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Bio Management of Major Seed Borne Diseases in Sesame

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ABSTRACT: Among the seed borne diseases of sesame, Root and stem rot caused by *Macrophomina phaseolina,* Alternaria leaf spot caused by *Alternaria sesami* and Cercospora leaf spot caused by *Cercospora sesame* are the major destructive diseases. The yield loss due to these diseases was around 57% at about 40% disease incidence. In this study, management of these diseases was done by using bio-agents like *Pseudomonas* spp. and *Trichoderma* spp. And it was revealed that seed treatment with a combination of two bio agents *i.e.,* Seed treatment with *Trichoderma viride* @ 10 g/kg of seed + *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by two sprays of Nimbecidine @ 10ml/l at thinning, flowering and spray of Sulphur @ 2g/l at capsule stage, resulted in less disease incidence and more seed yield under field conditions.

Keywords: *Trichoderma viride*, *Pseudomonas fluorescens*, seed borne diseases.

INTRODUCTION

Sesame (*Sesamum indicum* L.), also known as Til, is an erect annual plant that blooms and grows to a height of 50 to 100 cm. It belongs to the Pedaliaceae family and has white to purple tubular flowers (Gupta and Bisen 2021). It is a medicinal plant with the power to prevent diabetes, decrease blood pressure, prevent a variety of malignancies, and strengthen bones (Bhajbhuje, 2020). It is grown all over the world, including in Tanzania, India, China, Nigeria, and Myanmar with a total production of 7.08 lakh tones and a productivity of 442 Kg/ha, the sesame crop is farmed throughout all of India on an area of 16.03 lakh ha (Anon, 2021). India has several states that are good at producing sesame, including Madhya Pradesh, Uttar Pradesh, Rajasthan, West Bengal, Gujarat, Andhra Pradesh, Telangana, Karnataka, and Orissa. *Sesamum* grows on an area of 315 hectares in Madhya Pradesh, where it produces 126 tones and yields 400 kg per ha (Anon., 2020).

This crop is grown at a latitude of 1600 meters in a variety of climates, from the semi-arid tropics and subtropics to temperate regions (Karibasappan *et al*., 2020). And 25–30°C is the ideal temperature for crop growth. Due to its broad root system, it is a drought-tolerant crop that thrives in light to medium soils with an ideal pH range of 5.5 to 8.0. *Sesamum* cultivation is challenging in soils with high salinity and water retention. Normally, the sesame plant requires 90 to 120 days without frost. In a warm environment, the crop will grow more swiftly. Numerous phytopathogens attack the sesame crop, majority of which are seed-bornelike Root and stem rot, Alternaria leaf blight and Cercospora leaf spot of Sesame Ranging from 23.9 to 35.4% (Ranasingh *et al.*, 2019).

These seed-borne diseases are spread by infected seeds and they cause damage to seed, seedling, root, stem and foliage resulting in significant loss (Didwania *et al.*, 2019). It was estimated that Root and Stem rot causes 5-100 per cent loss of yield in all sesame growing areas (Meena, 2020) and Alternaria leaf blight causes 20 – 40 per cent yield loss (Kumar and Mishra 1992).

As the demand for export of sesame seed and oil is high the safer methods like biological control have gained the attention (Mallaiah *et al*., 2016). In this investigation seed treatment was done by using different bio agents to control the diseases.

MATERIALS AND METHODS

The experiment was carried out during kharif 2021-2022 in randomized block design with three replications and eight treatments (T_1 to T_8, detailed given in Table 3) including control to know the effectiveness of bioagents against the major seed borne diseases and the yield of sesame, in the field of All India Coordinated Research Project on Sesame and Niger, College of Agriculture, JNKVV, Jabalpur (M.P.) India using the local bio-agents like *Trichoderma viride*, *Pseudomonas fluorescence* and organics like vermicompost biological insecticide like Nimbecidine were used in this field experiment.

Per cent Disease Incidence given by Vidhyasekaran and Muthimilan (1995) and Per cent Disease Index (PDI) given by Kushwaha and Kausal (1970) were calculated for the sesame crop grown in the field to know the effective bio-agents for the control of major seed borne diseases.

Table 1: Disease rating scale of Per cent Disease Incidence.

