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Organic alternative and management of leaf blight of mustard

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Abstract
Mustard is commonly known as Sarson and valuable for its oil while black mustard is also used as a spice. It is second most important oil seed crop in India next to soybean. Average yield losses occur due to various pest and diseases among which *Alternaria* blight is an important disease. Hence, a trial was conducted at crop research farm, School of Basic Sciences, SHUATS, Allahabad during *Kharif*, 2016 to observe the impact of bio-agents and botanicals as foliar sprays along with incorporation of different manure in replications on mustard blight. The treatments were *Trichoderma harzianum* 10%, *Trichoderma viride* 10%, *Pseudomonas flourescens* 10%, Neem oil 10%, Eucalyptus oil 10%, *Terminalia arjuna* bark extract, *Oscimum sanctum* leaf extract 10% and control (water irrigated). The results showed that treatments *T. viride* (38.92%) and Neem oil (40.89%) were most suited to lower the disease intensity followed by Eucalyptus oil (43.12%), *T. harzianum* (44.25%), *Oscimum sanctum* leaf extract (49.04%), *Terminalia arjuna* bark extract (49.34%), *Pseudomonas flourescens* (50.90%) and Control (54.72). It was also found that cost benefit ratio was maximized in treatment *T. viride* (1: 3.62) and Neem oil (1: 3.54) with least expenditure.

Keywords: Mustard, *Alternaria*, bio-agents, control.

Introduction
Mustard is commonly known as Sarson and valuable for its oil while black mustard is also used as a spice. It is second most important oil seed crop in India next to soybean and accounts for 20.2 percent and 10.7 percent of the total acreage and production (USDA, 2012). Rapeseed- mustard contributed around 22.4 percent of total oilseed area and production in Indian (Anonymous, 2012) [2]. The average yield of rapeseed-mustard 2011-12 was 1145 kg/ha as compared to 1135 kg/ha of total oilseed (Anonymous, 2012) [2]. Indian mustard can be sown as monoculture as single crop is easier to plant, harvest, and market than mixture of other crop with low water requirement (Jha *et al.*, 2013) [5].

The major producer states are Madhya Pradesh, Gujarat, West Bengal and Assam. Total area in India for the year 2015-16 is 64.51 lakh hectares which is decreased by 1.01% as compared to previous year. Total production of in India for the year 2015-16 is 57.4 lakh metric tons. It has increased by 7% as compared to previous year. Average yield for the year 2015-16 was 890 kg/hectare as against 1007 kg/hectare during the year 2014-15. It has decreased by 1.5% as compared to previous year. (Anonymous, 2015) [3].

The productions of many years has revealed that there is a huge difference in actual yield and the yield at the farmer's field due to constraints caused by biotic and abiotic stresses. Among the biotic stress Alternaria blight disease caused by *Alternaria brassicae* (Berk.) Sacc. and *Alternaria brassicicola* (Schw.) is one of the important diseases of Indian mustard which has been reported from all continents of the world which causes 10-70% yield losses depending on the crop species**.** *Alternaria brassicae* and *Alternaria brassicicola* are cosmopolitan in their distribution. Alternaria blight disease appears usually in December and reaches its maximum towards the end of January and beginning of February in the northern part of country. When infection is severe and the symptoms appear abundantly, the yield is drastically affected (Shrestha *et al*., 2005) [9].

The increased interest of humans with environmental concern has encouraged reducing exploitation of antagonist micro flora in disease management. Plant bi-products and bio-agents have played significant role in the improvement of air- borne pathogen and in the improvement of seed quality and field emergence of plant seed. (Imtiaj and Lee, 2008; Verma *et al.*, 2008; Latif *et al.*, 2006) [4, 11, 7].

As the disease is not manageable by other methods, farmers usually adopt chemicals to achieve a quick and efficient control on the disease but have hazardous effects on environment. Hence, humans are forced to find out other alternatives to achieve the better

management. So, a trial was conducted to evaluate the effect of bio-agents and botanical along with incorporation of different manures in three replications on mustard blight.

