS 2312).

At Dharwad, deadhearts ranged from 1.0 – 91.5 %, the mean being 57.1 %. The entries EP-94, EC-19, E-73, EC-12, EC-15, EP-60 recorded damage less than the resistant check (IS 2312). The shoot fly deadhearts at Udaipur ranged from 1.0 - 87.9 % with mean damage of 50.9 %. The entries, E-73, EP-133, E-117, Local check, POP-52, E-77, EP-57, EC-13, EP-94, EP-58, EP-60, EP-128, EC-19 recorded damage less than the resistant checks (IS 2312).

National level: The mean damage was 55.6 % with range of 1.0 – 80.8 %. The entries, E-73, EP-133, EP-94, EP-117, POP-52, EC-19, EC-15 were better than check IS 2312 (Table 11.1).

Conclusion: The entries, E-73, EP-133, EP-94, EP-117, POP-52, EC-19, EC-15 was superior to resistant check (IS 2312).

Follow-up for Kharif 2009: The germplasm lines E-73, EP-133, EP-94, EP-117, POP-52, EC-19, and EC-15 may be utilized for breeding program for developing new resistant sources for shoot fly.

Shoot fly resistant nursery (SFN) and R lines for shoot fly (Group efforts of Entomologist & Breeder)

Table with summary results

No	Trial no Name	1 SFNI	2 SFNI	3 R lines-SF	Comments
1	Res. check :IS 2312	52.1	48.6	22.6	
2	Res. check :IS 18551	Not tested	46.7		
3	Res. check :IS 2205	Not tested	Not tested		
4	Sus. check : DJ 6514	73.4	71.5	57.1	
5	Local check	53.1	Not tested	33.8	
6	Mean	62.9	59.2	57.4	
7	Minimum	52.1	35.6	22.6	
8	Maximum	73.4	76.5	85.1	
9	CD (0.05)	13.2	35.0	28.8	
10	CV (%)	12.9	33.7	25.0	
11	Most resistance lines (on par with IS 2312)	7	3	4	
12	Next resistance lines (= trial mean)	8	4	6	
13	Most susceptible lines (on par with DJ 6514)	2	1	7	
14	Selected lines (value: on par with IS 2312)	(< 60%) = Local check, NRCSFR08-3, NRCSFR08-NRCSFR08-8, NRCSFR08-	(< 60%) = NRCSFR07-5, SUENT 13, SUENT 14	(<45%DH) = ICSR 18, ICSR 89045, ICSR 90034, ICSR	

No	Trial no Name	1 SFN-I	2 SFN-II	3 R lines-SF	Comments
		SUENT-8, PGN-111		93004	
15	Selected lines (value = trial mean)	(61-65%)= SUENT 19, PUGL 9, NRCSFR08-7, SF-1308-R07, SF 1303R07, NRCSFR08-1, P- 45 , NRCSFR08-6	NRCSFR07-4, CSV 15, SUENT 15, SPV 1616	(46-50% DH)= CSV 15, SPV 1616, , ICSR 90017, ICSR 108, ICSR 42, ICSR 33	
16	Data from locations (no)	3	3	2	
17	Locations considered for national average (no)	3	3	2	
18	Comment 1				
19	Comment 2				

1.12: Shoot fly resistance nursery (SFN-I)

The trial comprised of total 30 entries with 27 lines, one each local, resistant (IS 2312) and susceptible checks (DJ 6514). The trial was conducted at three locations Hyderabad, Parbhani and Indore. Shoot fly deadheart data was recorded at 14, 21 and 28 DAE.

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Hyderabad, Parbhani and Indore (Table 13.1). The shoot fly deadhearts at Hyderabad ranged from 31.5-73.4 %, the mean being 50.7 %. None of the entries were better than check (IS 2312). The entries NRCSFR 08-5, NRCSFR 08-3, SUENT 19 and SF1307-R 07, SUENT 20, NRCSFR08-2, CSV 15, SF-1303R07, NRCSFR08-7, NRCSFR08-8, SUENT-16, PUGL-9 AND PGN 39 were on par with resistant check IS 2312 and the damage ranged from 33.2 – 51.8% . At Parbhani, deadhearts ranged from 63.2 – 91 %, the mean being 80.7 % indicating high infestation. The entries CSV 15(LC), NRCSFR08-8, P-45, NRCSFR08-6, NRCSFR08-3, NRCSFR08-5, NRCSFR08-2, SF-1308-R07, PGN-111, PUGL-9 recorded less damage than resistant check (IS 2312) with damage of 63.2 - 79.3 % DH (Table 12.1).

The shoot fly deadhearts at Indore ranged from 42.7 – 71.9 % with mean damage of 57.3%. The entry NRCSFR08-1 was better than check. The entries SUENT 20, PGN 111 and NRCSFR08 were on par with resistant check (IS 2312).

National level: The mean damage was 62.9% with range of 52.1 – 73.4 %. None of the entries were better than resistant check (IS 2312). The entries CSV 15, NRCSFR08-8, NRCSFR08-3, and NRCSFR08-2 were on par with the resistant check and top entries (Table 12.1).

Conclusion: The entries Local check, NRCSFR08-8, NRCSFR08-3, NRCSFR08-2 were on par with the resistant check (IS 2312).

Follow-up for Kharif 2009: The entries, NRCSFR08-8, NRCSFR08-3, and NRCSFR08-2 may be utilized further for breeding for shoot fly resistance programme.

1.13: Shoot fly resistance nursery (SFN-II)

The trial comprised of total 12 entries with 10 varietal lines, two resistant (IS 2312) and one susceptible checks (DJ 6514). The trial was conducted at three locations Hyderabad, Parbhani and Indore. Shoot fly deadheart data was recorded at 14, 21 and 28 DAE.

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Hyderabad, Parbhani and Indore (Table 14.1). The shoot fly deadhearts at Hyderabad ranged from 30.7-72.2 %, the mean being 45.8 %. None of the entries were better than check (IS 2312). The entries SPV 1616, NRCSFR07-5, IS 18551, ICSV 705, SUENT-14, SUENT-15 and CSV 15 were on par with resistant check IS 2312 and the damage ranged from 33.5 – 43.8%.

At Parbhani, deadhearts ranged from 65.1 – 90.9 %, the mean being 78.8 % indicating high infestation. The entries NRCSFR07-5, NRCSFR07-4 were better than the resistant checks IS 2312 and 18551. The entries ICSV 705, SUENT-14, SUENT-15 were on par to resistant checks (Table 13.1).

The shoot fly deadhearts at Indore ranged from 38.7- 83.3 % with mean damage of 53.5 %. The data was not considered as infestation in DJ 6514 was below 70% DH.

National level: the mean damage was 59.2% with range of 35.6 – 76.5 %. None of the entries were better than resistant check (IS 2312). The entries NRCSFR07-5, SUENT-13, SUENT-14 recorded less damage and were on par with resistant checks (IS 2312, IS 18551) (Table 13.1).

Conclusion: No remarkable differences noticed between the entries.

Follow-up for Kharif 2009: It revealed that resistant levels may be increased through group efforts of entomologist and breeder. NRCSFR07-5, SUENT 13, and 14 found better than other entries.

R lines for shoot fly resistant (R lines-SF)

1.14: R lines for shoot fly resistance (R lines-SF)

The trial comprised of total 48 entries. It includes 43 experimental lines, two resistant (IS 2312), one susceptible checks (DJ 6514), one commercial check, SPV 1616, and one local check. The trial was conducted at three locations Palem and Hyderabad. Shoot fly deadheart data was recorded at 28 DAE at these locations.

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Hyderabad and Palem (Table 15.1). The shoot fly deadhearts at Palem ranged from 7.2-95.2 % but had high CV. At Hyderabad, the range was 38.1 to 97.6 % with the mean being 67.4 %. Half of the entries recorded < 60% deadhearts and were on par with resistant check (IS 2312) but not better than check. The entries CSV 15, ICSR 90017, ICSR 89045, and ICSR 33 recorded <50% deadhearts (Table 14.1). The data on 21 and 14 DAE was recorded on deadhearts % but had high CV >35% and hence could not considered.

National level: The entries CSV 15, SPV 1616, ICSR 93004, ICSR 90017, ICSR 90034, ICSR 89045, ICSR 108, ICSR 42, ICSR 33, and ICSR 18 recorded <50% deadhearts and found on par with resistant check (Table 14.1).