Disease scale	Description	Disease Reaction
0	No incidence	Immune or Highly Resistant
1	1-10% incidence	Resistant
2	11-25% incidence	Moderately Resistant
3	26-50% incidence	Moderately Susceptible
4	51-70% incidence	Susceptible
5	More than 70% incidence	Highly Susceptible

$$\text{Per cent disease incidence} = \frac{\text{Number of diseased plants}}{\text{Total number of plants}} \times 100$$

Table 2: Disease rating scale of Per cent Disease Index.

Disease grade	Description	Disease Reaction
0	No incidence	Immune or Highly Resistant
1	1-10% Leaf area infected	Resistant
2	11-25% Leaf area infected	Moderately Resistant
3	26-50% incidence Leaf area infected	Moderately Susceptible
4	51-70% incidence Leaf area infected	Susceptible
5	More than 70% incidence Leaf area infected	Highly Susceptible

$$\text{Per cent Disease Index (PDI} = \frac{\text{Sum of observed numerical rating}}{\text{No. of leaves observed} \times \text{Max. Disease score}} \times 100$$

RESULTS AND DISCUSSION

In field, the trail conducted for the management of major seed borne diseases of sesame, all the treatments were identified to be superior than control (Table 3 and Plate 1) revealed that among the treatments , T_6 (Seed treatment with *Trichoderma viride* @ 10 g/kg of seed + *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma varied* + 100 kg vermicompost) @ 250 kg/ha followed by two sprays of Nimbecidine @ 10ml/l at thinning, flowering and spray of Sulphur @ 2g/l at capsule stage) has recorded minimum disease incidence against Root and stem rot (8.33%) and minimum per cent disease index (PDI) for *Alternaria* leaf spot (5.33%) and *Cercospora* leaf spot (5.66%) and gave the maximum yield of 615 kg/ha followed by T_5 (Seed treatment with *Trichoderma viride* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by spray of Nimbecidine @ 10ml/l at thinning, flowering and spray of Sulphur at capsule stage @ 2g/l) which has recorded the disease incidence as 13.66% for Root and stem rot and PDI 7.66% and 7.00% for *Alternaria* leaf blight and *Cercospora* leaf spot with the yield 597 kg/ ha.

The maximum disease incidence of (43.33%) Root and stem rot and PDI (25.33% and 19.00%) for *Alternaria* leaf spot and *Cercospora* leaf spot was recorded in control (T_8) with minimum yield 260 kg/ha, followed by T_1 (Seed treatment with *Trichoderma viride* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by spray of *Trichoderma viride* at thinning, flowering and capsule stage @ 5g/l) has recorded 23.33 % disease incidence for Root and stem rot, PDI 16.33% and 14.33% for *Alternaria* leaf spot and *Cercospora* leaf spot with the yield 475 kg/ ha (Fig. 1).

The above findings were also reported by (Mahalakshmi, 2021) who conducted a field experiment in two consecutive years against Root & stem rot of sesame using integrated disease management practices and revealed that seed treatment with *Tricoderma viride* @ 4 g/Kg + *Pseudomonas flourescens* @ 10 g/Kg + soil application of *Pseudomonas fluorescens* @ 2.5 Kg/ha + *Tricoderma viride* @ 2.5 Kg/ha enriched in 100 Kg of FYM + neem cake @ 250 Kg/ha has effectively decreased the incidence of *Macophomina phaseolina* and gave higher yield in both the years.

Similar findings were also given by Gupta and Ranganatha (2014); Gupta and Bisen (2021) who worked on various sesame diseases and revealed that seed treatment with *Trichoderma viride* (5g/Kg seed and soil application of *T. viri*de @ 2.5Kg/ha was found effective and economical for the management of Root and stem rot of sesame.

(a) Best Treatment (T_6)

(b) Control (T_8)

Plate 1: Bio management of major seed borne diseases in sesame.

