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Effect of microalgae and spent mushroom compost on early blight (*Alternaria solani)* of potato

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Abstract
Potato (*Solanum tuberosum*) is the third most important food crop in the world after rice and wheat in terms of human consumption. It is attacked by many pathogens causing significant losses to potato producers throughout the world. Among them, early blight of potato caused by *Alternaria solani* is one of the major cause of concern in potato production at present. An experiment was conducted at Shuats, Allahabad during Rabi season 2021-2022 in a randomized block design (RBD) to evaluate the different doses of microalgae *viz*. 1%, 2%, 3%, 4% and 5% through irrigation in spent mushroom compost amended plots and bavistin were kept as a treated checked along with untreated control. The results revealed that microalgae @ 5% significantly reduced the disease intensity of *Alternaria solani* at 60, 75, 90 and 105 DAS (9.47%, 14.83%, 17.67% and 35.73%) as compared with other treatments. The plant height (cm) of potato was significantly increased in microalgae @ 5% at 45, 60, 75 and 105 DAS (13.80 cm, 20.80 cm, 27.40 cm and 36.57 cm over control. Thus, the use of microalgae can be exploited for the management of early blight (*Alternaria solani*) of potato.

Keywords: *Alternaria solani*, early blight, microalgae, bavistin

Introduction
Microalgae are considered as potential bio control agents as they exhibit antagonistic effect against many plant pathogens. They can produce bioactive compounds like phytohormones, form root associations or defend plants from pests and phytopathogens. The involvement of microalgae in the mineralization, mobilization of organic and inorganic, major and micronutrients, production of bioactive compounds, (polysaccharides, growth hormones, antimicrobial compounds, etc.) can improved the plant growth and thus makes them suitable as bio fertilizing options (Gayathri *et al*., 2015; Jager *et al*., 2010; Nilsson *et al*., 2002; Stirk *et al*., 2013; Prasanna *et al*., 2016) [2, 6, 11, 15, 12]. Microalgae stimulates soil microbial activity, facilitating nutrient availability and increasing soil fertility. As a result, the plant is healthier and grows more vigorously, enhancing crop yield and fruit quality (Renuka *et al*., 2018) [13]. Extensive research on the use of microalgae as bio fertilizer and soil conditioner has proved the potential of these organisms in sustainable agriculture (Gupta *et al*., 2013) [4].
Potato is one of the world's major staple crops after rice, wheat, and maize. It is the third most important crop in terms of human consumption after rice and wheat. Potato contains a wide range of vital nutrients such as low fatty contents, minerals and vitamins. It is a higher source of ascorbic acid, vitamins, proteins and both macro minerals and micro minerals (Khalid *et al.*, 2020) [7].
The potato plant is attacked by many pathogens causing significant losses to potato and among them early blight of potato caused by *Alternaria solani* is of major cause of concern in potato production at present. In India, this disease was first reported by Butler (1903) on potato leaves at Farrukhabad district in Uttar Pradesh (Hussain *et al.*, 2019) [5]. The primary damage of early blight is due to premature defoliation of the plant. Symptoms show dark brown or black lesions with concentric rings on leaves, which produce a 'target spot' effect. According to FAO, around 30% of yields across all crops are lost due to plant pests and diseases.

Materials and Methods
The experiment was conducted at the experimental research plot of the department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, during the Rabi season of 2021 to 2022.
The experiment was laid out in a randomized block design with 7 treatments and 3 replications.

Spent Mushroom Compost was first applied @ 3 tonnes/ha as basal seven days before sowing the potato tubers. The tubers were sown upon the ridges with a spacing of 60 cm maintaining plant to plant spacing of 15 cm in a plot size of 2×2 m^2. Microalgae were applied at 1%, 2%, 3%, 4% and 5% through irrigation at 27 days after germination and subsequently 15 days intervals. The effect of different doses of microalgae were compared with untreated control. The percent disease intensity of *Alternaria solani* was recorded at 60, 75, 90 and 105 DAS respectively. The plant growth parameters i.e. Plant height (cm) was recorded at 45, 60, 75 and 105 DAS respectively. The observations were recorded on incidence of *Alternaria solani* from randomly selected 5 plants from each plot.