Pest & disease resistant nursery for shoot fly (PDRN-SF)

The collaborative efforts of Entomology and Pathology have initiated from 2007 to search multi-trait resistant lines. The trial comprised of total 15 entries with 6 disease resistant, 4 pest resistant, one each resistant and susceptible check from respective discipline and one local check. 12 experimental varieties, one each local, resistant (IS 2312) and susceptible checks (DJ 6514). The trial was conducted at three locations: Dharwad, Parbhani and Udajpur

Table with summary results

No	Trial no	1	Comments
	Name	PDRN-SF	
1	Res. check :IS 2312	60.2	
2	Sus. check : DJ 6514	84.1	
3	Local check	66.7	
4	Mean	69.2	
5	Minimum	55.4	
6	Maximum	84.1	
7	CD (0.05)	19.4	
8	CV (%)	13.1	
9	Most resistance lines (on par with IS 2312)	5	
10	Next resistance lines (= trial mean)	2	

No	Trial no	1	Comments
	Name	PDRN-SF	
11	Most susceptible lines (on par with DJ 6514)	1	
12	Selected lines (value: on par with IS 2312)	(<65%) = NRCSFR06-1, GMRP 109, GMRP 12, SUENT 9, NRCSFR06-2	NRCSFR06-1 may be registered as a resistant source for shoot fly.
13	Selected lines (value: = trial mean)	(66-70%) Local check, GMRP 90	
14	Data from locations (no)	3	
15	Locations considered for national average (no)	3	
16	Comment 1		
17	Comment 2		

1.15: Pest and disease resistance for multiple resistance (PDRN)

The trial comprised of total 10 experimental entries, one each local, resistant (IS 2312) and susceptible checks (DJ 6514).

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Parbhani and Dharwad (Table 15.1). The shoot fly deadhearts at Parbhani ranged from 52.4 - 94.7 %, the mean being 69.7 % indicating very high levels of infestation. The entries NRCSFR 06-1, NRCSFR 06-2 were on par with resistant check IS 2312 (Table 15.1). At Dharwad across the genotypes, the deadhearts ranged was 56.2 to 80.6 % with an average of 56.2 %. The entries local check, GMRP 109 and NRCSFR 06-1 were on par with resistant check (IS 2312).

National level: The entry NRCSFR 06-1(55.4% DH) was better than the resistant check while GMRP 109, GMRP 12 and SUENT 9 were on par with resistant check. (Table 15.1)

Conclusion: Among the entries, NRCSFR 06-1 was better than resistant check IS 2312 against shoot fly and stem borer

Follow-up for Kharif 2009: NRCSFR 06-1 has found promising lines against shoot fly for three consequently season had suggested that it may be registered as potential source for shoot fly resistant

Marker assisted selected progenies for shoot fly resistance (MAS-SF)

The trial was conducted at three locations viz., (Zone-I: Hyderabad, Zone-II: Dharwad and Parbhani) and the material was planted around third week of July to first week of August 2008 involving a total 32 entries (23 BC₂F₄ MAS progenies, 3 resistant checks, 1 susceptible check, 1 local check, 2 RILs and 2 susceptible recurrent parents. The entries were evaluated in two-row plots with three replications against shoot fly using fish meal technique. The observations were recorded on number of shoot fly eggs per 5 plants at Dharwad, Hyderabad, Parbhani; no. of plants with eggs (%) at Parbhani; and deadhearts (%) at Dharwad, Parbhani and Hyderabad at 14, 21-, and 28- days after emergence (DAE).

1.16: Screening of BC₂F₄ MAS progenies against shoot fly resistance

(material contributed by Parbhani centre)

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts were recorded at Parbhani, Hyderabad and Dharwad (Table 16.1). The shoot fly deadhearts at Hyderabad ranged from 39.8- 78.8 with an average of 60.8%, At Parbhani the range was from 37.1 -77.2 %, the mean being 58.8 % and at Dharwad, the DH % ranged was from 37.8 – 91.7% with an average of 61.2% indicating moderate levels of infestation as compared to previous season especially at Parbhani. The entries NRCSFR 06-1, NRCSFR 06-2 were on par with resistant check IS 2312 (Table 16.1).

Table 16.1 shows that there the resistant check (ICSV 705, IS 2312 and IS 18551 recorded 46-54% deadhearts, while susceptible check (DJ 6514) showed 71.6 % deadhearts. The recurrent parents 20B and KR 192 were susceptible to shoot fly damage and recorded 56-60% deadhearts (Table 16.1).

MAS 1061-2, MAS 1061-4, MAS 1062-1, MAS 1062-3, MAS 1076-1, MAS 1261-3 at Hyderabad, MAS 1061-4, MAS 1261-3, MAS 1264-2, MAS 1264-3, at Parbhani were found to be at par with resistant checks at 5% level, while at Dharwad, no significant differences were recorded amongst the lines, while IS 2312 a resistant check itself recorded 67.5% deadhearts.

Across locations: The MAS progenies of 20B viz., MAS 1061-1, MAS 1061-4, MAS 1061-5, MAS 1076-1, MAS 1083-1 and MAS 1261-3 recorded lower infestation and were at par with resistant check at 5% (Table 16.1).

Potential local checks from AICSIP (LC-SF)

The trial was conducted at seven locations viz., (Zone-I: Hyderabad, Palem, Coimbatore, Zone-II: Parbhani), Akola, Indore and Zone-III: Udaipur. The material was planted around third week of July to first week of August 2008 involving a total 10 entries (6 potential local checks collected from Coimbatore (COS 28), Dharwad (CSV 15), Parbhani (PVK 809), Indore (JJ 1041), Surat GJ 38), and Udaipur (CSV 17). The checks thus collected from local areas were evaluated with a view to identify potential resistance sources for further use in breeding program.

Shoot fly deadhearts at 28 DAE: The data on shoot fly deadhearts recorded was found non significant at Coimbatore, Indore, and Udaipur (Table 17.1). The shoot fly deadhearts at Palem was ranged from 13.9 - 65.4% with an average of 31.6%, while at Hyderabad, it was ranged from 34.5- 73.6%, with an average of 58.7%. At Parbhani, the average deadhearts was highest (76.8%) and the second highest was at Indore. In all Zones, the data was non significant across the locations and genotypes. While at National level, CSV 15 recorded lowest deadhearts (43.7%) across the locations and genotypes and on par with resistant check IS 2312 at 28 DAE (Table 17.1).

Shoot fly deadhearts at 14 DAE: Only two locations (Akola and Hyderabad) were recorded deadhearts at 14 DAE. CSV 15 and SPV 1616 recorded lower deadhearts (< 32%) and on par with resistant check IS 2312 (Table 17.1).

Oviposition: There were no significant differences in oviposition among the entries (Table 17.2).

Presentation across locations and genotypes

Grain sorghum: In AVHT, AHT and AVT, none of the test entries found better than resistant check IS 2312. In IVT, SPV 1875, SPV 1874 and SPV 1880 were recorded moderate deadhearts (57.6 to 59.6 %) and in IHT (GS) the entries SPH 1642, SPH 1638, SPH 1646, SPH 1641, SPH 1628, and SPH 1629 recorded moderate deadhearts (< 65%).

Dual-purpose sorghum : In AVT, and IVT, none of the test entries found better than resistant check IS 2312. The entries SPV 1779, SPV 1782 in AVT and SPV 1871, SPV 1873, SPV 1862 in IVT found relatively moderate level shoot fly infestation but not better than resistant check.

Forage (single-cut): In AVT, the entries SPV 1848, SPV 1849, SPV 1852, and SPV 1853 recorded < 40% deadheart and on par with resistant check 2312. In IVT (forage single cut) none of the experimental varieties found resistant to shoot fly damage.

Forage (multi cut): In AVHT, the entries SPH 1624, SPV 1842, and local checks of respective centers were found relatively lower shoot fly infestation (<47.4%) than others with an average of 45.4 % which was on par with resistant check IS 2312 (23.0 %). In IVHT (multi cut) only SPV 1840 performed better (37.0 % DH) which was on par with resistant check IS 2312 (22.1 %).

Location effects:

- The three years data of shoot fly revealed that Dharwad, Parbhani, Akola and Udaipur centre may be considered for hot spot for shoot fly screening.

- The Palem centre needs to review for screening under artificial condition for shoot fly resistance.
- The checks from Surat (GJ 38), Indore (JJ 1941) and Udaipur (CSV 17) found good for shoot fly and may be utilized for breeding for insect resistance.

Accuracy of experiments: Most of these trials have been sown late to attract shoot fly incidence. The fish meal traps were placed either delay (Palem) or did not exercise (Kanpur and Coimbatore) resulted low incidence of shoot fly. Kanpur and Coimbatore may be considered for stem borer screening only.

What materials should be advanced as shoot fly resistance?

1. AVHT (GS) : CSH 16, SPH 1604, SPH 1606, SPH 1610, SPH 1611, SPH 1616
2. IVT (GS) : SPV 1875, SPV 1874, SPV 1880.
3. IHT (GS) : SPH 1642, SPH 1638, SPH 1646, SPH 1641, SPH 1628, SPH 1629
4. AVT (DP) : SPV 1779, SPV 1782
5. IVT (DP) : SPV 1871, SPV 1873, SPV 1862
6. AVT (Forage-SC) : SPV 1848, SPV 1849, SPV 1852, SPV 1853
7. IVT (Forage-SC) : Local check
8. AVHT (Forage-MC) : SPH 1624, SPV 1842, and local checks
9. IVHT (Forage-MC) : SPV 1840
10. SFN-I : CSV 15, NRCSFR08-8, NRCSFR08-3, NRCSFR08-2
11. SFN-II : NRCSFR07-5, SUENT-13, SUENT-14
12. PDRN (SF) : NRCSFR 06-1
13. R lines –SF : ICSR Nos. 93004, 90017, 90034, 89045, 108, 42, 33, 18
14. MAS-SF : MAS 1061-1, MAS 1061-4, MAS 1061-5, MAS 1076-1, MAS 1083-1, MAS 1261-3

2. Stem borer (*Chilo partellus*)

Grain sorghum

The grain sorghum materials in three trials (24 entries in AVHT, 22 entries in IVT, and 27 entries in IHT) were evaluated for stem borer under natural conditions. The stem borer infestation were measured in number of deadhearts at 45 DAE at Palem, Coimbatore in zone-I, Dharwad, Indore in zone -II and Udaipur, Kanpur in zone III. The observations were recorded on stem borer dead hearts (%), leaf injury damage (%), leaf injury level (1-9) and peduncle damage (%).