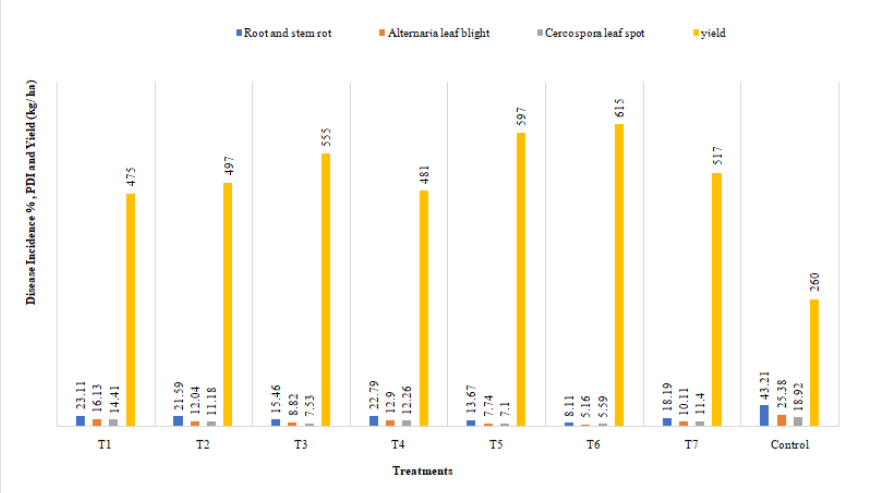

Fig. 1. Field performance of Bio-agents against major seed borne diseases of sesame (Yield Kg/ ha).

Table 3: Field performance of bio-agents against major seed borne diseases of sesame.

Sr. No.	Details of the Treatment	Root and stem rot (per cent disease incidence)	*Alternaria* leaf blight (PDI)	*Cercospora* leaf spot (PDI)	Yield (Kg/ha)
T_1	Seed treatment with *Trichoderma viride* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by spray of *Trichoderma viride* at thinning, flowering and capsule stage @ 5g/l	23.33	16.33	14.33	475
T_2	Seed treatment with *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched P. *fluorescens* (2.5 kg P. *fluorescens* + 100 kg vermicompost) @ 250 kg/ha followed by spray of P. *fluorescens* at thinning, flowering and capsule stage @ 5g/l	21.66	12.00	11.00	497
T_3	Seed treatment with *Trichoderma viride* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by rhizosphere inoculation of *Trichoderma viride* at thinning and spray at flowering and capsule stage @ 5g/l	15.66	8.66	7.66	555
T_4	Seed treatment with *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched P. *fluorescens* (2.5 kg P. *fluorescens* + 100 kg vermicompost) @ 250 kg/ha and rhizosphere inoculation of P. *fluorescens* at thinning and spray at flowering and capsule stage @ 5g/l.	22.66	12.6	12.33	481
T_5	Seed treatment with *Trichoderma viride* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by spray of Nimbecidine @ 10ml/l at thinning, flowering and spray of sulphur at capsule stage @ 2g/l.	13.66	7.66	7.00	597
T_6	Seed treatment with *Trichoderma viride* @ 10 g/kg of seed + *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by spray of Nimbecidine @ 10ml/l at thinning, flowering and spray of sulphur at capsule stage @ 2g/l.	8.33	5.33	5.66	615
T_7	Seed treatment with (Carbendazim 12 % + Mancozeb 63 %) @ 3g/kg, spray of (Carbendazim 12 % + Mancozeb 63 % 75WP %) at 2g/l at 45 and 60 days after sowing. (Treated check)	18.33	10.33	11.33	517
T_8	Control	43.33	25.33	19.00	260
	C.D (0.05)	2.546	2.610	1.813	1.972
	CV (%)	6.964	12.122	9.374	0.225
	SEm ±	3.241	0.89	0.78	1.966

CONCLUSIONS

In the bio management of seed borne diseases like Root and stem rot, *Alternaria* leaf blight and *Cercospora* leaf spot, Among all the treatments, the seed treatment with two different bio agents like *Trichoderma vride* and *Pseudomonas flourescens* has shown minimum incidence disease with maximum yield *i.e.*, T_6 (Seed treatment with *Trichoderma viride* @ 10 g/kg of seed + *Pseudomonas fluorescens* @ 10 g/kg of seed, furrow application of enriched *Trichoderma viride* (2.5 kg *Trichoderma viride* + 100 kg vermicompost) @ 250 kg/ha followed by two sprays of Nimbecidine @ 10ml/l at thinning, flowering and spray of Sulphur @ 2g/l at capsule stage) has recorded minimum disease incidence against Root and stem rot (8.33%) and minimum per cent disease index (PDI) for *Alternaria* leaf spot (5.33%) and *Cercospora* leaf spot (5.66%) and gave the maximum yield of 615 kg/ ha.

The maximum disease incidence of 43.33% for Root and stem rot and maximum per cent disease index of 25.33% for *Alternaria* leaf blight and 19.00% for *Cercospora* leaf spot with minimum yield of 260 kg/ ha was identified in the control.

FUTURE SCOPE

- More combinations of bio-control agents can be used for seed treatment to manage the seed borne mycoflora.
- By using seed health testing methods, seed treatment with bio agents can be done to study their effect on mycoflora.

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