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Research Article

In-vivo Evaluation of Bio Resources against Early Blight Disease in Potato Caused by *Alternaria solani*

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ABSTRACT

Potato is the major root vegetable belongs to the solanaceae family. Among fungal diseases early blight is the most devastating foliar disease caused by Alternaria solani. An experiment was conducted in SHUATS, Prayagraj during Rabi 2019-20 under field conditions for the management of early blight of potato using different bio resources such as vermicompost (VC), spent mushroom compost (SMC), neem cake (NC) and microalgae. The pathogen Alternaria solani was identified by standard isolation technique in in-vitro. The maximum reduction of disease was recorded with the combination of treatment T_5 VC+SMC+NC 40.38%. Similarly, the minimum reduction of disease was observed with T_4 Neem Cake 45.00% alone compared to control. Therefore, it is suggested that use of bio resources may reduce the disease incidence.

Keywords: *Bio resources, Vermicompost, Microalgae, Alternaria, Early blight, Potato.*

INTRODUCTION

Potato is an important staple food in many countries. It is one of the major root vegetable crop belongs to solanaceae family which is native to South America (Hijmans & Spooner, 2001) grown in both temperate and sub-tropical regions. Mostly potatoes are grown in hilly areas during short winter days. India is the second largest producer of potato after china with 48 million tons (FAOSTAT). In India Uttar Pradesh is the largest producer of potato with 15 thousand tons followed by West Bengal, Gujarat, Bihar, Madhya Pradesh and Punjab (Horticulture Statistics Division). Potato crop is affected by number of fungal, bacterial and viral diseases wherever the crop is grown.

Among the fungal diseases early blight caused by *Alternaria solani* of potato is the major foliar disease which affects the leaves, stem and tubers (Ellis & Martin). At first symptoms appears on the lower leaves with small, circular or irregular dark brown to black lesions which later enlarge and coalesce together which leads to chlorosis or dropping of leaf. The elongated brown to black lesions can be seen on the stem.

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The infected tuber may be circular or irregular in shape with dark sunken lesions on the surface or raised by a dark brown border. The tissue inside an infected potato becomes dry with corky texture. The severity of early blight is dependent upon the frequency of foliar wetness from rain, dew or irrigation and nutritional status of the foliage. Premature leaf senescence, low dry matter and reduced yield are affected in severe conditions (Mitchell, 2018). Alternative wet and dry periods are most favorable for sporulation and dispersal. The average annual yield loss due to this disease is 78% where potato crop is grown (Chakraborthy & Dey, 2012).

Management of this foliar disease mainly depends on chemical fertilizers alternatives such as bio resources are used in managing early blight of potato. Vermicompost is the rich source of macro and micro nutrients (Lampkin, 1990), Neem acts as fertilizer and shows the fungitoxic potential against fungi mostly rot fungi (Chukwuma, 2018), Spent mushroom compost rich in diverse microorganisms such as disease antagonistic bacteria and fungi (Adedeji, 2016). Application of composts has been shown to reduce the incidence and severity of foliar diseases in some crops (Cronin et al., 1996). Microalgae act as the bio stimulant and bio fertilizer that stimulates the growth and development of the crop (Biazzi et al., 2019). Therefore, the present investigation was done to find out a way to use alternative of chemicals such as bio resources under field conditions.

MATERIALS AND METHODS

The present investigation was carried out at Department of Plant Pathology and Central Research farm of SHUATS, Prayagraj during *Rabi* 2020. The techniques followed during the course of investigation are described below.

Isolation and Identification:

The infected leaves were collected from central research field and observed microscopically for the fungal spores. Isolation was done using standard tissue isolation technique. The infected leaves showing typical early blight symptoms were collected and cut into small pieces. Surface sterilized with 0.1% mercuric chloride for one minute then sterilized using distilled water. The sterilized bits were transferred into the petri plate along with slants containing potato dextrose agar media under aseptic conditions. Then incubated at room temperature (25± 10ºC) for 3-6 days and observed periodically for fungal growth. The pathogen is identified on the basis of morphological and cultural characteristics.

Figure 1: Showing symptoms of early blight on leaf of potato

Figure 2: Petriplates and slants showing growth of the fungus *Alternaria solani*

The present field experiment was laid out in Randomized Block Design with 7 treatments and 3 replications conducted during Rabi season in central research field, during *Rabi* 2019-2020. The bio resources such as vermicompost (VC), spent mushroom compost (SMC), neem cake (NC) and combinations (VC+SMC+NC) were applied at the time of land preparation that is before sowing. Microalgae 3kg/acre are applied at the rhizosphere area after 10 days of germination. Carbendazim fungicide was applied as foliar application at the first appearance of disease. The application of composts, microalgae and carbendazim were repeated at 45 and 85 DAS.