Table with summary results

No	Trial no Name	1 AVHT (GS)	2 IVT (GS)	3 IHT (GS)	Comments
1	Res. check :IS 2312	11.2	8.8	10.5	
2	Res. check :IS 18551	8.8	9.7	9.4	
3	Res. check :IS 2205	11.8	9.2	10.9	
4	Res. check :ICSV 705	8.3	NIL	NIL	
5	Sus. check : DJ 6514	17.3	19.3	20.7	
6	Local check	10.8	10.1	12.2	
7	Other check: CSH 16	8.4	Not tested	9.0	
8	Other check: CSH 23	10.5	Not tested	16.8	
9	Other check: CSV 15	10.6	9.5	Not tested	
10	Other check :CSV 17	6.5	10.5	Not tested	
11	Other. check: SPV 462	12.4	11.1	Not tested	
12	Mean	10.4	11.9	13.1	
13	Minimum	6.5	8.5	9.0	
14	Maximum	17.4	19.2	20.7	
15	CD (0.05)	6.2	6.6	7.8	
16	CV (%)	51.9	48.3	52.2	

No	Trial no Name	1 AVHT (GS)	2 IVT (GS)	3 IHT (GS)	Comments
17	Most resistance lines (on par with IS 2312)	6	3	2	
18	Next resistance lines (= trial mean)	4	2	6	
19	Most susceptible lines (on par with DJ 6514)	1	1	1	
20	Selected lines (value: on par with IS 2312)	(< 10%)= CSV 17, SPH 1605, SPH 1609, SPH 1604, CSH 16, SPH 1611	(< 10%)= SPV 1874, SPV 1875, CSV 15	(< 10%)= CSH 16, SPH 1629	
21	Selected lines (value: = trial mean)	(10-12 %)= CSH 23, SPH 1610, Local check, SPH 1615	(10-12%)= SPV 17, SPV 1886	(10-12 %)= SPH 1638, SPH 1633, SPH 1644, SPH 1641, SPH 1628, SPH 1632,	
22	Data from locations (no)	6	6	6	
23	Locations considered for national average (no)	6	6	6	

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

The data on stem borer deadhearts at 45 DAE was recorded at Palem, Coimbatore, in zone-I, Dharwad and Indore in zone -II and Udaipur, Kanpur in zone III. The data on stem borer leaf injury (scale 1-9) was recorded at Palem, Coimbatore and Udaipur, whereas, the data on stem borer leaf injury plants (%) was recorded at Palem, Coimbatore, in zone-I, Akola in zone -II and Udaipur in zone III.. Only Palem and Akola centre has recorded the data on peduncle damage (%).

Stem borer deadhearts (%) at 45 DAE: The damage recorded at Palem was ranged from 8.7 to 45%, however, the data was not significant. At Coimbatore, CSV 17 (2.9 %), SPH 1604, SPH 1605, SPH 1609 and local check (COS 2) performed even better (2.9 to 11.1%) than or equal to resistant, check IS 2205 (8.8 %). At other locations no good performance was observed against stem borer. At national level, SPH 1605, SPH 1609 and local check seems to good but not significantly superior than resistant check. At Dharwad centre the susceptible check recorded 1.5 % DH due to stem borer (Table 1.3).

Stem borer leaf injury to plants (%): The data could not be considered due to high CV in all locations (> 25%), (Table 1.2).

Stem borer leaf injury rating (1-9): The injury range was 1.0 to 6.7 with an average of 3.1 in the scale of 1-9. Across the location and genotypes the entries SPV 1817, SPH 1609, CSV 15, CSH 16 and SPV 1786 received (< 2.6) lowest injury (Table 1.3).

Peduncle damage plants (%): The promising entries at national level are SPH 1604, SPH 1609, SPH 1610, SPV 462, Local Check, SPH 1611, SPH 1596, SPH 1615, and SPH 1616 (Table 1.2). At Akola the peduncle damage was highest that ranged 29.1 to 69.5%.

2.2: Initial Varietal Trial for grain sorghum (IVT-GS)

The data on stem borer deadhearts at 45 DAE was recorded at Palem, Coimbatore, in zone-I, Dharwad and Indore in zone -II and Udaipur, Kanpur in zone III. The data on stem borer leaf injury (scale 1-9) was recorded at Palem, Coimbatore and Udaipur, whereas, the data on stem borer leaf injury plants (%) was recorded at Palem, Coimbatore, in zone-I, Akola in zone -II and Udaipur in zone III.. Only Palem and Akola centre has recorded the data on peduncle damage (%).

Stem borer deadhearts (%) at 45 DAE: At Palem, all the entries except SPV 1885 and DJ 6514 were on par with resistant check but CV % is >25%.The differences in damages recorded at Coimbatore was significant. The entries SPV 174, SPV 1875, CSV 15, and SPV 1882 recorded lowest stem borer deadhearts (<10.4%) and found on par with resistant check IS 2312 (7.0%). Local check COS2 and PSV 2 performed better in Zone I (Table 2.3). In Zone II, the entries SPV 1880, CSV 15, CSV 17, SPV 462, SPV 1874, SPV 1875 showed lower deadhearts due to stem borer (<8.0%). In Zone -III, the stem borer damage was <13.0%. All most all entries

were on par with resistant checks except SPV 1879, SPV 1877 and DJ 6514 in Zone-III. Across the locations and genotypes at National level, all entries significantly recorded lowest deadhearts except SPV 1877 and SPV 1885 (Table 2.3).

Stem borer leaf injury to plants (%): The data could not be considered due to high CV in all locations (> 25%), (Table 2.2).

Stem borer leaf injury rating (1-9): The injury range was 1.0 to 7.0 with an average of 3.3 in the scale of 1-9. Across the location and genotypes the entries SPV 181880, local check, CSV 15, CSV 17, SPV 1884, SPV 1885, SPV 1886, and SPV 462 received < 3.0 injury rating (Table 2.3).

Peduncle damage Plants (%): There were no significant differences in peduncle damage % due to stem borer between the genotypes and across the locations at Akola and Palem (Table 2.2).

2.3: Initial Hybrid Trial for grain sorghum (IHT-GS)

The data on stem borer deadhearts at 45 DAE was recorded at Palem, Coimbatore, in zone-I, Dharwad and Indore in zone -II and Udaipur, Kanpur in zone III. The data on stem borer leaf injury (scale 1-9) was recorded at Palem, Coimbatore and Udaipur, whereas, the data on stem borer leaf injury plants (%) was recorded at Palem, Coimbatore, in zone-I, Akola in zone -II and Udaipur in zone III.. Only Palem and Akola centre has recorded the data on peduncle damage (%).

Stem borer deadhearts (%) at 45 DAE The CV was high (>25%) at Palem, Dharwad, Indore and Udaipur. Across the zones all the entries except SPH 1648 found on par with resistant check.(Table 3.3).

Stem borer leaf injury to plants (%): The data could not be considered due to high CV in all locations (> 25%), (Table 3.2).

Stem borer leaf injury rating (1-9): The injury range was 2.2 to 7.0 with an average of 3.4 in the scale of 1-9. Across the location and genotypes there were no significant differences due to leaf injury rating (Table 3.3).

Peduncle damage Plants (%): There were no significant differences in peduncle damage % due to stem borer between the genotypes and across the locations at Akola and Palem (Table 3.2). Akola centre recorded highest peduncle damage plants than Palem.

Dual purpose sorghum

The dual purpose sorghum materials in two trials (14 entries in AVT and 21 entries in IVT) were evaluated for stem borer resistance under natural conditions The data on stem borer deadhearts were recorded at Coimbatore (zone-I), Dharwad (zone-II) Udaipur and Kanpur (zone-III). The observations were recorded on stem borer dead hearts (%), leaf injury damage (%), leaf injury level (1-9) and peduncle damage (%).

