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RESEARCH PAPER

Integrated management of Cercospora leaf spot of niger under field condition

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Abstract: Niger (*Guizotia abyssinica* Cass.) is an important minor oil seed crop grown in dry areas mostly in tribal and interior places as a lifeline of the tribal segment. Keeping in view the destructive nature of *Cercospora* leaf spot and its economic loss, the present investigation was conducted to evaluate the efficacy of fungicides and bioagents against *Cercospora* leaf spot of niger. Results revealed that all the treatments showed significant differences over the untreated check. Among the treatments evaluated for Cercospora leaf spot (*Cercospora guizoticola*) of niger, seed treatment with *Trichoderma harzianum* at 3g/kg followed by two sprays of carbendazim 50% WP at 0.1 per cent at 15 days interval during capitulum and pre-harvest stage recorded least per cent disease index (23.60), highest yield (8.90 q/ha) and seed test weight (4.85 g) which was found statistically on par with seed treatment with *T.harzianum* at 3g/kg followed by two sprays of (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent at 15 days interval during capitulum and pre-harvest stage which recorded per cent disease index of 25.57, a yield of 8.10 q/ha and test weight of 4.76 g.

Key words:Capitulum stage, *Cercospora* leaf spot, Per cent disease index, Pre-harvest stage

Introduction

Niger [*Guizotia abyssinica* (Linn. F.) Cass.] is an under-utilized minor oilseed crop in India grown on marginal and submarginal land by tribals with minimal inputs under rainfed conditions (Ranganatha *et al.*, 2009). Niger contains 34-36 per cent quality oil with 18-20 per cent protein in the seed (Rai *et al.,* 2016). It is also grown as an oilseed crop in India, supplying about 3 percent of the country's edible oil needs (Getinet and Sharma, 1996).

In India, niger occupied an area of 13.6 lakh ha and contributed to the production of 41 thousand tonnes with an average yield of 303 kg/ha, primarily during *kharif* (Anon, 2020). Madhya Pradesh, Odisha, Maharashtra, Karnataka and Chhattisgarh are the leading states contributing significantly to the niger production within the country.

Even in low soil fertility, moisture stress and poor crop management conditions, the crop can produce a high seed yield. It has a yield potential of 800-1000 kg/ha under optimum growing conditions (Ranganatha, 2014). Niger is a crop of dry areas grown mostly by tribal in interior places, due to which desired attention has not been given to the biotic and abiotic stresses. The crop is gaining importance and studies are being made on disease aspects (Rajpurohit, 2011).

The niger crop is found infested by several diseases and pests, which cause severe damage to the crop. The important diseases of niger are *Alternaria* blight (*Alternaria porii* and *A. alternata*), leaf spot (*Cercospora guizoticola*), seedling blight (*Alternaria tenuis*), seed rot (*Rhizoctonia bataticola*), rust (*Puccinia guizotiae*), powdery mildew (*Sphaerotheca* sp.) and root rot (*Macrophomina phaseolina*) (Rajpurohit and Dubal, 2009).

This disease is more severe under warm and humid weather. At the time of monsoon, the accidental rain at the flowering and seed development stage leads to the expansion of Cercospora leaf spot disease and can further result in poor seed set and seed yield (Rajpurohit, 2011). Yield loss due to the disease is one of the major constraints. Systematic studies on the estimation of loss in yield have not been worked out but its damage to the crop is reported to occur in India (Rajpurohit, 2011).

Keeping in view the destructive nature of the disease and its economic loss, the present investigation was undertaken for the management of Cercospora leaf spot disease (Kolte, 1985; Rajpurohit *et al.*, 2005; Rajpurohit, 2011).

Material and methods

A field experiment was conducted during *kharif* 2021 under AICRP on Sesame and Niger, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, India.

The investigation was carried out to evaluate the efficacy of fungicides and bioagents against Cercospora leaf spot of niger.The experiment was laid out in randomized block design (RCBD) with nine treatments and three replications. The treatments were randomly allotted to the plots. The variety DNS-4 was sown in a net plot size of 3 x 2.4 m^2 with a recommended package of practices.

