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*In-vivo M*anagement of Alternaria Leaf Spot of Cabbage (*Alternaria brassicicola*)

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A B S T R A C T

An experiment was conducted for *in-vivo* management of Alternaria leaf spot of Cabbage. The experiment was analyzed by using RBD (randomized block design) with three replications in a plot size 2x2m^2. Eight treatments were taken i.e. Neem oil, Eucalyptus oil, Clove oil, *Trichoderma viride*, Neem oil + *Trichoderma viride*, Eucalyptus oil + *Trichoderma viride*, Clove oil + *Trichoderma viride* along with the control. Observations were recorded at disease intensity 30, 45 and 60 (days after Transplanting), plant growth parameters such a yield (q/ha). Experiment revealed that Neem oil significantly reduced the Alternaria leaf spot of Cabbage, where among the use Neem oil seedling treatment @ 5% increased the yield. The maximum cost benefit ratio was recorded by Neem oil (1:3.26) Thus according to experimental finding and results discussed in the earlier chapter, it is concluded that Neem oil reduced the Alternaria leaf spot of Cabbage, where among the Neem oil seedling application found maximum yield was significantly superior as compare to other treatments.

Introduction

Cabbage (*Brassica oleracea*) is a leafy green or purple biennial plant grown as an annual vegetable crop for its dense leaved heads. It descends from *B. oleracea var. oleracea*, a wild field Cabbage. Cabbage heads generally range from 0.5 to 4 kg (1 to 9 lb) and can be green, purple and white. It is a multi-layered vegetable. Cabbage is a good source of vitamin K, vitamin C and dietary fiber. Cabbage provides 25kcal in form of carbohydrate 5.8g, dietary fibre 2.5g, fat, 0.1g, protein 1.28g, vitamin B 0.671mg, vitamin C 36.6mg, vitamin K 76µg, Calcium 40mg, Iron 0.47mg, Magnesium 12mg, Manganese 0.16 mg, Phosphorus 26 mg, Potassium170 mg, Sodium 18 mg, Zinc 0.18 mg and florate 1mg (Choudhary, 1967).

The cabbage crop is affected by various fungal as well as bacterial diseases like damping off, club root, downy mildew, sclerotinia rot, black leg, black rot, soft rot and Alternaria blight or Alternaria leaf spot. There are two species of Alternaria which

cause serious damage in cabbage: *Alternaria brassicae* and *Alternaria brassicicola*, they can survive saprophytically outside of the host and diseased crop debris (Yadav *et al.*, 2014).

Alternaria leaf spot/blight symptoms start as a small, circular, dark spot. As the disease progresses, the circular spots may grow to ½ inch (1cm) or more in diameter and are usually gray, gray-tan, or near black in color. Spots develop in a target pattern of concentric rings. Dark, sunken lesions are usually the expressions of Alternaria infections on roots, tubers, stems and fruits. The fungus may sporulate in these cankers, causing a fine, black, velvety growth of fungus and spores to cover the affected area.

A temperature range of 25 to 30°C and 15 to 35°C was found optimum for mycelial growth and sporulation of *A. brassicicola*, respectively. Mycelial growth was most favoured by 100% relative humidity with a gradual reduction in growth and sporulation till 70% RH and a decrease in growth and sporulation at 60 and 50% RH (Meena *et al.*, 2010).

At least 20% of agricultural spoilage is caused by *Alternaria* spp; most severe losses may reach up to 80% of yield and 59% loss of cabbage seed yield may occur due to *Alternaria* blight (Hossain and Mian, 2003).

Although the leaf spot disease is considered to be a major disease of the crop, no systemic work appears to be done on the disease in India or elsewhere. Keeping this in view, the present investigation on *Alternaria brassicicola*, the incitant of leaf blight of cabbage was undertaken in order to make a detailed study of the morphological characters and physiological behaviors of the pathogen and to find out suitable management practices for the disease under field condition.

Materials and Methods

The study was conducted field condition at department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during the *Rabi* season of 2018-19. Field experiment was laid-out in Randomized block design with three replications.

Field Preparation

The selected field area was well prepared and plot marked as per the layout plan. The selected field was ploughed, cleaned and the soil was well pulverized after which the total area was divided into sub-plots.

Nursery preparation

The nursery was raised in the trays with coco pit media. on the tray they were covered with the coco pit mixture. The coconut pit are 100% natural by product of coconut, coco pit has superior water holding capacity, excellent air space and high nutrient contents. The coco pit is useful in modern hydroponics and as soil amendment for potted Plants. Three trays each having size of 2.5 x 1.5 ft. were prepared for obtaining seedlings for transplanting and gap filling in the field for experimentation. A F1 hybrid variety BC-76 is chosen for the experiment.

The seed sowing was done on 19th November 2018. The seed were so on the tray with coco pit media. The seed rate utilized was 500 g/ha (*i.e*. seedlings required for transplanting one hectare area field). These trays were irrigated whenever required with the help of sprayer.

Treatment and transplantation of seedling

The experimental plot was laid out as per statistical design and necessary marking of the hills was done for transplanting the

seedling. Seedling was treated with essential oils and with their combinations. The healthy seedling of about 25-28 days old having uniform size were used for transplantation one these marked hills. The transplanting was done on 19th December 2018.

Disease intensity was recorded as grades in five randomly selected plants tagging in each plot and different time that is 30, 45 and 60 days after transplanting observe disease intensity as per the scale of Mayee and Datar (1986).

