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Management of charcoal rot caused by *Macrophomina phaseolina* (Tassi.) Goid in sorghum, *Sorghum bicolor* (L.) Moench.

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ABSTRACT : A field experiment on the management of charcoal rot caused by *Macrophomina phaseolina* (Tassi.) Goid of sorghum by utilising various soil amendments revealed that the combined treatment of straw mulch + neem cake + seed treatment with *Trichoderma viride* Pers. Ex. Fries recorded 7.4 per cent charcoal rot incidence, 18.0 per cent lodging, 0.76 nodes infection and 45.0 per cent senescence as compared to the untreated control (SPV-86) having 33.0 per cent charcoal rot, 52.3 per cent lodging, 2.1 nodes infection and 75 per cent senescence. Significantly higher grain yield was obtained from the combined treatment (1913 kg/ha) as against the untreated control (1412 kg/ha). The next best treatments were straw mulch + neem cake, straw mulch + seed treatment with *T. viride* and straw mulch alone. However, management of charcoal rot by straw mulch alone works out to be economical and effective.

KEY WORDS : Charcoal rot, *Macrophomina phaseolina*, neem cake, straw mulch, *Trichoderma viride*

Charcoal rot of sorghum caused by *Macrophomina phaseolina* (Tassi.) Goid, is a potentially destructive disease in the rabi sorghum tracts of Karnataka, Maharashtra, Andhra Pradesh and Gujarat. The potential use of *Trichoderma viride* Pers. Ex. Fries as a biocontrol agent for *M. phaseolina* is well established (Cook and Baker, 1983; Mathur and Bhatnagar, 1994; Ramakrishnan *et al.*, 1994). There is little information available on the integrated management of charcoal rot of sorghum using cultural and biological means. Hence, an effort was made to study

the effect of *T. viride* along with soil amendments on charcoal rot infection and grain yield in rabi sorghum.

MATERIALS AND METHODS

A field experiment was laid out at Regional Research Station (UAS, Dharwad), Bijapur, Karnataka. The experiment was laid out in a randomised block design with nine treatments replicated thrice. The treatments were Swati (base variety), straw mulch (5 t/ha), seed treatment with *T. viride*, neem cake (500 kg/ha), straw mulch + seed treatment with *T. viride*, straw mulch + neem cake, seed treatment with *T. viride* + neem cake, straw mulch + seed treatment with *T. viride* + neem cake and control (SPV-86).

The charcoal rot tolerant line "Swati" was used as a base variety for application of different treatments as mentioned above whereas, SPV-86 was used as a susceptible check. The crop was sown in five rows with 5m length and 45 x 15 cm spacing. Seed treatment was done with neem cake @ 500 kg/ha and/or *T. viride* culture (4g/ kg seeds). Straw mulch (5t/ha) was applied after the sowing and thinning operations of the crop. After anthesis, the crop was artificially inoculated with *M. phaseolina* culture following tooth-pick method of artificial inoculation (Edmunds *et al.*, 1964).

After the crop reached physiological maturity the observations on the charcoal rot parameters such as lodging (%), mean nodes crossed (nos.), mean length of spread (cm), senescence (% drying) and charcoal rot (CR %) were taken. At harvest, the grain yield from individual treatments was recorded. The data collected were subjected to analysis of variance after transformation.

RESULTS AND DISCUSSION

The results on different charcoal rot parameters under different treatments are presented in Table 1. The charcoal rot (CR %) ranged from 7.4 to 33.0 per cent. Significantly lower CR (7.4%) was recorded in the combined treatment of straw mulch + seed treatment with *T. viride* + neem cake, as compared to the base variety Swati (31.6 %) and susceptible check, SPV-86 (33.0 %).

Lodging due to charcoal rot was minimum in straw mulch (13.7 %) which was on par with straw mulch + neem cake (16.1%) and combination of straw mulch + ST with *T. viride* + neem cake (18.0%). Swati (untreated) and SPV-86 recorded 44.5 per cent and 52.3 per cent lodging, respectively.

Lowest mean nodes crossed (MNC nos.) were recorded in the treatments *viz.* straw mulch + ST with *T. viride* + neem cake (0.76) followed by straw mulch + neem cake (0.80). In Swati and SPV-86 (control) the infection crossed 1.8 and 2.1 nodes, respectively.

Mean length of spread (MLS cm) of charcoal rot infection was significantly low

Table 1. Charcoal rot parameters under different treatments

Treatment	Charcoal rot (%)	Lodging (%)	MNC (No.)	MLS (cm)	Senescence (%)	Grain Yield (kg/ha)
Swati (base variety)	31.6 (34.2)*	41.8 (40.3)	1.8	16.1	72.5	1487
Straw mulch	18.0 (25.1)	13.7 (22.1)	1.3	12.6	50.0	1744
ST with *T. viride*	11.8 (20.1)	30.3 (33.4)	1.4	14.2	70.0	1500
Neem cake	18.6 (25.5)	31.5 (34.1)	1.8	15.6	75.0	1521
Straw mulch + ST with *T. viride*	7.6 (15.9)	15.8 (23.4)	1.2	12.4	52.5	1717
Straw mulch + Neem cake	14.7 (22.6)	16.1 (23.7)	0.8	11.6	52.5	1757
ST + Neem cake	7.8 (16.2)	31.6 (34.2)	1.4	15.2	70.0	1568
Straw mulch + ST + Neem cake	7.4 (15.7)	18.0 (25.0)	0.7	9.7	45.0	1913
Control (SPV-86)	33.0 (35.0)	52.3 (46.3)	2.1	18.8	75.0	1412
CD (P=0.05)	3.76	4.4 8	0.41	4.37		96
CV%	9.29	8.21	16.70	17.90		13

* The values in parenthesis indicate arcsine transformations

in combination of straw mulch + ST with *T. viride* + neem cake (9.7 cm) followed by straw mulch + neem cake (11.6 cm) and straw mulch + ST with *T. viride* (12.4 cm). The untreated tolerant variety Swati and SPV-86 (check) recorded 16.1 and 18.8 cm length of spread of the disease, respectively.

It was observed that straw mulch + ST with *T. viride* + neem cake recorded the lowest drying (45.0%) followed by straw mulch (50.0%), straw mulch + neem cake, and straw mulch + ST with *T. viride* (52.5% each). In contrast, 70-75 per cent drying was observed in the treatments devoid of straw mulch; indicating the role of straw mulch in soil moisture conservation and preventing the crop from quick drying.

Significantly high grain yield was recorded in straw mulch + ST with *T. viride* + neem cake (1913 kg/ha) followed by straw mulch (1744 kg/ha) and straw mulch + ST with *T. viride* (1717 kg/ha) as compared to untreated varieties Swati (1487 kg/ha) and SPV-86 (1412 kg/ha).

From the above results it becomes clear that, wherever straw mulch is applied there is significant increase in grain yield as well as reduction in charcoal rot and lodging. Seed treatment with *T. viride* has also significantly controlled the charcoal rot. Similar results have been obtained in other locations (Anon., 1992, 1993; Lukade, 1995).

The results reveal that the most effective management of charcoal rot in rabi sorghum is obtained by the combined treatment of straw mulch + seed treatment with *T. viride*.

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