Seeds were treated with carbendazim at 3g/kg for all the treatments. All other packages of practices were followed and kept common to all the treatments.The first spray of bioagents at the flowering stage was carried out for all the treatments to avoid the adverse effect of fungicides on honey bee activity for pollination and good seed set. Details of all the treatments imposed are mentioned below

Tr. No. Treatment details

T_1 ST* + Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of carbendazim 50% WP at 0.1 per cent at 15 days intervals during capitulum and pre-harvest stage

T_2 ST + Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of mancozeb 75%WP at 0.2 per cent at 15 days intervals during capitulum and pre-harvest stage

T_3 ST + Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of (carbendazim 12% + mancozeb 63%WP) at 0.2 per cent at 15 days intervals during capitulum and pre-harvest stage

T_4 ST + Spray of *Pseudomonas fluorescens* at 1 per cent at flowering stage followed by two sprays of propiconazole 25% EC at 0.1 per cent at 15 days intervals during capitulum and pre-harvest stage

T_5 ST + Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of hexaconazole 5% SC at 0.1 per cent at 15 days intervals during capitulum and pre-harvest stage

T_6 ST + Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of (tebuconazole 50% + trifloxystrobin 25% w/w) 75WG at 0.05 per cent at 15 days intervals during capitulum and pre-harvest stage

T_7 ST + Spray with *Trichoderma harzianum* at 1 per cent during flowering, capitulum and pre-harvest stage

T_8 ST + Spray with *Pseudomonas fluorescens* at 1 per cent during flowering, capitulum and pre-harvest stage

T_9 Untreated check ST* indicates seed treatment with carbendazim 50% WP @ 3g/kg is common for the treatments T_1-T_8

Table 1. Disease rating scale for cercospora leaf spot of niger

Score	Description	Reaction
0	No infection	Immune
1	1-10% leaf area infected	Resistant
2	11-25% leaf area infected	Moderately resistant
3	26-50% leaf area infected	Moderately susceptible
4	51-70% leaf area infected	Susceptible
5	71-100% leaf area infected	Highly susceptible

The average intensity in each plot was calculated by the formula employed by Wheeler, 1969.

$$\text{Per cent disease index (PDI)} = \frac{\text{Summation of numerical ratings}}{\text{No.of leaves observed x Maximum disease score}} \times 100$$

Percent Disease Index (PDI) was recorded as per the disease intensity at field conditions by using a Disease Rating scale of (0 to 5), as developed by Mayee and Datar (1986) and Town send and Heuberger (1943).

Results and discussion

All the treatments showed significant differences over the untreated check. Among the treatments evaluated against Cercospora leaf spot of niger, T1- spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of carbendazim 50% WP at 0.1 per cent recorded least per cent disease index of 23.60 which was found statistically on par with T3- spray of *Trichoderma harzianum*at 1 per cent followed by two sprays of (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent which recorded per cent disease index of 25.57. This was followed by a T2- spray of *Trichoderma harzianum*at 1 per cent followed by two sprays of mancozeb 75% WP at 0.2 per cent witha per cent disease index of 32.70 (Fig. 1).

Spray of *Trichoderma harzianum* at 1 per cent was found less effective with per cent disease index of 51.31 and was found on par with the spray of *Pseudomonas fluorescens* at 1 per cent with per cent disease index of 52.62. However, they were found significantly superior over the untreated check which displayed a per cent disease index of 60.59.

