

Sorghum Pathology - Rabi 2011-12

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Executive summary

I. Disease situation

Prevalence of charcoal rot and lodging in sorghum growing region (rabi-2011-12) was estimated around Solapur and Dharwad. Crop lodging at maturity was rampant and the incidence of charcoal rot (CR) ranged 50-70% around Solapur and 10 - 50% Dharwad. Most of the farmers grow cultivar locally identified as local, Maldandi, Dukari, Yosada, and Dagadi. Around Parbhani reddening of foliage was recorded which was widely spread. Viral diseases were also recorded but in traces. At Dharwad foliar diseases rust and downy mildew were prevalent with low intensity/incidence.

II. Management of charcoal rot

i. Eco- friendly management of charcoal rot through seed treatment: Field trials on management of charcoal rot through eco friendly seed treatments were laid at Solapur and Dharwad during Rabi 2011-12. There were seven treatments that included bleaching powder in different combinations along with treatments with ash, FYM, and Bavistin. Seed treatment of sorghum with bleaching powder (100%) reduced CR incidence by 33.6 % followed bleaching powder 75% (i.e. Bl. powder + FYM in 3:1 proportion) and bavistin reducing incidence by 27 and 25.8 per cent respectively. The reduction in the incidence with these treatments was significant at both the places. These treatments also reduced the pith rot significantly in the range of ~ 33- 34 per cent. The treating of seeds also increased grain yields substantially at both the places and increase was highest (~65%) when seeds were treated with bleaching powder (100%) followed by bavistin. Similarly treatments also increased fodder yield significantly at both the places.

ii. Evaluation of germplasm for resistance against charcoal rot: Trials with twelve advanced hybrids and varieties in deep soil revealed low incidence (~38.8 to 42.1%) of Charcoal rot in test entries SPV 2034, SPH 1666, SPV 2033 and CSV 22 and there were no significant differences between test entries tested at four locations with pith rot that ranged 16.8 to 22 cm. Trials in shallow soils showed that the advanced entries SPV 2031 and SPV 2029 contracted lowest charcoal rot in the range of ~39.8 to 43.9% among ten test lines and pith rot length was 18.1 to 22.6 cm. Evaluation of 19 test lines of initial hybrids and varieties revealed entries SPV 2150, SPV 2154, CSH 15R, CSV 22 and SPV 2152 had contracted ~38 to 40.0% charcoal rot disease and there were no significant differences between test entries and checks. Performance of **initial hybrid and varieties in shallow soil revealed** lowest charcoal rot (~38 to 41%) in SPV 2158, SPV 2159, and SPV 2162 and fourteen entries tested did not differ with pith rot ~15 to 21 cm.

Detailed report

A. Eco-friendly management of charcoal rot through seed treatment

Replicated field trials on management of charcoal rot through eco friendly seed treatments were laid at Solapur and Dharwad during Rabi 2011-12. There were seven treatments replicated four times in *M phaseolina* sick soils. The seeds were treated with- i. ash, ii. FYM, iii. bleaching powder (100%), iv. Bleaching powder + ash (3:1 proportion), v. Bleaching powder+ FYM (3:1 proportion), vi. Bavistin, and vii. Control,

Observations were recorded on CR incidence, nodes crossed by Mp, length of Mp infection in stem (pith rot), grain yield and fodder yield. Taking together the results of two trials at two places, seed treatment with bleaching powder (100%) reduced CR incidence by 33.6 per cent followed by treating seeds with bleaching powder 75% (Bl. powder + FYM; 3:1 proportion) and Bavistin reducing incidence by 27 and 25.8 per cent respectively. While viewing on location basis, at Solapur bleaching powder (100%) reduced CR by 29.9 %, Bavistin by 24.4 and bleaching powder 75% (bleaching powder :FYM; 3:1) by 20% and at Dharwad these treatment reduced incidence by 33.6, 25.8 and 27 per cent. The reduction was significant at both the places (Table 1.1). The treating seeds with bleaching powder alone or in combination with ash or FYM reduced pith rot in the range of 32.7 to 34.4 per cent; similarly reduced nodal spread of *M. phaseolina*. The effects were significant at both places. Grain yield was increased by 65.2 per cent when the seeds were treated with bleaching powder (100%) followed by bavistin treatment and combination of bleaching powder with ash or FYM which increased yield in the range of 40.7 to 59 per cent. The effects were similar at both the places and the increase in yield was significant (Table 1. 2). Fodder yield was increased by 45.8 and 43 per cent when the seeds were treated with bleaching powder (100%) and bavistin respectively. Bleaching powder (100%) application increased fodder yield at both the places, maximum increase was 32 per cent at Solapur and 48.8 per cent at Dharwad however bavistin was best at Dharwad that increased fodder yield by 51.7 per cent. Bleaching powder in combination with ash or FYM also increased fodder yield to varying extent at both the places.