Table with summary results

No	Trial no Name	1		Comments
		AVT (DP)	2 IVT (DP)	
1	Res. check :IS 2312	12.7	14.1	
2	Res. check :IS 18551	9.7	14.6	
3	Res. check :IS 2205	11.7	11.7	
4	Res. check :CSV 705	8.3	12.2	
5	Sus. check : DJ 6514	21.1	21.8	
6	Local check	10.1	9.9	
7	Other check: CSV 15	8.1	17.1	
8	Other check :CSV 23	13.3	14.2	
9	Mean	11.2	14.2	
10	Minimum	7.3	9.9	
11	Maximum	21.1	21.8	
12	CD (0.05)	16.0	11.5	

13	CV (%)	75.1	57.1
14	Most resistance lines (on par with IS 2312)	3	3
15	Next resistance lines (= trial mean)	2	1
16	Most susceptible lines (on par with DJ 6514)	1	1
17	Selected lines (value: on par with IS 2312)	(<10%) = SPV 1781, SPV 1722, CSV 15,	(<11%) = Local check, SPV 1870, SPV 1864,
18	Selected lines (value: = trial mean)	(<12%) = SPV 1823, SPV 1779	(<12%) = SPV 1866
19	Data from locations (no)	4	4
20	Locations considered for national average (no)	4	4
21	Comment 1		
22	Comment 2		

2.4: Advanced Varietal Trial for dual purpose (AVT-DP)

The trial comprised of total 14 entries with 6 experimental varieties, two commercial checks (CSV 15, CSV 23), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE: The damage recorded at Coimbatore was ranged from 6.6 to 55.2 %. The entries SPV 1782 and SPV 1822 found low damage and comparable with resistant check IS 2205. At Dharwad, the CV was high 56.6%. It was surprisingly noticed that DJ 6514 the susceptible check had lowest stem borer damage and resistant check had highest damage at Dharwad. At Udaipur, the damage was very low (3.7 to 7.2%) whereas, at Kanpur, the damage was ranged from 8.9 -14.7% SPV 1822 recorded lowest deadhearts.

National level: All entries except DJ 6514 were on par with resistant check IS 2205. SPV 1822, CSV 15, SPV 1781 were recorded <10% DH due to stem borer (Table 4.2).

Stem borer leaf injury to plants (%): The data could not be considered due to high CV in all three locations (> 25%), (Table 4.2).

Stem borer leaf injury rating (1-9): Only two centers have recorded leaf injury rating. The injury range was 1.0 to 4.33 with an average of 2.54 in the scale of 1-9 across the location. There were no significant differences between the treatments (Table 4.2).

Peduncle damage plants (%): Only Akola centre has recorded peduncle damage which was moderate to high (23.7- 54.4%). The data could not be considered due to high CV (42.8%), (Table 4.2).

2.5: Initial Varietal Trial for dual purpose (IVT-DP)

The trial comprised of total 21 entries with 13 experimental varieties, two commercial checks (CSV 15, CSV 23), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE

The damage recorded at Coimbatore was ranged from 6.6 to 55.2 %. The entries SPV 1863, SPV 1864, and SPV 1866 found low damage and comparable with resistant check IS 2205. At Dharwad, the CV was high 77.4%. It was surprisingly noticed that DJ 6514 the susceptible check had far lower stem borer damage than resistant check. At Udaipur, the damage was very low (4.1 to 8.1%) and all entries were on par with IS 2205. At Kanpur, the damage was ranged from 9.7 -17.8%. Only one entry, SPV 1861 has recorded lowest deadhearts (<10%) and on par with resistant check IS 18551. Across the centers in zone -III, the range was very narrow 7.7 to 12.0 % and did not differ significantly to each other (Table 5.2).

National level: All entries except DJ 6514 were on par with resistant check IS 2205 (Table 5.2).

Stem borer leaf injury to plants (%): The data could not be considered due to high CV in all three locations (> 25%), (Table 5.2).

Stem borer leaf injury rating (1-9): Only two centers recorded leaf injury rating. The injury range was 1.0 to 4.67 with an average of 2.54 in the scale of 1-9 across the locations. There were no significant differences between the treatments (Table 5.2).

Peduncle damage plants (%): Only Akola centre has recorded peduncle damage which was moderate to high (19.0- 56.4%). The data could not be considered due to high CV (35.7%).

Forage sorghum (single and multi cut)

The forage sorghum (single and multi cut) in four trials comprised of 16 entries in AVT -single cut, 14 entries in IVT-single cut, 14 entries in AVHT-multi cut and 12 entries in IVHT-multi cut trial. These materials were evaluated for stem borer resistance under natural conditions by planting early to enable the attack of stem borer for infestation. The data recorded at Coimbatore, Udaipur, Kanpur, Hisar, and Ludhiana. The observations were recorded on stem borer damage (%) at 45 DAE, leaf injury damage (%) and leaf injury level (1-9).

Table with summary results

No	Trial no	1	2	3	4
	Name	AVT (F-SC)	IVT (F-SC)	AVHT (M-SC)	IVHT (M-SC)
1	Res. check :IS 2312	9.5	21.9	24.1	22.0
2	Res. check :IS 18551	9.7	19.0	23.0	24.0
3	Res. check :IS 2205	8.1	23.7	22.3	26.3
4	Sus. check : DJ 6514	20.2	78.9	78.8	81.9
5	Local check	11.5	42.1	32.7	51.1
6	Other check: CSV 21F	13.5	47.9	-	-
7	Other check: HC 308	13.4	45.6	-	-
8	Other check: SSG 59-3	-	-	47.8	60.3
9	Other check :CSH 20 MF	-	-	57.8	55.0
10	Mean	13.4	45.3	45.4	47.2
11	Minimum	8.1	19.0	22.3	22.1
12	Maximum	20.2	78.9	78.8	81.9
13	CD (0.05)	7.5	23.8	23.1	18.2
14	CV (%)	43.9	33.2	32.3	17.5
15	Most resistance lines (on par with res check)	10	7	6	2
16	Next resistance lines (= trial mean)	-	-	-	-
17	Most susceptible lines (on par with DJ 6514)	-	-	-	-
18	Selected lines (value: on par with res check)	SPVs 1845, 1846, 1847, 1848, 1849, 1851, 1853, CSV 21 F, HC 308, and local check)	SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, and local check	SPH 1625, SPH 1626, SPH 1627, SPV 1844, SSG 59-3, and local check	SPH 1622, and local check
19	Selected lines (value: = trial mean)	-	-		
20	Data from locations (no)	5	5	5	5
21	Locations considered for national average (no)	5	2	2	2
22	Comment 1				
23	Comment 2				

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

The trial comprised of total 16 entries with 9 experimental varieties, two commercial checks (CSV 21F, HC 308), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE In Zone-I. at Coimbatore, SPV 1848 recorded lowest stem borer deadhearts (8.7%) and found on par with IS 2205. None of the other entries was significantly superior to

resistant check. In Zone-III, at Hisar, the stem borer deadhearts (%) ranged from 18.3 to 35.0 with an average of 27.0%. No entry other than local check (SSG 59-3) stood equal to resistant check IS 2205. At Kanpur, the range was 10.0 to 16.9 % with an average of 13.1%. All entries except SPV 1846 found on par with IS 2205. However, the entries SPV1852, SPV 1848, local check (Mauti) and SPV 1853 recorded <13% deadhearts. At Ludhiana, the deadhearts % was very low (0.0- 5.3%) and the CV was very high > 25%). At Udaipur, the range was 3.7 – 7.9 %. The entries SPV 1845, SPV 1849, SPV 1850, SPV 1851, HC 308, and SPV 1853 had lower damage (<6.5%) and noticed on par with resistant check IS 2205. Across the centers, in Zone –III, the stem borer damage was ranged 8.4 – 14.6% with an average of 12.2% (Table 6.2).

National level: Ten lines (SPVs 1845, 1846, 1847, 1848, 1849, 1851, 1853, CSV 21 F, HC 308, and local check) had recorded <15% deadhearts and found on par with resistant check IS 2205 (Table 6.2).

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 3.65 – 10% and mean was 6.86%. The entries SPV 1849, SPV 1848 and CSV 21F recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 2.16 % and it ranged from 0.01 – 13.3%. The CV was high (> 30%), hence comparison could not be made (Table 6.1).

National level: The mean damage was 4.5% and damage range was 1.8 – 10.5%. The entries SPV 1848, SPV 1847 recorded damage on par with resistant check (IS 2205).

Stem borer leaf injury rating (1-9): The stem borer leaf injury rating on 1-9 scale was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 3.0 – 4.3 and mean was 3.4. The entries Local check, SPV 1853, HC 308, SPV 1852 and SPV 1849 recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 1.17 and it ranged from 1.0- 2.33 (Table 6.2). Except susceptible check all entries were on par to resistant check (IS 2205).

National level: The mean damage was 2.3 and damage range was 2.0 - 2.83. The entries CSV 21F, Local check, SPV 1853, HC 308, and SPV 1852 recorded damage on par with resistant check (IS 2205).

Conclusion: The entries, SPV 1845, SPV 1847, SPV 1848 and local check recorded low stem borer damage across the genotypes and locations.

2.7: Initial Varietal Trial for forage single cut (IVT-FSC)

The trial comprised of total 14 entries with 7 experimental varieties, two commercial checks (CSV 21F, HC 308), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE

In Zone-I. at Coimbatore, SPV 1854 and CSV 21F recorded lowest stem borer deadhearts (<10%) and found on par with IS 2205. None of the other entries was significantly superior to resistant check. In Zone-III, at Hisar, the stem borer deadhearts (%) ranged from 19.3 to 33.7 with an average of 26.6%. No entry other than local check (SSG 59-3) stood equal to resistant check IS 2205. At Kanpur, the range was 9.80 to 17.2 % with an average of 12.7%. The entries SPV 1855, SPV 1858, SPV 1859 HC 308, Mauti, and CSV 21F found on par with IS 2205. The local check recorded lowest deadhearts % than resistant check. At Ludhiana, the deadhearts % was very low (0.0- 6.3%) and the CV was very high > 25%) and thus could not be considered. At Udaipur, the range was 3.1 – 8.3 %. The entries SPV 1856 lower damage (<4 %) and noticed on par with resistant check IS 2205. In zone-III, across the centers and genotypes, the stem borer damage range was 8.4 – 15.1% with an average of 12.0% (Table 7.2).

