Management Of Alternaria blight disease of mustard through biofungicides

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Abstract. Alternaria blight, caused by Alternaria brassicae, is a major disease affecting mustard crops, leading to significant yield losses. Traditional chemical fungicides have been extensively used to manage this disease, but concerns over environmental pollution, development of resistance, and potential health hazards have shifted the focus towards alternative strategies. Biofungicides, derived from natural sources such as microbes, plants, and their products, have emerged as promising alternatives for managing Alternaria blight while ensuring sustainability and minimal environmental impact. The purpose of the present study was the use of biofungicides as a more sustainable alternative for managing Alternaria blight in mustard at Amity University, located in Noida, Uttar Pradesh. The organic treatment included FYM, Neem oil, Trichoderma viride in different combinations. Pusa Sag1 variety was used for the field study. The present findings revealed the significance differences were recorded in different growth stages of mustard among the various treatment tested. It has been found that minimum disease incidence was observed in T5-Trichoderma viride + FYM + Neem oil (3%), followed by T4- Trichoderma viride + Neem oil (13%), T3- Trichoderma viride (15%), T2- Neem oil(28%), T1- FYM(28%). Biofungicides holds great promise for sustainable disease control while minimizing environmental risks and promoting agricultural resilience.

KEY WORDS: Alternaria blight disease, Mustard, Biofungicide, Disease management.

1. INTRODUCTION

Mustard (*Brassica juncea*) is an annual herbaceous plant. In most situations, a waxy layer covers the stems. The leaves are serrated, lobed, and have the larger terminal lobes on occasion. The yellow flowers grow clustered in groups of 5 to 12 blossoms [1]. The seeds are mostly red to brown in colour. The name mustard, is derived from the Latin word mustum, or must of old wine mixed with crushed seed makes it one of the most important spice in the world [2].Mustard is a cool season crop and is cultivated in the tropical as well as in the temperate climates. It is vulnerable to frost, cold, and drought, it is sown early to avoid frost damage and harvested before the advent of frost. It can be grown wide under rainfed as well as irrigated conditions. In India it is grown in Rabi season from September-October to February-March. Mustard can be cultivated in a variety of soil types, ranging from sandy loam to clay loam. They are sensitive to water logging and do not thrive in thick soils, but they can endure moderate salinity. Their optimum growth and development require soil with a neutral pH.

Brassica juncea, prominently Known as rai, sarso, raya, laha, toral, or lahl is considered as significant oilseed crops in India. It is generally recognised as Indian mustard that is overall natural as oilseed as well as vegetable and fixings [1, 3]. Brassica juncea is prepared to do high output, solid plantlet improvement, quicker earth layering capacity, better resilience to high temperature and drought with upgraded resistance from insects and diseases [4, 5]. It is otherwise called a transporter of vitamin A, vitamin D, vitamin E and vitamin K which are fat soluble in the body. After soybean, mustard accounts for about one-third of India's oil production, making it the country's most important edible oilseed crop. India accounts for 19.29% of total mustard acreage and 11.27 percent of total mustard production globally [6]. In terms of productivity, India was last among the top ten mustard seed producing countries and could not maintain any position among the top 10 mustard seed producing countries.

As a result, for India to achieve edible oil self-sufficiency, particularly through mustard, good quality seed of suitable variety and timely transmission to oilseed producers are critical, and the use of farm saved seed must be restricted [7].