The percent disease incidence of early blight of potato was calculated using the formula given by (sharma & kotle, 1994) scale of 0-5 as shown in Table 1. For the study of disease incidence 5 plants were randomly selected from each plot and lower leaf, middle leaf and upper leaf were selected and percentage of each leaf was calculated according to the given scale.

Table 1: Rating scale given by sharma and kotle, 1994

Rating	Description
0	No symptom
1	1-10% Disease infection
2	11-25% Disease infection
3	26-50% Disease infection
4	51-70% Disease infection
5	>71% Disease infection

Per cent Disease incidence (%) was recorded at 40, 80 and 120 days after sowing. The disease severity accomplished with percent disease incidence (PDI) was calculated using the formula given by wheeler (1969).

$$PDI = \frac{\text{Sum of all disease ratings}}{\text{No. of observations assessed} \times \text{maximum disease rating}} \times 100$$

RESULTS AND DISCUSSION

Results revealed that all the treatments significantly reduced the disease incidence compared to control under field conditions. The highest reduction was observed in treatment combination with T_5 VC+SMC+NK 40.38% followed by carbendazim T_1 43.94%. The minimum disease incidence was seen with treatment T_4 Neem cake and T_2 Spent mushroom compost 45.00% and 48.71%. The maximum early blight incidence was recorded with the treatments T_3 Vermicompost and T_6 Microalgae with 51.05% and 54.14% compared to control. (Table 4.2, Figure 4.1).

Table 4.2 Effect of bio resources against early blight disease incidence caused by *Alternaria solani* under field conditions

T.No	Treatments	Mean of PDI at 40DAS	Mean of PDI at 80 DAS	Mean of PDI at 120 DAS
T_0	Control	26.20	50.96	58.23
T_1	Carbendazim	16.65	38.96	43.94
T_2	Spent mushroom compost	20.81	44.67	48.71
T_3	Vermicompost	22.43	47.11	51.05
T_4	Neem cake	17.83	42.23	45.00
T_5	VC+SMC+NC	13.98	34.48	40.38
T_6	Microalgae	24.00	48.81	54.14
SE(m)±		0.29	0.40	0.65
SE(d)±		0.41	0.56	0.91
C.D		0.91	1.25	2.02

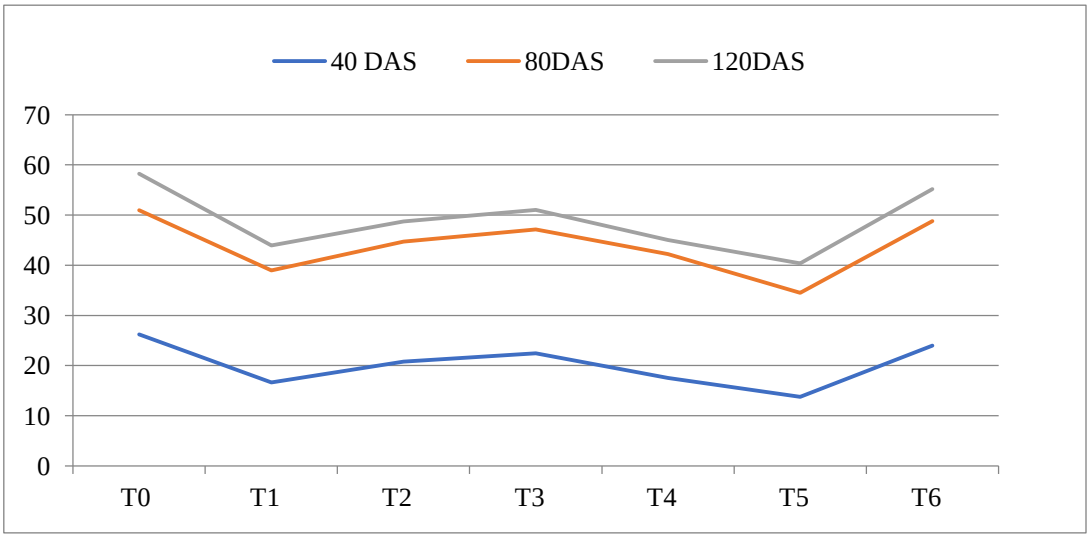

Figure 4.1: Effect of bio resources in management of early blight disease of potato caused by *Alternaria solani*

CONCLUSION

The present field experimental study states that the highest disease reduction was observed with combination treatment T_5 VC+SMC+NC, T_4 Neemcake and T_3 Spent mushroom compost alone.

Therefore, it may be concluded that use of bio resources reduce the foliar early blight disease incidence.

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