National level: seven lines (SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, and local check) had recorded <15% deadhearts and found on par with resistant check IS 2205 (Table 7.2).

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 3.91 – 9.2% and mean was 6.7%. The entries local check,

SPV 1859, hc 308, SPV 1855, CSV 21F and SPV 1854 recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 4.6 % and it ranged from 0.01 – 12.0%. The CV was very high (> 30%), hence comparison could not be made (Table 7.1).

National level: The mean damage was 5.7% and damage range was 1.9 – 9.9%. The entries CSV 21F, local check, SPV 1860, SPV 1859, SPV 1855, SPV 1854 on par with resistant check (IS 2205) and promising.

Stem borer leaf injury rating (1-9): The stem borer leaf injury rating on 1-9 scale was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 2.6 – 4.3 and mean was 3.5. The entries spv 1856, spv 1854, spv 1860, Local check, recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 1.4 and it ranged from 1.0 – 2.33 (Table 7.2). All entries were on par to resistant check (IS 2205).

At national level, the mean damage was 2.5 and damage range was 2.0 – 3.3. The entries SPV 1860, SPV 1854, SPV 1856, CSV 21F and local were promising.

Conclusion: The entries, SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, and local check recorded low deadhearts due to stem borer.

2.8: Advanced Varietal and Hybrid Trial for forage multi cut (AVHT-FMC)

The trial comprised of total 14 entries with 4 experimental hybrids, 3 experimental varieties, two commercial checks (CSH 20F, SSG 59-3), one local check, three resistant checks (IS 18551, IS 2512 and IS 2205) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE: In Zone-I, at Coimbatore, the range was 8.5 to 16.8 with an average of 16.3%. However, not a single entry was found on par with resistant check IS 2205. In Zone-III, at Hisar, the stem borer deadhearts (%) ranged from 19.7 to 36.0 with an average of 28.4%. No entry other than local check (SSG 59-3) found equal to resistant check IS 2205. Interestingly, DJ 6514 recorded 23.7% DH which was on par with IS 2205. At Kanpur, the range was 10.2 to 20.7 % with an average of 14.3%. The entries SPH 1625, SPH 1627, SPV 1842, SSG 59-3, and local check Mauti, recorded lower deadhearts (<14.0%) and found on par with IS 2205. The local check recorded lowest deadhearts % than resistant check. At Ludhiana, the deadhearts % was very low (0.0- 7.2.3%) and the CV was very high > 25%) and thus could not be considered. At Udaipur, the range was 3.3 – 7.3 % with an average of 5.6%. The entries SPH 1627, SPH 1624, SPV 1844, and local check CSV 17 had lower damage (< 6 %) and found on par with resistant check IS 2205. In zone-III, across the centers and genotypes, the stem borer damage range was 8.5- 16.8% with an average of 12.7%. SPH 1625, local check and interestingly DJ 6514 found on par with resistant check IS 2205 (Table 8.2).

National level: The entries SPH 1625, SPH 1626, SPH 1627, SPV 1844, SSG 59-3, and local check recorded lowest stem borer deadhearts (<24% and found on par with IS 2205, (Table 8.2).

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 4.3 – 9.2% and mean was 9.3%. The CV was high (> 30%). The entries local check, SPH 1627, CPH 20MF, SPH 1624, SPV 1842, SPH 1625 and local check recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 1.89 % and it ranged from 0.01 – 14.9% (Table 8.1). The CV was very high (> 30%). The entries , CPH 20mf, , SPV 1844, , SPV 1843, SPH 1627, SPH 1626, SPH 1625 and SPH 1624 were on par with resistant check (IS 2205)

At national level, the mean damage was 1.89% and damage range was 2.15 – 12.1%. The entries SPH 1627, CSH 20mf, SPH 1624, SPH 1625 were on par with resistant check (IS 2205) and promising.

Stem borer leaf injury rating (1-9): The stem borer leaf injury rating on 1-9 scale was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 3.0 – 4.3 and mean was 3.6. There was no significant difference between varieties but the entries SPH 1627, SSG 59-3, SPV 1843, CSH 20MF, SPV 1856, recorded less damage. At Coimbatore the mean damage was 1.2 and it ranged from 1.0 – 2.33 (Table

8.2). The entries CSH 20 MF, SPV 1844, SPH 1843, SPH 1627, SPH 1626, SPH 1625 and SPH 1624 were on par to resistant check (IS 2205).

At national level, the mean damage was 2.4 and damage range was 2.0 – 3.3. The entries SPH 1627, SPV 1843, SSG 59-3, CSH 20 MF, SPH 1624 and SPH 1626 were promising.

Conclusion: The entries SPH 1627, CSH 20 MF and SPH 1624 were promising based on stem borer leaf injury and injury rating.

2.9: Initial Varietal and hybrid Trial for forage multi cut (IVHT-FMC)

The trial comprised of total 12 entries with 2 experimental hybrids, 2 experimental varieties, two commercial checks (CSH 20F, SSG 59-3), one local check, four resistant checks (IS 18551, IS 2512, IS 2205, ICSV 705) and one susceptible check (DJ 6514).

Stem borer deadhearts (%) at 45 DAE: In Zone-I, at Coimbatore, the range was 3.8 to 33.2 with an average of 15.4 %. However, not a single entry was found on par with resistant check IS 2205. In Zone-III, at Hisar, the stem borer deadhearts (%) ranged from 20.0 to 32.7 with an average of 26.3%. No entry other than local check (SSG 59-3) found equal to resistant check IS 2205. Interestingly, DJ 6514 recorded 23.7% DH which was on par with IS 2205. At Kanpur, the range was 10.2 to 19.0 % with an average of 14.1%. The data recorded on deadhearts was insignificant. At Ludhiana, the deadhearts % was very low (0.0- 7. 4%) and the CV was very high (> 25%) and thus could not be considered. At Udaipur, the range was 3.5 – 8.2 % with an average of 6.1%. The entry SPH 1622 and CSH 20 MF had lower damage (< 6 %) and found on par with resistant check IS 2205. In zone-III, across the centers and genotypes, the stem borer damage range was 8.8- 16.1% with an average of 12.2%. SPH 1622, SPH 1623, local check and interestingly DJ 6514 found on par with resistant check IS 2205 (Table 9.2).

National level: The mean damage was recorded 12.9 with a range of 7.9 to 17.2%. The entries SPH 1622, and local check recorded lowest stem borer deadhearts (< 26%) and found on par with IS 2205 (Table 9.2).

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 4.1 – 9.9% and mean was 7.1%. The entries local check recorded damage on par with resistant check (IS 2205). At Coimbatore the mean damage was 0.01 % and it ranged from 0.01 – 13.4% (Table 9.1). The CV was very high (> 30%), hence comparisons could not be made.

At national level, the mean damage was 4.6% and damage range was 2.1 – 10%. All entries were on par with resistant check (IS 2205). The entries SPV 1840, SPH 1623, SPV 1841, SPH 1622 and CSH 20MF were on par with resistant check (IS 2205) and promising.

Stem borer leaf injury rating (1-9): The stem borer leaf injury rating on 1-9 scale was recorded at two centers Udaipur and Coimbatore. At Udaipur the damage ranged from 3.0 – 4.6 and mean was 3.6. The entries SSG 59-3, SPH 1622, CSH 20 MF and SPV 1841 recorded less damage. At Coimbatore the mean damage was 1.1 and it ranged from 1.0 – 2.0 (Table 9.2). The entries SPH 1623, CSH 20 MF, SPV 1841, SPV 1840, SSG 59-3 and SPH 1622 were on par to resistant check (IS 2205).

National level: The mean damage was 2.4 and damage range was 2.0 – 3.0. The entries SSG 59-3, SPH 1622, CSH 20 MF and SPV1841 were promising. The entries SPH 1622 and local check found superior to other entries by recording lowest deadhearts.

Conclusion: The entries SPV1841, SPH 1622 and CSH 20mf were promising based on stem borer leaf injury and injury rating.

Sweet sorghum

The sweet sorghum advanced varieties and hybrids (24 entries) were evaluated for stem borer resistance under field conditions by plating them early to attract stem borer infestation. The data were recorded on stem borer deadhearts (at Rahuri). The peduncle damage (%) and leaf injury rating (1-9) to the plants was recorded at Akola.

2.10: Advanced Varietal & Hybrid Trial for Sweet Sorghum (AVHT-SS)

The trial comprised of total 24 entries, (8 varieties, 7 hybrids, three commercial checks, one local check, four resistant checks (IS 2312, IS 18551, IS 2205, ICSV 705) and one susceptible check (DJ 6514). The trial was conducted at two locations: Rahuri and Akola.