Percent Disease intensity

Percent Disease intensity (%) was recorded at 60, 75, 90 and 105 days after incidence of early blight by the formula given by (Wheeler, 1969) [16].

$$\text{Percent disease intensity (\%)} = \frac{\text{Sum of disease ratings}}{\text{Total number of rating} \times \text{Maximum disease grade}} \times 100$$

Table 1: Description of disease rating scale for Alternaria. Mayee and Datar (1986) [17]

Grade	Description of symptoms
0	No Symptoms
1	Less than 1% leaf area affected
3	1- 10% leaf area cover by spot
5	11-25% leaf infected
7	26-50% leaf area infected
9	more than 50% leaf infected and cover by spot

Results and Discussion

Effect of microalgae on disease intensity of early blight of potato

The data presented in table 2 reveals the response of microalgae on *Alternaria solani* disease Intensity of potato at 60, 75, 90 and 105 DAS under field condition. The results indicates that microalgae @ 5% was significantly superior over all the other treatments showing minimum disease intensity of *Alternaria solani* at 60, 75, 90 and 105 DAS (9.47%, 14.83%, 17.67% and 35.73%), followed by microalgae @ 4% (10.40%, 15.80%, 19.27% and 37.37%), microalgae @ 3% (11.77%, 16.57%, 20.87%, 38.93%), microalgae @ 2% (12.30%, 17.40%, 23.73%, 40.87%), microalgae @ 1% (13.27%, 18.53%, 24.77%, 41.87%) as compared to bavistin (treated checked) (5.53%, 7.20%, 11.20%, 23.27%) and control (14,47%, 21.37%, 29.27%, 45.00%). The statistical analysis of data showed that all treatments were found significant over control.

Effect of microalgae on plant height of early blight of potato

The data presented in table 3 reveals the response of microalgae on plant height of potato at 60, 75, 90 and 105 DAS under field condition. The results indicates that microalgae @ 5% significantly increased the plant height at 45, 60, 75 and 105 DAS (13.83 cm, 20.80 cm, 27.40 cm and 36.57 cm) followed by microalgae @ 4% (13.20 cm, 20.13 cm, 25.83 cm, 35.97 cm), microalgae @ 3% (12.33 cm, 18.87 cm, 25.63 cm, 35.17 cm), microalgae @ 2% (11.87 cm, 17.80 cm, 24.80 cm, 34.80 cm), microalgae @ 1% (10.67 cm, 17.00 cm, 23.67 cm, 29.40 cm) as compared to bavistin (treated checked) (16.10 cm, 23.93 cm, 31.07 cm, 39.17 cm) and control (9.73 cm, 16.17 cm, 22.50 cm, 26.63 cm). The statistical analysis of data showed that all treatments were found significant over control.

The above findings are in agreement with (Michalak and Chojnacka, 2015) [10] where they applied a growing microalgae/cyanobacteria culture via soil application, seed treatment, and/or foliar spray as algae has antibacterial properties that can aid in pathogen management against soil-borne diseases. Similar results were obtained by Kusvuran *et al.*, (2021) [9] who investigated the effectiveness of algae (*Chlorella vulgaris Beijerinck*) foliar applications [1%, 3%, or 5% (v/v)] on mitigation of drought stress in broccoli plants. The most effective application concentration of microalgae was determined as 5%. The investigations revealed that the application of microalgae is a sustainable strategy to improve the defence system of drought-stressed broccoli plants. This was supported by Elarroussi *et al*., (2016) [1] who investigated the possibility of microalgae polysaccharides as bio stimulant of plant growth on tomato and pepper. The treatment with TPE solution (3 g.L-1) increased the plants size of tomato and pepper by 20% and 30%, respectively. Kumar *et al.*, (2018) [8] also reported that micro algal dry biomass of *Chlorella vulgaris* and *Spirulina platensis* improve the growth parameters, yield attributes, bio- chemical composition, anti-nutritional composition and minerals in onion. Similarly, Shaaban *et al.*, (2010) [14] evaluated green microalgae water extract to wheat plants and found that concentration of 50% algae extract can lead to increase in plant growth and 140% yield increase.

Table 2: Effect of microalgae on disease Intensity (%) of early blight of potato

Treatment No.	Treatment Name	Disease Intensity (%)			
		60 DAS	75 DAS	90 DAS	105 DAS
T_0	*Control*	14.47	21.37	29.27	45.00
T_1	*Bavistin*	5.53	7.20	11.20	23.27
T_2	*Microalgae @ 1%*	13.27	18.53	24.77	41.87
T_3	*Microalgae @ 2%*	12.30	17.40	23.73	40.87
T_4	*Microalgae @ 3%*	11.77	16.57	20.87	38.93
T_5	*Microalgae @ 4%*	10.40	15.80	19.27	37.37
T_6	*Microalgae @ 5%*	9.47	14.83	17.67	35.73
CD at 5%		0.66	0.97	1.06	1.83
SE.D (±)		0.30	0.45	0.49	0.84