Materials and Methods

A field experiment was conducted at the crop research farm, School of Basic Sciences, SHUATS, Allahabad during *Kharif,* 2016 to observe the impact of bio-agents and botanicals along with incorporation of different manures on mustard blight. The experiment was laid out in a randomized block design with three replications, seven treatments including an untreated control and application was done as foliar spray where as the manures were mixed in soil. The treatments were *Trichoderma harzianum* 10%, *Trichoderma viride* 10%, *Pseudomonas flourescens* 10%, Neem oil 10%, Eucalyptus oil 10%, *Terminalia arjuna* bark extract, *Oscimum sanctum* leaf extract 10% and control (water irrigated). Bio-agent powdered formulation was brought to the laboratory and the viability was checked by serial dilution method, the C.F.U was found to be 10^6 (appropriate) for foliar spray. The seeds were sown in 2 x 2 m^2 plot size with a spacing of 45 cm row to row and 15 cm plant to plant. The crop was sown as line sowing on 2nd August, 2012. The biometric observations were taken on five randomly selected plants in a net plot area. Thinning was done two weeks after sowing to maintain a uniform plant distance in respective treatments for uniform plant population. The disease intensity was recorded at 60, 75 and 90 DAS and pod yield was recorded.

Results & Discussion

The data presented in table.1 reveals that all botanicals and bio-agents were able to reduce the disease intensity at 60, 75 and 90 DAS. At 90 DAS treatments T_2 - *T. viride* (38.92%) and T_4- Neem oil (40.89%) were effective in lowering the disease intensity followed by T_5 (43.12%), T_1 (44.25%), T_7 (49.04%), T_6 (49.34%), T_3 (50.90%) and T_0 Control (54.72). Similar results were recorded by Reshu and Khan, 2012 [8] where they observed 76 and 68% reduction in disease intensity on leaves and pods, respectively and suggested that *T. viride* can be used to control Alternaria blight disease of mustard. Also, Karthikeyan *et al*. (2008) [6] evaluated three antagonists: *Pseudomonas fluorescens* (Pf1), *Bacillus subtilis* and *Trichoderma viride*, were tested alone and in combination for suppression of onion leaf blight (*Alternaria palandui*) disease under field condition and they concluded that *Trichoderma viride* was best in reducing the disease intensity.

The data in table no. 2, it shows that cost benefit ratio was maximum in treatment T_2 - *T. viride* (1: 3.62) with minimum disease intensity which was also earlier evaluated by Verma *et al.* (2008) [11] where *Trichoderma viride* was found effective in reducing the disease severity and increasing cost benefit ratio under field experimental conditions.

Table 1: Effect of treatments on blight intensity at 60, 75 and 90 DAS of mustard:

Treatment		60 DAS	75 DAS	90 DAS
T_1	*T. harzianum*	23.933	36.886	44.250
T_2	*T. viride*	20.523	30.846	38.923
T_3	*P. flourescens*	31.420	42.050	50.903
T_4	Neem Oil	21.816	33.500	40.893
T_5	Eucalyptus oil	22.186	33.946	43.120
T_6	*T.arjuna* bark extract	27.936	40.603	49.346
T_7	*O. sanctum leaf extract*	25.366	38.260	49.046
T_0	Control	34.546	48.346	54.720
F-test		S	S	S
C.D. (P = 0.05)		2.298	2.471	1.647

Table 2: Cost Benefit Ratio

S. No.	Treatment	Yield of q/ha	Cost of yield	Total cost Of yield (Rs.)	Common Cost (Rs.)	Treatment Cost (Rs.)	Total cost	C: B ratio
01	T_1 *Trichoderma harzianum*	12.413	3,700 Rs/q	45928/-	13,200/-	342	13,542/-	1: 3.39
02	T_2 *Trichoderma viride*	13.266	3,700 Rs/q	49,084/-	13,200/-	342	13,542/-	1: 3.62
03	T_4 *Pseudomonas flourescens*	10.196	3,700 Rs/q	37,725 /-	13,200/-	342	13,542/-	1: 2.79
04	T_5 Neem oil	13.046	3,700 Rs/q	48,270/-	13,200/-	450	13,650/-	1: 3.54
05	T_6 Eucalyptus oil	12.893	3,700 Rs/q	47,704/-	13,200/-	1200	14,400/-	1: 3.31
06	T_7 *T. arjuna* extract @10%	10.626	3,700 Rs/q	39,316/-	13,200/-	300	13,500/-	1: 2.91
07	T_7 *O. sanctum* leaf extract @5%	12.063	3,700 Rs/q	44,633/-	13,200/-	300	13,500/-	1: 3.31
08	T_0 Control	9.086	3,700 Rs/q	33,618/-	13,200/-	---------	13,200/-	1: 2.55

Conclusion

It can be observed from above data that foliar spray with *T. viride* @ 10% was most beneficial it terms of decrement in disease severity (38.92) and maximized outputs (1:3.62). It was also found that neem oil foliar application @ 10% was also effective in managing the disease next to *T. viride*.

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