Stem borer deadhearts (%) at 45 DAE: The data recorded at Rahuri on stem borer deadhearts was very low (0.0 – 12.8%) and had high CV (>25%). Therefore could not consider for compilation. However, the entries SPSSV 27 and SPSSV 36 had lowest borer damage. No other centre has recorded the data on deadhearts (Table 10.1).

Stem borer leaf injury to plants (%): One centre Akola has recorded the data on leaf injury to plants. Interestingly, DJ 6514 had lowest leaf injury. The data could not be considered due to high CV in all locations (> 25%), (Table 10.1).

Stem borer leaf injury rating (1-9): No data on leaf injury rating was recorded by any centre.

Peduncle damage plants (%): Only Akola centre has recorded peduncle damage which was moderate to high (8.3- 56.6%). The data could not be considered due to high CV (51.8%).

Conclusion: The entries SPSSV 27 and SPSSV 36 had lowest borer damage.

Follow-up for Kharif 2009: The entries SPSSV 27 and SPSSV 36 may be promoted for further testing.

Germplasm lines

One trial for confirmation of stem borer resistance comprised of total 21 entries having 15 germplasm lines, 1 pop line, 1B line, 1 local check, two resistant checks (IS 2312, IS 18551) and one susceptible check (DJ 6514). The trial was conducted only at Dharwad centre. The observations were recorded only on deadhearts % due to stem borer at 45 DAE.

2.11: Testing of advanced germplasm lines for stem borer resistance (AGP-SB)

One trial for confirmation of stem borer resistance comprised of total 21 entries having 15 germplasm lines, 1 pop line, 1B line, 1 local check, two resistant checks (IS 2312, IS 18551) and one susceptible check (DJ 6514). The trial was conducted only at Dharwad centre. The observations were recorded only on deadhearts % due to stem borer at 45 DAE.

Stem borer deadhearts at 45 DAE The damage recorded at Dharwad was ranged from 8.6 to 32.7%; however, the data was not significant and had higher CV (58.8%). At Dharwad centre the susceptible check recorded 8.6 % DH due to stem borer, whereas, the resistant check IS 2205 and IS 2312 recorded 20-32% DH, (Table 11.1).

Conclusion: The DJ 6514 had lowest DH than resistant check. If so, the reason behind it needs to be studied.

Follow-up for Kharif 2009: The seeds of DJ 6514, IS 2312 and IS 2205 may be replaced.

Pest & disease resistant nursery for stem borer (PDRN-SB)

The collaborative efforts of Entomology and Pathology have initiated from 2007 to search multi-trait resistant lines. The trial comprised of total 15 entries with 6 disease resistant, 4 pest resistant, one each resistant and susceptible check from respective discipline and one local check. 12 experimental varieties, one each local, resistant (IS 2312) and susceptible checks (DJ 6514). The trial was conducted at two locations at Dharwad, and Udaipur

2.12: Pest and disease resistance for multiple resistance (PDRN-SB)

The trial comprised of total 10 experimental entries, one each local, resistant (IS 2312) and susceptible checks (DJ 6514).

Stem borer deadhearts at 45 DAE: The data on stem borer deadhearts were recorded Dharwad and Udaipur (Table 17.1). The stem borer deadhearts at Dharwad was rejected to high CV (>30%). The entries NRCSFR 06-1, NRCSFR 06-2 were on par with resistant check IS 2312. At Udaipur across the genotypes, the deadhearts ranged was 2.6 to 9.1 % with an average of 5.9 %. The entries SUENT 9, NRCSFR 06-1 and SUENT 8 recorded less damage than the resistant check (IS 2312).

Conclusions: The entries SUENT 9, NRCSFR 06-1 and SUENT 8 recorded less damage than the resistant check (IS 2312)

Follow-up for Kharif 2009: NRCSFR 06-1 may be considered as multi-pest resistant line (shoot fly and stem borer)

Stem borer resistance nursery (SBN) - Kharif 2008

The trial consists of 16 entries, comprising of 13 test entries, one resistant check, one susceptible and one local check. The test entries were evaluated at three locations: Coimbatore, Surat and Hisar. The data of Hisar was recorded for only one replication, hence could not be considered. The trial was conducted under natural conditions in view of hot spot location.

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Coimbatore and Surat. At Coimbatore the damage ranged from 0 – 13.2% and mean was 3.2%. As the CV was exceptionally high data was not considered. At Surat mean damage was 27.7 % and it ranged from 20.2 – 35.4% (Table 18.1). The entries NRCSBR 09-2, NRCSBR 08-1 and PUGL-9 recorded damage less than resistant check (IS 2205). At national level, the mean damage was 15.5% and damage range was 11.6 – 24.3%. All entries were on par with resistant check (IS 2205). The entries NRCSBR 08-1, LOCAL 8, PUGL-9, NRCSBR 08-2, P-45 were on par with resistant check (IS 2205) and promising.

Stem borer leaf injury rating (1-9): The stem borer leaf injury rating on 1-9 scale was recorded at Coimbatore. At Coimbatore the mean damage was 1.0 and it ranged from 1.0 – 1.67 (Table 18.1). There was no significant difference among the entries.

Stem borer dead hearts % (45 DAE): The stem borer deadhearts was recorded at two centers Coimbatore and Surat. At Coimbatore the damage ranged from 12.5 – 28.9% and mean was 20.5%. The entries, PGN 56, P-45, PGN-35, PGN-30, NRCSBR 08-1, and Local check recorded damage less than resistant check (IS 2205) At Surat mean damage was 14.9 % and it ranged from 9.3 – 23.8% (Table 18.1). The entry NRCSBR 08-2, recorded damage less than resistant check (IS 2205). The entries NRCSBR 08-1, Local 8, PFGS-93, PUGL-9, and Local check were on par with resistant check (IS 2205). At national level, the mean damage was 17.7% and damage range was 14.1 – 23.6%. All entries were on par with resistant check (IS 2205). The entries NRCSBR 08-1, PGN-56, recorded damage less than resistant check (IS 2205). The entries PGN-35, P 45, Local 8, Local check and PGN 30 were on par to resistant check (IS 2205) and promising.

Conclusion: The entries NRCSBR 08-1, PGN-56, PGN-35, P 45, Local 8, Local check, and PGN 30 were promising

Follow-up for Kharif 2009: NRCSBR 08-1, PGN 35, P 45 may be promoted for advanced trail testing.

R lines for stem borer resistant (R lines-SB)

2.13. R lines for stem borer resistance (R lines-SB)

The trial comprised of total 20 entries. It includes 14 experimental lines, one resistant (IS 2205), two susceptible checks (DJ 6514, Swarna), two commercial checks, SPV 1616, CSV 15 and one local check. The data was recorded on stem borer deadhearts, peduncle damage and leaf injury at Hyderabad and Surat. The days to flowering was also noted.

Stem borer leaf injury plants (%): The stem borer leaf injury was recorded at two centers Surat. At Surat, the damage ranged from 18-45 % and mean was 30.1 % (Table 19.1). The entries ICSR No 10, ICSR No57, ICSR No 96, ICSR No 89005, ICSR No 89006, and ICSR No 89059 recorded damage less than resistant check (IS 2205).

Peduncle damage (%): The peduncle borer damage was recorded at Surat. The mean was 27.6 % with minimum 16.8% and maximum damage was 38.0%. There are significant differences among the entries. The entries, ICSR No 57, ICSR No 96, ICSR No 89005, ICSR No 89059, and ICSR No 89006, recorded damage less than resistant check (IS 2205), (Table 19.1).

Stem borer dead hearts % (45 DAE): The stem borer deadhearts was recorded at two centers Hyderabad and Surat. At Hyderabad the damage ranged from 9.9 -50.0 % and mean was 26.05%. The entries, ICSR No 96, ICSR No 89005, and ICSR No 89006 recorded damage less than resistant check (IS 2205) At Surat mean damage was 18.0 % and it ranged from 11.2-20.1% (Table 19.1). There are significant differences among the entries. The entries, ICSR No 57, ICSR No 96, ICSR No 89005, ICSR No 89059, and ICSR No 89006, recorded damage less than resistant check (IS 2205). At national level, the entries, ICSR No 10, ICSR No 96, ICSR No 89005, and ICSR No 89059 recorded damage less than the mean damage than IS 2205 (Table 19.1).

Conclusion: The entries the entries, ICSR No 10, ICSR No 96, ICSR No 89005, and ICSR No 89059 were promising

Follow-up for Kharif 2009: The entries, ICSR No 10, ICSR No 96, ICSR No 89005, and ICSR No 89059 may be promoted for breeding program.

Presentation across locations and genotypes:

Stem borer: The stem borer incidence was moderate to high (15-45 %). The highest damage was noticed at Coimbatore. At Kanpur, Hisar and Ludhiana very low to moderate population was observed, At Hisar and Ludhiana the initial rainfall was high, and hence could not germinated properly. The trial materials at these centers were evaluated for stem borer resistance (Annexure I).

Grain Sorghum: In AVHT: CSV 17, SPH 1605, SPH 1609, SPH 1604, CSH 16, SPH 1611, In IVT SPV 1874, SPV 1875, CSV 15 and in IHT CSH 16, SPH 1629 were found <10%v stem borer damage.

Dual Purpose: sorghum: In AVT: SPV 1781, SPV 1722, CSV 15, and IVT Local check, SPV 1870, SPV 1864 found less susceptible.