Rajasthan is India's largest mustard growing state, accounting for 46.08 percent of overall mustard production, while Haryana and Gujarat are far ahead of other states in terms of productivity.
India, Nepal, Canada, China, Pakistan, Bangladesh, and Sweden are the world's major mustard producers. In terms of production, Canada is the best in the world. It is mostly grown in Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, and Gujarat in India. Rajasthan is India's biggest mustard producer, producing up to 49-50 percent of the country's total oil seed [8].
In agriculture, seed is used to propagate 90% of all crops. The most widely planted oilseed crops in the world (groundnut, sesame, mustard, etc.) are all susceptible to seed brone illnesses. Fungi are classified as external seed-borne or internal seed-borne based on whether they are present on the seed coat or within the seed. The symptoms of Alternaria blight disease arise on seedling and adult plant leaves and stem, as well as in siliquae during the ripening stage. Dark stains on the leaves and silique diminish photosynthetic capacity and induce immature ripening, resulting in lower quality seed production in both vegetable and oliferous crop[9, 10, 11, 12].
Alternaria blight is caused by the fungal pathogens *Alternaria brassicae* and *Alternaria brassicicola*, is a major disease of mustard (Brassica juncea), leading to significant yield losses (17-45%) and reduced oil quality. Conventional management relies heavily on synthetic fungicides, raising concerns about environmental damage, fungicide resistance, and human health Microorganisms like *Trichoderma viride* and *Pseudomonas fluorescens* produce metabolites that directly inhibit fungal growth[9, 10].
The specific symptoms typically associated with Alternaria leaf blight are leaf lesion, lesion expansion, leaf yellowing, lesion coalescence, stem and fruit infections, spore production, defoliation and reduced yield[11].
Preventive measures for Alternaria leaf blight include maintaining proper plant spacing for good air circulation, and applying bio-fungicides preventatively in high-risk situations. Removing and destroying infected plant debris can also help reduce the disease's overwintering potential. Use certified disease-free seeds to avoid introducing the fungus through infected seeds. Additionally, crop rotation, use resistant varieties, monitoring, cultural practices, biological control and plant nutrition[13, 14, 15].

Managing Alternaria leaf blight through biofungicides involves using naturally occurring microorganisms or their derivatives to suppress the growth and activity of the Alternaria fungus[16].

Before using any biofungicide product, it's essential to read and follow the manufacturer's instructions regarding application rates, timing, and safety precautions. Additionally, it's a good idea to conduct small-scale trials to evaluate the efficacy of biofungicides under local growing conditions[17].

2. MATERIALS AND METHODS

The experimental findings of the present investigation entitled “Management of Alternaria blight disease of mustard”. Pusa Sag1 (variety) was carried out at the Noida (Uttar Pradesh) during the Rabi season of 2021 (October 2023- March 2024) to identify and managed alternaria blight disease of mustard variety Pusa Sag1.

2.1 Sampling and data collection:

Daily observations on Alternaria blight disease was observed from the date of sowing to maturity of mustard crop. After first appearance of leaf blight, further observations were repeated at weekly interval as well as leaves infestation caused by alternaria blight disease was obsevere at each growth stage. Three plants per plot were randomly selected for recording observations at weekly interval of leaf blight.

2.2 Percentage of disease infestation(%):

Select the present sample of plants from mustard crop, at random, to monitor for symptoms of Alternaria bight disease infection. The number of plants sampled will depend on the size of the field and the level of disease prevalence, but a minimum of 50 plants is recommended for accurate estimation. Observe the plants regularly for symptoms of Alternaria blight disease infection, such as leaf spot or leaf blight. Record the number of plants in sample that display symptoms of the disease.

Disease incidence is the percentage of plants in a population that shows symptoms of the disease at a given time. Disease severity, on the other hand, is a measure of the proportion of plant tissue that is affected by the disease.

The percentage disease incidence was calculated by using the following formula:

Disease incidence (%) = (Number of plants with symptoms / Total number of plant inspected) * 100

Yield data in all the treatments was also estimated.

The experiment was conducted with six organic treatment in different growth stages i.e, 65DAS, 80DAS and 95DAS.

Table1: Treaments details

Treatments	Treatment details
T1	*FYM*
T2	*NEEM OIL*
T3	*TRICHODERMA VIRIDE*
T4	*NEEM OIL+TRICHODERMA VIRIDE*
T5	*NEEM OIL+TRICHODERMA VIRIDE+FYM*
T6	CONTROL

3. RESULT AND DISCUSSION:

The observation on disease incidence in mustard crop at different days of sowing were recorded and presented below:

Testing of different treatments on disease incidence on leaves of mustard at different intervals (65, 80 and 95 DAS)

65 DAS: Result showed the maximum disease incidence (%) was recorded in T6-control(70%) and minimum disease incidence was observed in T5-Trichoderma viride + FYM + Neem oil (20%), followed by T4- Trichoderma viride + Neem oil (28%), T3- Trichoderma viride (38%), T2- Neem oil(50%), T1- FYM(50%). However, T5-Trichoderma viride + FYM + Neem oil was found superior over all the treatments and T1- FYM and T2- Neem oil was found least significant among the treatments. All the the treatment were significant over the control and also significant among themselves.

