Effect of neem cake, neem oil and plant extracts on purple blotch of onion (*Allium cepa* L.) caused by *Alternaria porri* (Ellis) Cif.

Abstract

The present study was conducted to evaluate the Effect of neem cake, plant extracts and neem oil on purple blotch of onion (*Allium cepa* L.) caused by *Alternaria porri* (Ellis) Cif. Six different treatments were tested in a randomized block design with 3 replications at the Central Research Field, Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *Rabi* season of 2023. The results should that the minimum per cent disease intensity was recorded in T_1Neem cake + Neem oil (31.72), T_5 Neem cake + Eucalyptus leaf extract (37.40).bulb weight of onion (71.13g), bulb diameter (7.13cm), bulb yield per plot (2.106kg), yield (105.317 q/ha) and benefit cost ratio (1: 4.42) were found in T_1Neem cake + Neem oil (31.72) when compared to untreated check and other treatments.

Keywords: *Alternaria porri,* neem cake, neem oil, onion, plant extract, purple blotch.

1 Introduction

Onion (*Allium cepa* L.) is one of the most important vegetable crops belongs to the family Amaryllidaceae.There are more than 780 species, usually perennial bulbous plants grown worldwide **(Mukul *et al*. 2024)**.

Onion is also called as "Queen of kitchen". It contains a phytochemical called quercetin which is effective in reducing the risk of cardiovascular diseases, anticancers and has antioxidant property. It is supposed to have its origin in the middle East Asian countries and introduced in India from Palestine **(Kareem *et al*. 2018)**.

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Production of Onion in 2022-23 is expected to be around 254.73 lakh tone **(APEDA, 2022-23).** In India the yield of onion is very low as compared to the world average yield of 19.1t/ha **(Bhoite and Backiyavathy, 2022)**.

The most important factors responsible for the diseases like purple blotch, downy mildew, stem phylium blight, basal rot and storage rots etc. Among the foliar diseases, purple blotch is one of the most destructive diseases, commonly prevailing in almost all onion growing pockets of the world, which causes heavy loss in onions under field conditions. Losses can range from 30 to 100 per cent. The disease may reach epidemic states during the favorable conditions of high relative humidity (80-90 %) and optimum temperature (24±10 ºC). Purple blotch disease of onion causes significant reduction in foliar production and bulb yield **(Gupta and Pathak, 1988)**.

The several effective fungicides have been recommended against this pathogen, but they are considered as a long-term solution, due to concerns of expense, exposure risks and the hazards of its residues. Moreover, the development of resistance of pathogenic fungi towards synthetic pesticides is of great concern that can affect significantly the efficacy of chemical fungicides. The present study was aimed to determine the efficacies of different bio-agents and neem oil against purple blotch of onion **(Chethana *et al.*, 2015)**.

2 Materials and Methods

The study was conducted in randomized block design (RBD) with plot size 2x1m² and there were three replications for each treatment. The experiment was conducted on Nasik redvariety of onion. Observations on disease intensity (%) of purple blotch of onion were recorded at 30 days interval, bulb weight of onion (g), bulb diameter (cm), bulb yield per plot (kg), yield (q/ha) and B:C ratio data were obtained after the harvest on physiological maturity.

Table 1 Treatments combination

Treatment Number	Treatment Details	References
T_0	Control (Untreated)	-
T_1	Neem cake @440gm (S.A) +	**Kumar (2007)**

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Comment [MT5]: Explain how the disease intensity percentage was evaluated here. Also improve on your methodology. how was the cost benefit ratio of onion calculated.

	Neem oil 5% (F.S)	
T_2	Neem cake @440g (S.A) + Datura leaf extract @10% (F.S)	**Brahmane*et al*. (2015)**
T_3	Neem cake @440g (S.A) + Lantana leaf extract @10% (F.S)	**Brahmane*et al*. (2015**
T_4	Neem cake @440g (S.A) + Bael leaf extract @10% (F.S)	**Kumar (2007)**
T_5	Neem cake @440g (S.A) + Eucalyptus leaf extract@10% (F.S)	**Kumar (2007)**
T_6	Mancozeb @0.2% (F.S) (Treated check)	**Chethana *et al*. (2011)**

Dose: Neem cake @440g 2m^2(S.A), Plant extract (10%), neem oil (5%) and mancozeb (0.2%)

S.A: - Soil amendment **F.S: - Foliar spray**

2.1 Preparation of plant extracts

Hundred grams of fresh healthy plant parts (leaves) collected from field was washed with distilled water and air dried and crushed in 100 ml of distilled water (w/v). The crushed product was filtered through double layer, muslin cloth and further filtrated through Whatsman No. 1 filter paper using funnel and volumetric flasks (100 ml cap.). The prepared solution was 100 per cent concentration, which was further diluted to required concentrations of 10 per cent**(Shekhawat and Prasada, 1971).**

2.2 Percent disease intensity (PDI)

Percent disease index was calculated by using the following formula **(Wheeler, 1969).**

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of individual ratings}}{\text{No of leaves observed}} \times \frac{100}{\text{Maximum disease grade}}$$

To calculate the PDI, five plants were randomly examined from each plot and scored for disease severity using the 0-5 scale established by **Sharma, (1986).**

Table 2Disease rating scale

Scale	Description
0	No disease symptoms
1	A few spots towards tip covering 10% leaf area
2	Several dark purplish brown patches covering up to 20% leaf area.
3	Several patches with paler outer zone covering up to 40% leaf area.
4	Leaf streaks covering up to 75% leaf area or breaking of the leaves from center.
5	Complete drying of the leaves or breaking of the leaves from center.