Forage (single-cut) : The entries SPVs 1845, 1846, 1847, 1848, 1849, 1851, 1853, CSV 21 F, HC 308, local check in AVT and in IVT the entries SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, and local check) found better/

Forage (multi-cut): In AVHT : SPH 1625, SPH 1626, SPH 1627, SPV 1844, SSG 59-3, and local check and IVHT the entries SPH 1622, and local check found lower stem borer damage.

Overall conclusions: The data was not properly recorded due to early heavy rains in Zone-III (Hisar, Ludhiana) as a results, poor germination was recorded.

Looking ahead: There is need to concentrate in northern region for stem borer screening.

Location effects: The data on stem borer revealed that Kanpur, Hisar, Ludhiana, Surat, Coimbatore and Dharwad may be considered for stem borer screening as hot spot. Parbhani and Akola witnessed moderate peduncle damage.

Accuracy of experiments: Most of these trials have been sown in time particularly in Zone-III, but due to early and heavy rains there were germination problems.

What materials should be advanced as stem borer resistance?

1. AVHT (GS) : CSV 17, SPH 1605, SPH 1609, SPH 1604, CSH 16, SPH 1611
2. IVT (GS) : SPV 1874, SPV 1875, CSV 15
3. IHT (GS) : CSH 16, SPH 1629
4. AVT (DP) : SPV 1781, SPV 1722, CSV 15,
5. IVT (DP) : Local check, SPV 1870, SPV 1864.
6. AVT (Forage-SC) : SPVs 1845, 1846, 1847, 1848, 1849, 1851, 1853, CSV 21 F, HC 308, and local check
7. IVT (Forage-SC) : SPVs 1854, 1855, 1857, 1859, CSV 21 F, HC 308, local check
8. AVHT (Forage-MC) : SPH 1625, SPH 1626, SPH 1627, SPV 1844, SSG 59-3, LC
9. IVHT (Forage-MC) : SPH 1622, and local check
10. PDRN (SB) : SUENT 9, NRCSFR 06-1 and SUENT 8
11. SBN : NRCSBR 08-1, PGN-56, PGN-35, PGN 30, P-45, Local check
12. R lines –SB : ICSR No 10, 96, 89005, 89059

3. Head bug (*Calocoris angustatus* Leth.)

Grain sorghum

3.1. Advanced varietal and hybrid trial- Kharif 2008

Head bug population/ panicle (no): The data on head bug population/ panicle was recorded at Palem and Parbhani. At Palem, the bug population ranged from 17.67-40.0 / panicle with mean of 24.6/ panicle. There were no significant differences among the entries. At Parbhani the mean population of bug was 3.91/ panicle and it ranged from 1.5 – 8.67 bugs/ panicle. The entries, CHS 16, SPH 1606, SPV 1616, SPH 1596 and SPH 1606 recorded lower bug populations (Table 1.5). At national level, the mean population of bug was 14.23/ panicle and it ranged from 10.33 – 21.33 bugs/ panicle. The entries, CSH-23, SPV 1616, SPH 1596, SPH 1606, and SPV 1817 were promising.

Days to 50% flowering: The data on days to 50% flowering was recorded at Dharwad. The flowering ranged from 67-93 days and mean was 83 days. The lines CSV 17, SPH 1609, CSH 23, SPV 1786 and SPH 1606 were earlier to flower.

Conclusion: The entries CSH-23, SPV 1616, SPH 1596, SPH 1606, and SPV 1817 were promising based on panicle colonization by bug.

3.2. Initial varietal trial- Kharif 2008

Head bug population/ panicle (no): The data on headbug population/ panicle was recorded at Palem and Parbhani. At Palem, the bug population ranged from 15.67 – 51.67 / panicle with mean of 29.45/ panicle. The entries, SPV 1879, CSV 17, SPV 1886, SPV 462 and SPV 1877 recorded less bug population/ panicle. At Parbhani the mean population of bug was 4.31/ panicle and it ranged from 1.0 – 9.33 bugs/ panicle. The entries, CSV 17, SPV 1884, SPV 1880, SPV 1616 and SPV 1877 recorded lower bug populations (Table 2.5). On all India basis, the mean population of bug was 16.86/ panicle and it ranged from 8.33 - 27.83 bugs/ panicle. The entries, CSV 17, SPV 1879, SPV 1877, SPV 462 and SPV 1616 were promising.

Days to 50% flowering: The data on days to 50% flowering was recorded at Dharwad. The flowering ranged from 72-95 days and mean was 85 days. The lines SPV 1886, SPV 1884, CSV 15, CSV 17 and SPV 1880 were earlier to flower.

Conclusion: The entries, CSV 17, SPV 1879, SPV 1877, SPV 462 and SPV 1616 were promising based on panicle colonization by bug.

3.3. Initial hybrid trial- Kharif 2008

Head bug population/ panicle (no): The data on head bug population/ panicle was recorded at Palem and Parbhani. At Palem, the bug population ranged from 13.67 – 49.33 / panicle with mean of 24.43/ panicle. The entries, CSH 23, SPH 1644, SPH 1642, SPH 1646 and SPH 1645 recorded lower bug population/ panicle. At Parbhani the mean population of bug was 4.69/ panicle and it ranged from 1.67-13.33 bugs/ panicle. The entries, SPH 1629, SPH 1643, SPH 1642, SPH 1641, and SPH recorded low bug populations (Table 1.5).

On all India basis, the mean population of bug was 14.54/ panicle and it ranged from 867- 26.67 bugs/ panicle. The entries, SPH 1644, SPH 1642, SPH 1646, SPH 1645 and SPH 1641 were promising.

Days to 50% flowering: The data on days to 50% flowering was recorded at Dharwad. The flowering ranged from 72-95 days and mean was 83 days. The lines SPH 1641, SPH 1637, SPH 1635, SPH 1630, SPH 1629, SPH 1631, CSH 16 and SPH 1628 were earlier to flower .

Conclusion: The entries, SPH 1644, SPH 1642, SPH 1646, SPH 1645 and SPH 1641 were promising.

4. Validation of IPM module

An IPM module was developed and validated at three locations viz; Palem, Parbhani and Indore. The location specific intercropping recommendations were used while formulating the trials.

4.1. Indore

The treatment of sole sorghum with seed treatment of thiomethoxam followed by spray of endosulphan @ 0.07% at 45 DAE (T-6) was found superior on the other treatments. The lowest shoot fly damage (3.1 %), lowest tem borer damage (4.05%) and highest yield (17.2 kg/plot) was recorded (Table 20.1)

Table 20.1: Testing and validation of IPM module at Indore Kharif- 2008

Treatments	SFDH % (28 DAE)	SBDH % (45DAE)	Sorghum equivalent yield Kg/plot (Plot size 36 Sqm)
T1 = Sole crop with out treatment	11.04	15.51	8.73
T2= sole with treatment with thiomethoxam @ 3 g/ha seed	4.93	13.46	13.06
T 3= intercropping with soybean 2:1 without treatment	8.91	7.26	10.05
T4= intercropping with soybean +seed treatment with thiomethoxam@ 3 g/ha seed	4.41	6.66	13.61
T5 = sole with seed treatment with thiomethoxam followed by spray of NSKE 5% at 45 DAE	3.45	5.74	12.72
T6= sole with seed treatment with thiomethoxam followed by spray of endosulphan @ 0.07% at 45 DAE	3.1	4.05	17.23
T7= Farmers practices	9.52	8.72	9.2
C D (p= 0.05)	0.97	1.25	2.08
CV (%)	8.04	10.48	9.7

Note: Sole sorghum: CSV 15, Intercrop: Soybean: JS 9305
Plot size= Plot size 18 row of 6 m 45cm apart(8.10m x 6.0m) = 48.6 sq m (Net plot 36 Sqm)

4.2. Parbhani

The shoot fly damage was ranged from 9.6 to 29 %, whereas the stem borer was very low (0.88%). As far damage is concern the treatment of sole with treatment with thiomethoxam @ 3 g/ha seed (T2) recorded lowest shoot fly damage (9.6%) and on par with T4, T-5, and T-6. The treatment of intercropping with soybean + seed treatment with thiomethoxam@ 3 g/ha seed was yielded 7.43 kg/plot and found equally good with the treatment of T6= CSV-15 with seed treatment + Endosulfan @0.07% at 45 DA E (Table 20.2).

Table 20.2: Testing and validation of IPM module at Parbhani Kharif- 2008

Treatments	SFDH % (28 DAE)	SBDH % (45DAE)	Grain yield Kg/plot
T1 = CSV- 15 Sole crop with out seed treatment	28.86	6.05	4.2
T2= CSV-15 sole with seed treatment of thiomethoxam @ 3 g/kg seed	9.66	1.46	6.35
T 3= CSV-15 without seed treatment + soybean (2:4)	29.63	4.8	5.04
T4 = CSV-15 with seed treatment + soybean (2:4)	11.56	3.55	7.43
T5 = CSV-15 with seed treatment + NSKE 5% at 45 DAE	10.88	1.08	6.83
T6= CSV-15 with seed treatment + Endosulfan @0.07% at 45 DAE	10.45	0.88	7.18
T7= Farmers practices	19.03	3.73	5.23
C D (p= 0.05)	2.38	0.76	0.31
CV (%)	7.8	13.89	2.85

Note: Sole sorghum: CSV 15, Intercrop with Soybean (variety ?); Plot size= Plot size 18 row of 6 m 45cm apart (8.10m x 6.0m) = 48.6 sq m (Net plot 36 Sqm)

4.3. Palem

The range of shoot fly, stem borer and head bug damage was moderate to high. Although, the intercropping (T2) : Sole with treatment with thiomethoxam @ 3 g/ha seed was found better than other treatment, but there was no significant differences. The yields (kg/plot) were low. The highest yield was recorded in T2 (11.8 kg/plot). The trial was not properly managed (Table 20.3)..