80 DAS: Result showed the maximum disease incidence (%) was recorded in T6-control (60%) and minimum disease incidence was observed in T5-Trichoderma viride + FYM + Neem oil (6%), followed by T4- Trichoderma viride + Neem oil (20%), T3- Trichoderma viride (28%), T2- Neem oil(40%), T1- FYM(40%). However, T5-Trichoderma viride + FYM + Neem oil was found superior over all the treatments and T1- FYM and T2- Neem oil was found least significant among the treatments. All the the treatment were significant over the control and also significant among themselves.

95 DAS: Result showed the maximum disease incidence (%) was recorded in T6-control (50%) and minimum disease incidence was observed in T5-Trichoderma viride + FYM + Neem oil (3%), followed by T4- Trichoderma viride + Neem oil (13%), T3- Trichoderma viride (15%), T2- Neem oil(28%), T1- FYM(28%). However, T5-Trichoderma viride + FYM + Neem oil was found superior over all the treatments and T1- FYM and T2- Neem oil was found least significant among the treatments. All the the treatment were significant over the control and also significant among themselves.

Table 2: Disease incidence of Alternaria blight disease in mustard at different growth stages

Treatments	Disease incidence (%) in 65DAS	Disease incidence (%) in 80DAS	Disease incidence (%) in 95DAS
T1-FYM	50.00	40.00	28.00
T2-NEEM OIL	50.00	40.00	28.00
T3-TRICHODERMA	38.00	28.00	15.00
T4- *NEEM OIL+TRICHODERMA VIRIDE*	28.00	20.00	13.00
T5- *NEEM OIL+TRICHODERMA VIRIDE+FYM*	20.00	6.00	3.00
T6- CONTROL	70.00	60.00	50.00
SED (±)	0.41	0.89	0.19
CD (p=0.05)	0.91	1.99	0.42

Here, Table2 shows that the disease incidence percentage as impacted by six organic treatment viz., FYM (T1), Neem oil (T2), Trichoderma (T3), Neem oil and Trichoderma combined (T4), all treatments combined (T5), and untreated control (T6).
Disease incidence in various treatment were found to vary considerably at all the observational stages. In all the treatment, the disease incidence at 65DAS shows that T6 (Untreated) had a higher disease incidence i.e.70% than T5 (Neem oil + FYM + Trichoderma) i.e. 20%. At 80DAS, it shows that the disease incidence outcome is mediocre i.e. T6 is 60% and T5is 6%, as compared to the 65DAS. At 95DAS, the outcome demonstrates strong performance in contrast to the first and second treatments i.e. T5 is 3% and T6 is 50%. . The highest occurrence of the disease is seen in 65DAS, and T6 has a high incidence proportion.

Table 3: Effects of different treatments on the yield of mustard

Treatments	Yield (q/ha)
T1-FYM	11.10
T2-NEEM OIL	12.60
T3-TRICHODERMA	13.90
T4- *NEEM OIL+TRICHODERMA VIRIDE*	14.30
T5- *NEEM OIL+TRICHODERMA VIRIDE+FYM*	16.20
T6- CONTROL	8.12
SED(±)	0.31
CD (p=0.05)	0.70

Here, Table 3 shows that the minimum yield was recorded in T6- control (8.12q/ha), the maximum yield were recorded in T5- Trichoderma viride + FYM + Neem oil (16.20q/ha), followed by T4- Trichoderma viride + Neem oil (14.30q/ha), T3- Trichoderma viride (13.90q/ha), T2- Neem oil(12.60q/ha), T1- FYM(11.10q/ha). Among the treatments, treatment T5 (Neem oil + Trichoderma viride + FYM) was the most effective yield.

4. CONCLUSION

In conclusion, it is clear that from the above discussion Alternaria blight disease is a very destructive pathogen that causes considerable damage to mustard crops. Among the treatments, treatment T5 (Neem oil + Trichoderma viride + FYM) was the most effective followed by T4 (Neem oil + Trichoderma viride), T3 (Trichoderma), T2(Neem oil) and T1(FYM). As in T5, the combination of three treatment were given i.e. Neem oil, Trichoderma and FYM. Thus, the combination treatment was found to be the best treatment for mustard crop. The highest occurrence of the disease is seen in 65DAS, and T6 has a high incidence proportion. Yield data in all the treatments was also estimated. Among the treatments, treatment T5 (Neem oil + Trichoderma viride + FYM) gives the most effective yield. There is a scope for more experimentation to validate the results on larger basis or different location.

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