B. Multi-locations AICSIP varietal & hybrid trials

1. Advanced Hybrid and Varietal Trial - Deep soil

Twelve entries along with local checks were evaluated against charcoal rot (locations- Solapur, Dharwad, Parbhani and Bijapur) in *M. phaseolina* sick soils under rabi conditions. Evaluation was also carried by inoculating *Macrophomina phaseolina* (Mp) using tooth pick method (stem stab). Evaluations of reaction against *M. phaseolina* were based on per cent plants infected, fungal growth (diseased lesion; measured in centimetre by splitting stem) in stem and number of nodes crossed. Foliar diseases were assessed using 1-9 rating scale.

1.1. Charcoal rot: On all India (Table 2.1) basis lowest incidence (-38.8 to 42.1%) was observed SPV 2034, CSH 15R, SPH 1666, SPV 2033 and CSV 22. There were no significant differences between test entries and checks and the highest (-51.3 – 43.8 %) incidence was observed in SPV 2035, LC, SPV 2049 and M 35-1. At Solapur CSH 15R, SPH 1663 and SPV 2034 recorded lowest CR in the range of 66.7 to 80 % and there were no significant differences in test entries. Highest incidence was observed in SPV 2035, SPH 1689 and SPV 2104 (100%). At Dharwad lowest incidence was observed in E 36-1, SPV 2033, SPV 1689, SPH 1690 and SPH and highest incidence of (32.4 – 56.7%) was recorded on M 35-1, SPH 1663, SPV 2035, CSH 15 R and local check (SPV 86). However none of the entry showed significantly superiority or equality to E 36-1 that recorded lowest incidence of -5%. At Parbhani SPV 1663, CSH 15R, SPV 2035 and 2033 showed lowest (11- 15.3%) incidence and highest was recorded on SPV 2104, P. Moti, LCR and E 36-1 and there were no significant differences in test entries. At Bijapur there were no significant differences in entries towards CR incidence however lowest incidence (-21- 30%) was recorded in SPV 2104, CSV 22, SPH 1666 and SPH 1689 and the highest (-41-70%) was in M 35-1, LC, SPH 1663 and SPV 2035.

In inoculated plants (Table 2.1) length of Mp infection did not significantly differ in test entries when the data on four centres were considered together. The length ranged from 16.8 to 22.3 cm. Highest length (-21 to 22.3 cm) of infection was observed in SPH 1663, SPV 2034, LC, SPH 1666 and SPV 22.3. The lowest (16.8 to 19.0 cm) infection could be observed in SPH 1690, CSH 15 R, SPV 2104 and M 35-1. V2046 and SPV 2034

1.2. *Flowering*: SPV 2049 and CSV 22 took least days to flower between 72-73 days. Longest time of ~79 days was taken by SPV 2034 and 2035 when the data from Dharwad and Parbhani was considered and test entries differed significantly in flowering (Table 2.2)

1.3. *Other diseases*: Foliar disease rust was recorded at Dharwad. Entries showed moderate to resistant reaction. E 36-1 and LC showed moderate resistance rest all were resistant to the disease. Downy mildew was recorded at Dharwad. It ranged from 3 to 11.6 per cent with no significant differences between test entries. However SPV 86, SPV 2049 and SPV 2034 contracted lowest (2.9 to 3.7%) DM.