Table 2. Field efficacy of chemical fungicides and bioagents against cercospora leaf spot of niger under field conditions

Tr. No	Treatment details	CLS(PDI)	Test weight (g)	Yield (q/ha)
T_1	Spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of carbendazim 50% WP at 0.1 per cent	23.60 (29.00) *	4.85	8.90
T_2	Spray of *Trichoderma harzianum* at 1 per cent at flowering stage followed by two sprays of mancozeb 75%WP at 0.2 percent	32.70 (34.85)	4.63	7.77
T_3	Spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of (Carbendazim 12% + Mancozeb 63%WP) at 0.2 percent	25.57 (30.25)	4.76	8.10
T_4	Spray of *Pseudomonas fluorescens* at 1 per cent followed by two sprays of propiconazole 25% EC at 0.1 per cent	42.06 (40.39)	4.71	7.20
T_5	Spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of hexaconazole 5% SC at 0.1 per cent	43.40 (41.18)	4.74	7.80
T_6	Spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of (Tebuconazole 50% + Trifloxystrobin 25% w/w) 75WG at 0.05 per cent	40.39 (39.42)	4.74	6.80
T_7	Spray with *Trichoderma harzianum* at 1 per cent	51.31 (45.74)	4.64	6.60
T_8	Spray with *Pseudomonas fluorescens* at 1 per cent	52.62 (46.50)	4.67	6.40
T_9	Untreated check	0.59 (51.12)	4.57	5.60
S.Em. ±		1.45	0.03	0.37
C.D. at 5%		4.40	0.09	1.10
C.V. (%)		6.32	1.06	8.75

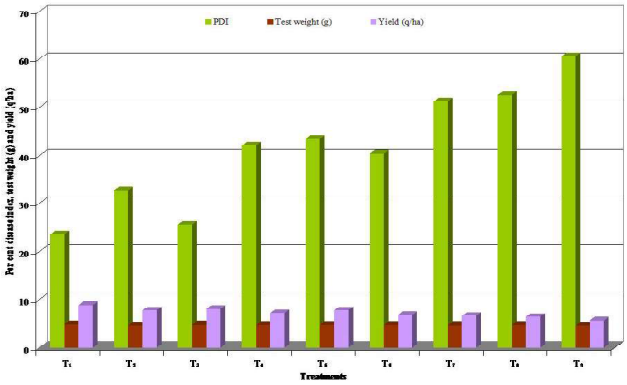

Fig.1 Graphical representation of the effect of fungicides and bioagents on per cent disease index of Cercospora leaf spot, test weight and seed yield

Concerning the effect of fungicides and bioagents on yield parameters of the crop, T1- spray of *Trichoderma harzianum* at 1 per cent followed by two sprays of carbendazim 50% WP at 0.1 per cent recorded the highest seed yield of 8.90 q/ha, with maximum test weight of 4.85 g. However, the treatment was found on par with T3- spray of *T. harzianum* at 1 percent followed by two sprays of (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent which recorded seed yield of 8.10 q/ha and test weight of 4.76 g. Whereas, the lowest seed yield (5.60 q/ha) and test weight (4.57 g) were recorded in untreated check (Table 2).

Similar results were obtained by Sandipan *et al.* (2014) who reported that (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent recorded the least per cent disease index of Cercospora leaf spot (13.62) and highest yield of 337 kg/ha which was followed by the carbendazim 50% WP (0.1%) for Cercospora leaf spot (17.03).The above results are also in agreement with Sandipan *et al.* (2018) who reported that Saaf (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent, recorded the least percent disease index of Cercospora leaf spot (19.18) which was followed by the carbendazim 50% WP (0.1%) for Cercospora leaf spot (18.48). Gupta (2017) reported similar results indicating that (carbendazim 12% + mancozeb 63% WP) at 0.2 percent recorded least per ent disease index of Cercospora leaf spot of niger (5.62).

Conclusion

Seed treatment with carbendazim 50% WP at 3g/kg along with a spray of *Trichoderma harzianum* at 1 per cent during the flowering stage followed by two sprays of carbendazim 50% WP at 0.1 per cent at 15 days intervals during capitulum and pre-harvest stage,and seed treatment with carbendazim 50% WP at 3g/kg and foliar spray of *T. harzianum* at 1 per cent during flowering stage followed by two sprays of (carbendazim 12% + mancozeb 63% WP) at 0.2 per cent at 15 days interval during capitulum and the pre-harvest stage was found effective for the management of Cercospora leaf spot of niger with higher seed yield.

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