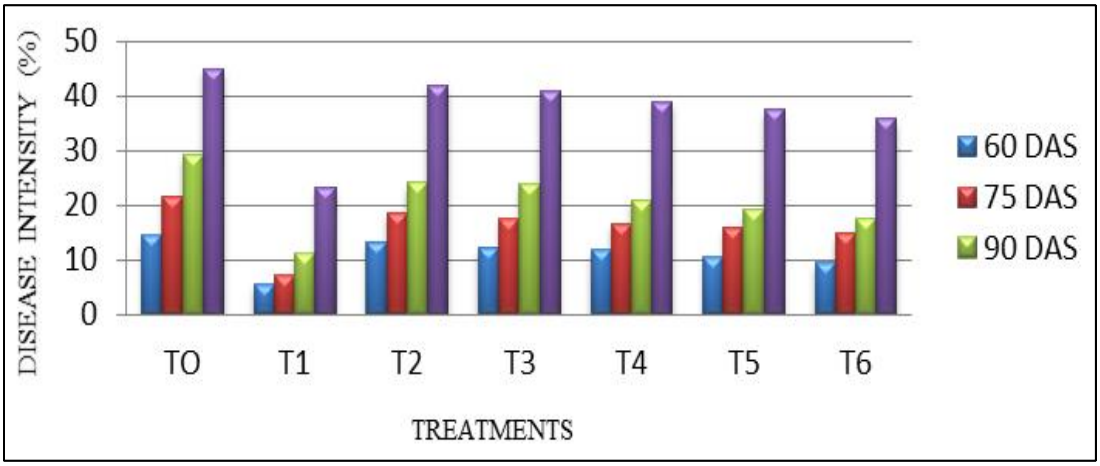

Fig 1: Effect of microalgae on disease Intensity (%) of early blight of potato

Table 3: Effect of microalgae on plant height (cm) of potato

Treatment No.	Treatment Name	Plant Height (cm)			
		45 DAS	60 DAS	75 DAS	105 DAS
T_0	*Control*	9.73	16.17	22.50	26.63
T_1	*Bavistin*	16.10	23.93	31.07	39.17
T_2	*Microalgae @ 1%*	10.67	17.00	23.67	29.40
T_3	*Microalgae @ 2%*	11.87	17.80	24.80	34.80
T_4	*Microalgae @ 3%*	12.33	18.87	25.63	35.17
T_5	*Microalgae @ 4%*	13.20	20.13	25.83	35.97
T_6	*Microalgae @ 5%*	13.83	20.80	27.40	36.57
CD at 5%		0.82	0.95	1.01	1.18
SE.D (±)		0.37	0.43	0.46	0.54

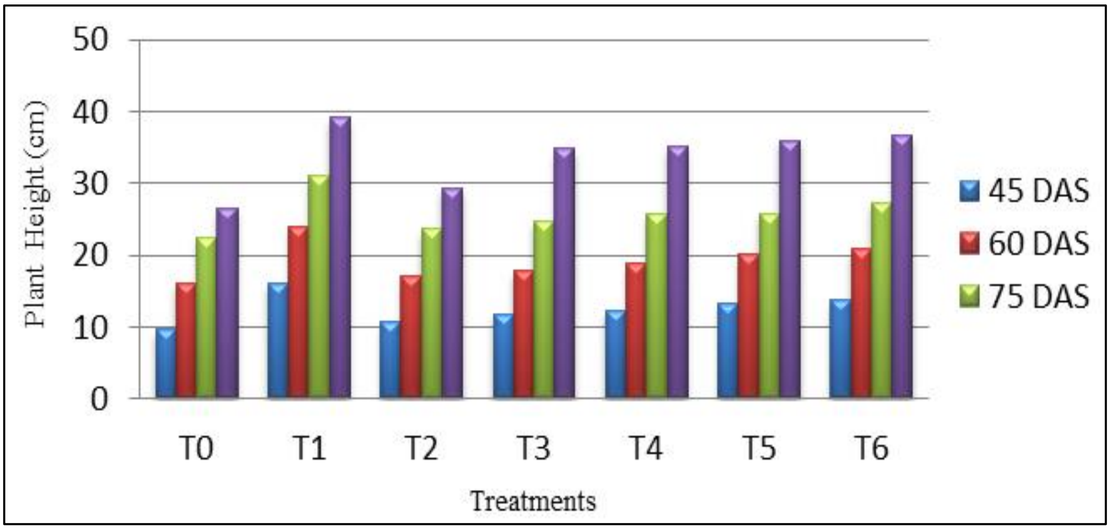

Fig 2: Effect of microalgae on plant height (cm) of potato

Conclusion

Based on the results, it was concluded that, T_6 - Microalgae @ 5% was superior over all the treatments and significantly reduced the early blight disease in potato and increased the plant height. This shows the ecofriendly application of bio-fertilizers in the field of plant protection as biological control is a promising tool to maintain current level of agricultural production while reducing the release of polluting chemical pesticides to the environment. Thus, these ecofriendly treatments is found as a better alternative to fungicides due to their fewer negative impacts on the environment and easy availability as well as economically feasible. However, the present study was limited to one crop season under Prayagraj conditions, therefore to substantiate the present result more trials are needed for 2-3 seasons for further recommendations.