2. Advanced Hybrid and Varietal Trial - Shallow soil

Ten entries along with checks were evaluated against charcoal rot (locations- Solapur, Dharwad, Parbhani and Bijapur) in *M. phaseolina* sick soils under rabi conditions. Evaluation was also carried by inoculating *Macrophomina phaseolina* (Mp) using tooth pick method (stem stab). Evaluations of reaction against *M. phaseolina* were based on per cent plants infected, fungal growth (diseased lesion; measured in centimetre by splitting stem) in stem and number of nodes crossed. Foliar diseases were assessed using 1-9 rating scale.

2.1. *Charcoal rot*: On all India (Table 3.1) basis lowest incidence (~39.8 to 43.9%) was observed SPV 2031, SPV 2029 and Maulee. There were no significant differences between test entries and checks and the highest (~49-50 %) incidence was observed in CSH 15 R, SPV 2048, and SPV 1665. At Solapur incidence was quite high over 90 per cent and all the entries showed incidence above 90 per cent with no significant differences. At Dharwad lowest (6.5-17.6) incidence was observed in E 36-1, SPV 2031 and SPV and highest incidence of (38.1-42.7%) was recorded on SPH 1665, CSV 8R, and SPV 2048 and entries differed significantly. At Parbhani no significant differences were observed and SPV 2034, SPV 2031 and SPV 2048 showed lowest (12-13.7%) incidence and highest was recorded on LC, P. Moti and E 36-1. At Bijapur there were no significant differences in entries towards CR incidence however lowest incidence (~27-34%) was recorded in SPV 2029, LC and Maulee and the highest (~50-55%) was in SPH 1665, SPV 2048 and CSH 15R.

In inoculated plants (Table 3.1) length of Mp infection did not significantly differ in test entries when the data on four centres were considered together. The length ranged from 18.1 to 22.6 cm. Highest length (~21 to 23 cm) of infection was observed in Phule Anuradha, LC and SPH 1665. The lowest (16.8 to 19.0 cm) infection could be observed in SPH 2031, SPV 2034 and SPV 2084. Infection remained restricted to about two nodes (Table 3.2).

2.2. *Flowering*: SPH 1665, Phule Anuradha and CSH 15 R took least days to flower between ~72-74 days. Longest time of ~79 days was taken by SPV 2084 and SPV 2029 and SPV 2034 when the data from Dharwad and Parbhani was considered and test entries differed significantly in flowering (Table 3.2)

2.3. *Other diseases*: Foliar disease rust was recorded at Dharwad. Entries showed resistant reaction with no significant differences. Downy mildew was recorded at Dharwad. It ranged from 0 to 45.8 per cent with significant differences between test entries. However SPV 2029, Maulee and SPV 2084 contracted lowest (0- 1.9%) DM. Highest Incidence was in SPV 2034, M 35-1 and SPV 2031 (Table 3.2).

3. Initial Hybrid & Varietal Trial - Deep soil

Nineteen entries along with checks were evaluated against charcoal rot (locations- Solapur, Dharwad, Parbhani and Bijapur) in *M. phaseolina* sick soils under rabi conditions. Evaluation was also carried by inoculating *Macrophomina phaseolina* (Mp) using tooth pick method (stem stab). Evaluations of reaction against *M. phaseolina* were based on per cent plants infected, fungal growth (diseased lesion; measured in centimetre by splitting stem) in stem and number of nodes crossed. Foliar diseases were assessed using 1-9 rating scale.

3.1. *Charcoal rot*: On all India (Table 4.1) basis lowest incidence (~38 to 40.0%) was observed SPV 2150, SPV 2154, CSH 15R, CSV 22 and SPV 2152. There were no significant differences between test entries and checks and the highest (~46-48 %) incidence was observed in SPV 2144, SPV 2153, SPV 2139, SPV 2146 and SPV 2143. At Solapur incidence ranged from 46.7 to 100 per cent with no significant difference in test entries. However lowest incidence in the range of 46.7 to 80 per cent was recorded were CSH 15R, SPV 2140, CSV 22, SPV 2142 and SPV 2152. Highest incidence (~93 to 100 per cent) was recorded in SPH 1721, SPV 2139, SPV 2143, SPV 2153 and M 35-1. At Dharwad CR incidence ranged from 3.1 to 53.5 per cent and lowest (3.1 to