Table 20.3: Testing and validation of IPM module at Palem Kharif- 2008

Treatments	SFDH 28DAE (%)	SBDH (%)	Head bug population/25 panicles at milk stage	Yield (kg/ha)
T1 = CSV- 15 Sole crop with out seed treatment	21.99	18.27	46.6	8.41
T2= CSV-15 sole with seed treatment of thiomethoxam @ 3 g/kg seed	20.34	12.52	47.33	11.85
T 3= CSV-15 without seed treatment + soybean (2:4)	29.68	16.43	50.33	7.58
T4 = CSV-15 with seed treatment + soybean (2:4)	23.61	15.42	41.66	8.91
T5 = CSV-15 with seed treatment + NSKE 5% at 45 DAE	27.05	14.65	50.66	11.75
T6= CSV-15 with seed treatment + Endosulfan @0.07% at 45 DAE	22.32	9.25	43	15.62
T7= Farmers practices	27.48	19.91	73.33	6.46
C D (p= 0.05)	16.78	4.4	23.24	0.76
CV (%)	38.28	16.29	25.91	4.24

Note: Sole sorghum: CSV 15, Intercrop with Redgram (variety ?); Plot size= Plot size 18 row of 6 m 45cm apart(8.10m x 6.0m) = 48.6 sq m (Net plot 36 Sqm)

Annexure-I: Promising entries with less susceptibility to key pests of grain sorghum in different trials

Trial	Shoot fly	Stem borer	Head bug
AVHT-GS	SPV 1817, SPV 1616, local checks	SPH 1605, SPH 1609, CSV 17, CSH 16	SPH 1606, SPV 1616, CSH 23, SPH 1596, SPV 1817
IVT-GS	SPV 1875, SPV 1874, SPV 1880	SPV 1874, SPV 1875, local check, CSV 15	SPV 1877, SPV 1879, SPV 1616, CSV 17, SPV 462
IHT-GS	SPH 1642, SPH 1638, SPH 1646, SPH 1641, SPH 1628, SPH 1629	SPH 1629, SPH 1637, CSH 16	CSH 23, SPH 1642, SPH 1644
AVT-DP	SPV 1779, SPV 1782	SPV 1781, SPV 1822, CSV 15,	-
IVT-DP	SPV 1871, SPV 1873, SPV 1862	SPV 1864, SPV 1866, SPV 1870, local check	-
AVT-SC	SPV 1848, SPV 1849, SPV 1852, SPV 1853	SPV 1845, 1846, 1847, 1848, 1849, 1850, 1853, HC 308, CSV 21F	-
IVT-SC	SPV 154, HC 308, SPV 1857, LOCAL CHECK	SPV 1854, 1855, HC 308, CSV 21F, SPV 1857, SPV 1859, LOCAL CJECK	-
AVHTMC	SPH 1624, SPV 1842, LOCAL CJECK	SPH 1626, SPH 1625, SPH 1627, SPV 1844, SSG 59-3, LOCAL CHECK,	-
IVHTMC	SPV 1840	SPH 1622, LOCAL CHECK,	-
AVHT (SS)	SPSSV 27, SPSSV 34	SPSSV 27 and SPSSV 36	-
Germplasm lines (SF)	EP 58, EP 60, EP 94, EP 117, EP 133, POP 52, Local check	-	-
SFN -I	NRCSFR08-3, NRCSFR08-2, NRCSFR08-8, NRCSFR08-5, SUENT8, PGN -111	-	-
SFN -I	NRCSFR07-5, SUENT 13, SUENT 14	-	-
R lines (SF)	ICSR 18, ICSR 89045, ICSR 90034, ICSR 93004	-	-
R lines (SB)	-	ICSR No 10, ICSR No 96, ICSR No 89005, and ICSR No 89059	-
SBN	-	NRCSBR 08-1, PGN-56, PGN-35, P 45, Local 8, Local check, and PGN 30	-
PDRN (SF/SB)	NRCSFR06-1, GMRP 109, GMRP 12, SUENT 9, NRCSFR06-2	SUENT 9, NRCSFR 06-1 and SUENT 8	-
MAS-SF	MAS 1061-1, MAS 1061-4, MAS 1061-5, MAS 1076-1, MAS 1083-1 and MAS 1261-3	-	-
Potential local checks	CSV 15 and SPV 1616	-	-

Note: No data on midge and shoot bug

Annexure II: Summary of fish meal technique used as a trap for shoot fly screening at AICSIP centers

SI No	Centre	Date sown	Fish meal trap used	Shoot fly DH% at 28 DAE in AVHT (Range)	Shoot fly DH% at 28 DAE in AVHT (Mean)	Comments
1	Coimbatore	3-Jul	NO	0.0 -26.5	6.3	Evaluated for stem borer. Not good for shoot fly screening
2	Palem	1-Jul	Yes	11.2- 50.9	23.7	Delay in applying fish meal.
3	Dharwad	28-Jul	Yes	47.4-93.4	74.0	Very good to shoot fly screening
4	Rahuri	25-Jul	Yes	20.3-93.3	47.4	May be utilized for shoot fly screening
5	Parbhani	22-Jul	Yes	55.0-85.1	83.9	Very good to shoot fly screening
6	Akola	14-Jul	Yes	14.8-84.2	63.1	Very good to shoot fly screening
7	Indore	14-Jul	Yes	22.7-66.6	46.2	May be utilized for shoot fly and stem borer screening
8	Surat	30-Jul	Yes	34.5-72.3	55.9	May be utilized for shoot fly and stem borer screening.
9	Udaipur	20-Jul	Yes	9.5-87.5	54.7	Very good to shoot fly screening.
10	Kanpur	27-Aug	NO	8.8-36.4	14.4	Not suitable for shoot fly screening.
11	Hisar	10-Jul	NO			Not suitable for shoot fly screening, known for stem borer screening.
12	Ludhiana	18-Jul	NO			Not suitable for shoot fly screening, known for stem borer screening.

Annexure-III: Compliance report on receipt of shoot fly screening trials data

SI No	Centre	Trials supplied (No)	Trials received (No)	Date sown	Shoot fly data received (Date)	Dead line of data receipt (Date)	Days to receive shoot fly data after sowing	Deviation from dead line (days)	Ranking (promptness in sending shoot fly data)
1	Coimbatore	14	14	3-Jul	4-Sep	30-Aug	63	5	4
2	Palem	9	9	1-Jul	11-Dec	30-Aug	163	103	10
3	Dharwad	11	11	28-Jul	1-Dec	30-Aug	126	93	8
4	Rahuri	3-I	3	24-Jun	30-Aug	30-Aug	67	0	2
4	Rahuri	3-II	3	25-Jul	30-Aug	30-Aug	36	0	2
5	Parbhani	10	10	22-Jul	8-Sep	30-Aug	48	9	3
6	Akola	9	9	14-Jul	4-Nov	30-Aug	113	66	7
7	Indore	7	7	14-Jul	26-Aug	30-Aug	43	-4	1
8	Surat	15-I	15	7-Jul	14-Sep	30-Aug	69	15	5
8	Surat	15-II	15	30-Jul	14-Sep	30-Aug	46	15	5
9	Udaipur	18	18	20-Jul	24-Sep	30-Aug	66	25	6
10	Kanpur	9	9	27-Aug	10-Dec	30-Aug	105	102	9
11	Hisar	9	9	10-Jul					
12	Ludhiana	4	4	18-Jul					

Annexure-IV: Stem borer and other pests trials data-Compliance report

Centre	No of trials supplied	Planted date	Stem borer data received (date)	Head bug	Aphids	Mite/head worms
Coimbatore	17	3-Jul	20-Oct	29-Nov		28-Nov
Palem	11	1-Jul	11-Dec	11 Dec		
Dharwad	13	28-Jul	1-Dec	01 Dec		
Rahuri	4	24-Jun	14-Oct		14-Oct	
Rahuri	4	25-Jul	14-Oct			
Parbhani	12	22-Jul	29-Nov	29-Nov	29-Nov	29-Nov
Akola	10	14-Jul	12-Dec			
Indore	9	14-Jul	25-Oct			
Surat	17	7-Jul	14-Oct			
Surat	17	30-Jul	14-Oct			
Udaipur	18	20-Jul	19-Nov			
Kanpur	9	24-Aug	10-Dec			
Hisar	11	10-Jul	5-Dec	NR	NR	NR
Ludhiana	4	18-Jul	2-Jan	NR	NR	NR

Note: NR=Data not received