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0 1 2 3 4 5

Figure 1 Disease rating scale

3Results

3.1 Effect of neem cake, plant extracts and neem oil on disease intensity of purple blotch of onion

The data statically analaysed and presented in **Table 3** and depicted in **Figure 2**reveald effect of organic amendment, plant extracts and neem oil on disease intensity of *Alternaria porri* on onion under field condition. The treatments were found to have significantly reduced disease intensity as compared to the control (untreated ckeck). As the treated check (T_6) mancozeb @0.2% reduced the disease intensity of purple blotch of onion at its maximum point within the treatments Neem cake + Neem oil (T_1) showed maximum reduction of disease intensity of Neem

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cake + Eucalyptus leaf extract (T_5), Neem cake +Lantana leaf extract (T_3),Neem cake + Bael leaf extract (T_4)and Neem cake + Datura leaf extract (T_2)the highest disease was recorded in Control (T_0) (Untreated check) with (59.19) % disease intensity.

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3.2Effect of neem cake, plant extracts and neem oil on bulb weight of onion (g), bulb diameter (cm), bulb yield per plot (kg) and yield (q/ha) of onion

The data presented in **Table 4** and depicted in **Figure 3** reveals the response of selected treatments of organic amendment, plant extracts and neem oil on bulb weight of onion(g), bulb diameter (cm), bulb yield per plot (kg) and yield (q/ha)of onion under field conditions. The results indicate that the untreated check T_0 (control) show significantly reduced for all the replications. The maximum data was recorded T_1Neem cake + Neem oil on fresh weight of bulb (68.80gm), diameter of bulb (6.80cm), bulb yield per plot (1.968kg),bulb yield **(**98.383q/ha**)** the lowest data was recorded inControl(T_0) (Untreated check).

4 Discussions

The probable reasons for such findings may be due to the soil application of neem cake that could have improved the availability of nutrients to the crop by enhancing the mineralization and supply of readily available nutrients to the soil microbial community which may have supported the plant growth by **Sharma *et al.* (2019)**. Whereas, neem oil was used as foliar spray that may have inhibited the emergence of fungal pathogen due to existence of major components such as azadirachtin, saladin, nimbi, nimonol and iso-meldenin**(Hinduja *et al.*,2021)** which have the ability to disrupt the cell membrane and facilitate intracellular compound leakages lead to cell lysis resulting in healthy plant growth. Similar findings have been reported by **Sindu *et al.* (2022)**and **Divya *et al.* (2022)**.who revealed that the maximum disease inhibition was found in the neem oil treatment, suggesting that the use of garlic extracts could be a viable approach to control *Alternaria porri*. Though among all the treatments chemical fungicide (Treated check) has shown the minimum disease control with strong fungicidal effect against the pathogen. As of, it may produce some toxic chemical residues, which may have potential harmful effects to non-targeted organisms. So, considering the ecosystem, neem oil significantly inhibits the pathogen

Comment [MT9]: Which are findings are you talking about. Give the finding before explanations. Also improve on your methodology.

could lead to better health of the plants which in turn helps in producing minimum disease intensity and leading to a healthier plant and environment friendly.

Table 3 Effect of neem cake, neem oil and plant extracts on disease intensity of purple blotch of onion

Treatment Number	Treatment Details	Disease intensity (%)		
		30 DAT	60 DAT	90 DAT
T_0	Control (Untreated)	10.41	38.60	59.19
T_1	Neem cake + Neem oil	8.11	19.43	31.72
T_2	Neem cake + Datura leaf extract	9.45	27.40	45.31
T_3	Neem cake + Lantana leaf extract	8.85	23.44	41.57
T_4	Neem cake + Bael leaf extract	9.15	25.46	43.60
T_5	Neem cake +Eucalyptus leaf extract	8.75	21.54	37.40
T_6	Mancozeb (Treated check)	7.98	15.49	19.46
	CD (5%)	**0.90**	**0.63**	**0.26**

Table 4 Effect of neem cake, plant extracts and neem oil on bulb weight of onion (g), bulb diameter (cm), bulb yield per plot (kg) and yield (q/ha) of onion

Treatment Number	Treatment Details	Bulb weight(g)	Bulb diameter(cm)	bulb yieldper plot (kg)	yield (q/ha)
T_0	Control (Untreated)	40.43	3.40	1.370	39.817
T_1	Neem cake + Neem oil	68.80	6.80	1.968	98.383
T_2	Neem cake + Datura leaf extract	57.86	4.86	1.538	80.900
T_3	Neem cake + Lantana leaf extract	61.40	5.92	1.751	89.567
T_4	Neem cake + Bael leaf extract	59.53	5.43	1.645	86.233
T_5	Neem cake +Eucalyptus leaf extract	64.20	6.15	1.869	93.450
T_6	Mancozeb (Treated check)	71.13	7.13	2.106	105.317
	CD (5%)	**0.16**	**0.05**	**0.07**	**0.83**

5 Conclusion

From the results of this study if may be concluded that neem cake (Soil amendment) + neem oil (Foliar spray) recorded the minimum disease intensity of purple blotch of Onion caused by *Alternaria porri* (Ellis) Cif. and bulb weight of onion (g), bulb diameter (cm), bulb yield per plot (kg), yield (q/ha) and benefit cost ratio of onion. The present investigation was limited to one crop season (*Rabi*, 2023-24), under the agroclimatic conditions of Prayagraj (U.P.) hence, additional research is necessary to validate the findings of the study as the data collected for one crop season is inadequate to make definite conclusions.

Comment [MT10]: IT

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