20.5%) incidence was observed in E 36-1, SPV 2150, SPV 2154, SPV 2145 and SPV 2149. The highest incidence of (33- 53.5%) was recorded on SPV 2146, SPV 2140, SPV 2153, SPV 2144 and LC and the test entries differed significantly. At Parbhani there were no significant differences in entries towards CR incidence however lowest incidence (~10-14%) was recorded in SPV 2154, CSV 22, SPV 2149, SPV 2150 and SPV 2140 and the highest (~20- 27%) was in LC, P Moti, CSH15R, SPV 2145 and E 36-1. At Bijapur there were no significant differences in entries towards CR incidence however lowest incidence (~22-73%) was recorded in DSV 4(LC), SPV 2150, SPV 2152, SPV 2153 and SPH 1721 and the highest (~53- 73%) was in SPH 2146, SPV 2145, 2143, 2149 and CSH15R.

In inoculated plants (Table 4.1) length of Mp infection did not significantly differ in test entries when the data on four centres were considered together. The length ranged from ~18 to 22.6 cm. The highest length (~21 to 23 cm) of infection was observed in SPV 2145, SPV 2146, CSH 15R, SPV 2144 and SPH 1720. The lowest (17.9- 18.4 cm) infection could be observed in SPV 2142, CSV 22, SPV 2151, SPV 2150 and SPV 2149 and infection remained restricted to about two nodes (Table 4.2).

3.2. **Flowering:** SPV 2146, SPH 1720, SPH 1721, CSH 15 R, SPV 2148 and E 36-1 took least days to flower between ~75-73 days. Longest time of ~84-86 days was taken by SPV 2139, CSV 22, SPV 2152, SPV 2149 and SPV 2142 when the data from Dharwad and Parbhani was considered and test entries differed significantly in flowering (Table 4.2)

3.3. **Other diseases:** Foliar disease rust was recorded at Dharwad. Entries showed resistant reaction with no significant differences. Downy mildew was recorded at Dharwad. It ranged from 2.4 to 11 per cent with no significant differences between test entries. However SPV 2141, SPV 2138, CSV 22, SPV 2150 and M 35-1 contracted lowest (2.4 – 2.9 %) DM. Highest Incidence (7.3 to 11.0) was in SPV 2047, SPV 2154, SPV 2140, SPV 2149 and SPV 2146.

4. Initial Hybrid & Varietal Trial - Shallow soil

Fourteen entries along with checks were evaluated against charcoal rot (locations- Solapur, Dharwad, Parbhani and Bijapur) in *M. phaseolina* sick soils under rabi conditions. Evaluation was also carried by inoculating *Macrophomina phaseolina* (Mp) using tooth pick method (stem stab). Evaluations of reaction against *M. phaseolina* were based on per cent plants infected, fungal growth (diseased lesion; measured in centimetre by splitting stem) in stem and number of nodes crossed. Foliar diseases were assessed using 1-9 rating scale.

4.1. **Charcoal rot:** On all India (Table 4.1) basis incidence ranged from 38.1 to 51.3 and the lowest incidence (~38 to 41%) was observed M 35-1, SPV 2158, SPV 2159, SPV 2162 and Maulee. There were no significant differences between test entries and checks and the highest (~45- 51 %) incidence was observed in SPV 2160, SPV 2155, SPV 2154,, SPV 2161 and CSV 8R. At Solapur incidence was quite high and it ranged from 80 to 100 per cent with no significant difference in test entries. However lowest incidence in the range of 80- 86.7 per cent was recorded were CSH 15R, Maulee, SPV 2157, M 35-1 and Phule Anuradha. Highest incidence (100 per cent) was recorded in SPV 2160 SPV 2161, SPV 2162, SPV 2163 and E 36-1. At Dharwad CR incidence ranged from 4.9 to 57.0 per cent and lowest (4.9 to 14.8%) incidence was observed in SPV 2160. SPV 2162, SPV 2158, M 35-1 and SPV 2163 . The highest incidence of (~25 to 57%) was recorded on SPV 2155, SPV 2156, CSH 5R, SPV 2157 and LC and the test entries differed significantly. At Parbhani there were no significant differences in entries towards CR incidence however lowest incidence (~11- 15%) was recorded in SPV 2157, SPV 2162, SPV 2155 , SPV 2158 and SPV 2163 and the highest (~21-26%) was in LC, SPV 2160, SPV 2161. P moti and E 36-1. At Bijapur there were no significant differences in entries towards CR incidence though incidence ranged from ~25 to 64 per cent. The lowest incidence (~25- 37%) was recorded in SPV 2159, SPV 2157, SPV 2163, SPV 2156 and M 35-1 and the highest (~54- 64%) was in LC, Maulee, SPV 2154, and SPV 2161.