References

1. Elarroussia H, Elmernissia N, Benhimaa R, El Kadmiria IM, Bendaou N, Smouni, Wahbya I. Microalgae polysaccharides a promising plant growth biostimulant. Journal of Algal Biomass Utilization. 2016;7(4):55-63.
2. Gayathri M, Kumar PS, Prabha AML, Muralitharan G. *In vitro* regeneration of *Arachis hypogaea* L. and *Moringa oleifera* Lam. using extracellular phytohormones from *Aphanothece* sp. MBDU 515. Algal Research. 2015;7:100-105.

3. Gomez AA, Gomez KA. Statistical Procedures for Agricultural Research. A Wiley- Inter science Publication, John Wiley, Sons, Inc. USA; c1984 Feb 17. p. 680.
4. Gupta V, Ratha SK, Sood A, Chaudhary V, Prasanna R. New insights into the biodiversity and applications of cyanobacteria (blue-green algae) - Prospects and challenges. Algal Research. 2013 Mar 1;2(2):79-97.
5. Hussain T, Singh BP, Kaushik SK, Lal M, Gupta A. Duplex PCR for detection of early and late blight co-infecting potato. Indian Journal of Horticulture. 2019 Jul 1;76(2):319-323.
6. Jager K, Bartok T, Ordog V, Barnabas B. Improvement of maize (*Zea mays* L.) anther culture responses by algae-derived natural substances. South African Journal of Botany. 2010 Aug 1;76(3):511-516.
7. Khalid W, Khalid MZ, Aziz A, Tariq A, Ikram A, Rehan M, *et al*. Nutritional composition and health benefits of potato. Advance Food & Nutritional Science. 2020 Jun 18;5:7-16.
8. Kumar R, Kumar P, Subramanian J, Arumugam A, Rasheeq AA. Exploring the microalgae bio fertilizer effect on onion cultivation. Waste and Biomass Valorisation. 2020 Jan;11(1):77-87.
9. Kusvuran S. Microalgae (*Chlorella vulgaris Beijerinck*) alleviates drought stress of broccoli plants by improving nutrient uptake, secondary metabolites, and antioxidative defines system. Horticultural Plant Journal. 2021 May 1;7(3):221-231.
10. Michalak I, Chojnacka K. Algae as production systems of bioactive compounds. Engineering in. Life Science. 2015 Mar;15(2):160-176.
11. Nilsson M, Bhattacharya J, Rai AN, Bergman B. Colonization of Roots of Rice (*Oryza sativa*) by Symbiotic Nastic Strains. New Phytology. 2002 Dec;156(3):517-525.
12. Prasanna R, Kanchan A, Kaur S, Ramakrishnan B, Ranjan K, Singh MC, *et al*. Chrysanthemum growth gains from beneficial microbial interactions and fertility improvements in soil under protected cultivation. Horticulture Plant Journal. 2016 Jun 1;2(4):229-239.
13. Renuka N, Guldhe A, Prasanna R, Singh P, Bux F. Microalgae as multifunctional options in modern agriculture: current trends, prospects and challenges. Biotechnology advances. 2018 Jul 1;36(4):1255-1273.
14. Shaaban MM, El-Saady AM, El-Sayed AB. Green microalgae water extract and micronutrients foliar application as promoters to nutrient balance and growth of wheat plants. Journal of American Science. 2010;6(9):631-636.
15. Stirk WA, Ordog V, Novak O, Rolcik J, Strnad M, Balint P, *et al.* Auxin and cytokinins relationships in 24 microalga strains (1). Journal of Phycology. 2013 Jun;49(3):459-467.
16. Wheeler L, Shaver KG, Jones RA, Goethals GR, Cooper J, Robinson JE, *et al.* Factors determining choice of a comparison other. Journal of Experimental Social Psychology. 1969 Apr 1;5(2):219-32.
17. Mayee CD, Datar VV. Phytopathometry, Technical Buletien-1 (Special Buletein-3), Marathwada Agric. Univ. Parbhani, India; c1986. p. 218.