In inoculated plants (Table 4.1) length of Mp infection did not significantly differ in test entries when the data on four centres were considered together. The length ranged from ~15 to 21 cm. The highest length (~18- 21 cm) of infection was observed in Maulee, SPV 2156, P Anuradha, SPV 2161 and LC. The lowest (~15-17 cm) infection could be observed in SPV 2158, SPV 2157, SPV 2163, SPV 2162 and M 35-1 and infection remained restricted to about two nodes (Table 4.2).

4.2. *Flowering*: SPV 2160, Phule Anuradha, Maulee, CSH 15R and SPV 2161 took least days to flower between ~72- 76 days. Longest time of ~81 to 85 days was taken by SPV 2159, SPV 2155, SPV 2158, SPV 2154 and SPV 2162 when the data from Dharwad and Parbhani was considered and test entries differed significantly in flowering (Table 4.2)

4.3. *Other diseases*: Foliar disease rust was recorded at Dharwad. Entries showed resistant reaction with no significant differences. Downy mildew was recorded at Dharwad. It ranged from ~1 to 21 per cent with significant differences between test entries. However P. Anuradha, SPV 2155, SPV 2161, Maulee, and SPV 2159 (~1 to 2.3 %) DM. Highest Incidence (4.6 to 20.6 %) was in SPV 2160, SPV 2158, SPV 2154, SPV 2163 and SPV 2162.

Performance of entries against charcoal rot

Trial	Entries			
	Per cent CR (≤ check)**	Nodal crossing (≤ check)**	Lesion spread (cm) (≤ check)**	Checks
AVHT Deep	SPV 2034, SPH 1666, SPV 2033, SPV 1663, SPV 1690 (38.8 – 42.4%)	SPV 1690, SPV 2104, SPV 2049, SPV 1689, , SPV 2033 (16.8 – 20.5 cm)	SPH 1690 SPV 2104, SPV 2035, SPV 2049, SPH 1666, SPV 2033 (1.7 -2 node)	CSH 15R, CSV 22, M35-1 (17.4 – 20.1 % CR)
AVHT Shallow	SPV 2031, , SPV 2029, SPV 2034, SPV 2084 (39.8-46.2%)	SPV 2031, SPV 2034, SPV 2084, SPV 2048 (18.1 -19.4 cm)	SPV 2031, SPV 2029, SPV 2048, SPV 2084 (1.7-1.9)	CSH 15R, M35-1, Mauli, Phule Anuradha (43.9-49.2 %CR)
IVHT Deep	SPV 2150, SPV 2154, SPV 2152, SPV 2140, SPV 2142 (37.9- 41.3%)	SPV 2142, SPV 2151, SPV 2150, SPV 2149, SPV 2154 (17.9 – 18.5 cm)	SPV 2149, SPV 2154, SPV 2142, SPH 1721, SPV 2150 (1.6-1.7)	CSH 15R, CSV 22 (39.5% CR)
IVHT Shallow	SPV 2158, SPV 2159, SPV 2162, SPV 2157, SPV 2156 (39.9-41.08%)	SPV 2158, SPV 2157, SPV 2163, SPV 2162, SPV 2159 (15.2-17.4 (cm)	SPV 2158, SPV 2155, SPV 2160, SPV 2163, SPV 2162 (1.6-1.7 node)	CSH 15R, M 35-1, Mauli, Ph Anuradha (38.1-51.3 % CR)

** compare on one or more checks

Annexure 1: List of collaborators from AICSIP centre

1	Dr. Ashok V Gadewar	Principal Scientist	NRCS, Solapur
2	Dr YD Narayana	Principal Scientist	UAS, Dharwad
3	V. G. Mulekar	Sorghum Pathologist	MKV Parbhani