Disease intensity (%) was calculated by using the following formula

$$PDI = \frac{\text{Sum of numerical disease ratings}}{\text{No. of plants observed X Maximum disease rating}} \times 100$$

Results and Discussion

The effect of botanicals on disease intensity of leaf spot of cabbage caused by the *Alternaria brassicicola*

The minimum disease intensity (%) was recorded in T_7-Neem oil (26.35%), followed by T_3-*Trichoderma viride* + Neem oil (29.61%), T_6 Eucalyptus oil (31.56) T_2 *Trichoderma viride* + Eucalyptus oil (32.13), T_1- *Trichoderma viride* + Clove oil (33.90%),T_6 Clove oil (34.15), as compared to treated T_4 *Trichoderma viride* (36. 46%) and untreated control T_0-control (47.04%).T_7, T_3, T_4 were significant to other. Among the treatments (T_6 and T_2) and (T_1 andT_5) were non-significant to other but significant over untreated control (Fig. 1–3; Table 1 and 2).

Effect of treatments on disease intensity with head weight of cabbage

The maximum disease intensity (%) with head weight of cabbage was recorded in treatmentT_4-*Trichoderma viride* (30.87%) with head weight of 0.58kg/head followed by T_2- *Trichoderma viride* + Eucalyptus oil (26.70%) with head weigh of 0.63kg/head, T_1 *Trichoderma viride* + Clove oil (28.016%) with head weight of 0.66 kg/hea d, T_5 Clove oil (28.95%) with head weight of 0.72 kg/head,T_3 *Trichoderma viride* + Neem oil (24.67%)with head weight of 0.83kg/head as, T_6-Eucalyptus oil (26.04%) with head weight of 0.85kg/head compared to treated T_7-Neem oil (22.37) and untreated control T_0- control (37.00%) with head weight of 0.54 kg/head. All the treatments were significant over untreated control. Among the treatments and (T_7 and T_3) were found non- significant to each other (Fig. 4 and Table 3).

Table.1 Treatment details

Sl. No	Treatments	Treatment name	Concentration %
1	T_1	Neem oil	**5**
2	T_2	Eucalyptus oil	**5**
3	T_3	Clove oil	**5**
4	T_4	*Trichoderma viride*	**5**
5	T_5	*Trichoderma viride*+Neem oil	**2.5+2.5**
6	T_6	*Trichoderma viride*+Eucalyptus oil	**2.5+2.5**
7	T_7	*Trichoderma viride*+Clove oil	**2.5+2.5**
8	**T_0**	**Control**	**-**

Table.2 Percent of disease intensity at 30, 45 and 60 DAT as affected by treatments

Sr. No.	Treatments	Percent Disease Intensity		
		30 DAT	45 DAT	60 DAT
T_1	*Trichoderma viride* + Clove oil	22.01	28.14	**33.90**
T_2	*Trichoderma viride*+Eucalyptus oil	21.50	26.49	**32.13**
T_3	*Trichodermaviride*+Neem oil	19.73	24.69	**29.61**
T_4	*Trichoderma viride*	25.24	30.91	**36.46**
T_5	Clove oil	23.40	29.30	**34.15**
T_6	Eucalyptus oil	20.70	25.87	**31.56**
T_7	**Neem oil**	**18.09**	**22.67**	**26.35**
T_0	Control	27.53	36.44	**47.04**
Result		S	S	**S**
S.E.D(+/-)		0.626	0.408	**0.398**
C.D.		1.342	0.716	**0.857**
C.V.		**3.441**	**1.459**	**1.443**

Table.3 Effect of treatments on disease intensity with head weight of cabbage

SR. No	Treatments	Dosage	PDI	Head weight (kg)
T_1	*Trichoderma viride*+Clove oil	2.5+2.5	28.016	**0.66**
T2	*Trichoderma viride*+Eucalyptus oil	2.5+2.5	26.706	**0.72**
T_3	*Trichoderma viride*+Neem oil	2.5+2.5	24.676	**0.83**
T_4	*Trichoderma viride*	5	30.870	**0.58**
T_5	Clove oil	5	28.950	**0.72**
T_6	Eucalyptus oil	5	26.043	**0.85**
T_7	**Neem oil**	**5**	**22.370**	**1.02**
T_0	Control	-	37.003	**0.54**
	SEd± C			**0.002**
	CD@5%		3.317	**0.123**
	CV (%)		**6.746**	**9.615**

Table.4 Cabbage yield (tones/ha) as affected by treatment

Sr. No	Treatments	Dosage (%)	PDI	Yield (t/ha)
T_1	*Trichoderma viride*+ Clove oil	2.5+2.5	28.016	**25.68**
T_2	*Trichoderma viride*+ Eucalyptus oil	2.5+2.5	26.706	**24.37**
T_3	*Trichoderma viride*+ Neem oil	2.5+2.5	24.676	**27.15**
T_4	*Trichoderma viride*	5	30.870	**19.53**
T_5	Clove oil	5	28.995	**26.29**
T_6	Eucalyptus oil	5	26.043	**29.21**
T_7	Neem oil	5	22.370	**32.14**
T_0	Control	-	**37.003**	**16.41**
	SEd±C			**0.38**
	CD @ 5%		3.317	**1.586**
	CV(%)		**6.746**	**3.60**

Fig.1 Seedling treatment

Fig.2 Leaf affected by *Alternaria brassicicola*

Fig.3 Disease intensity

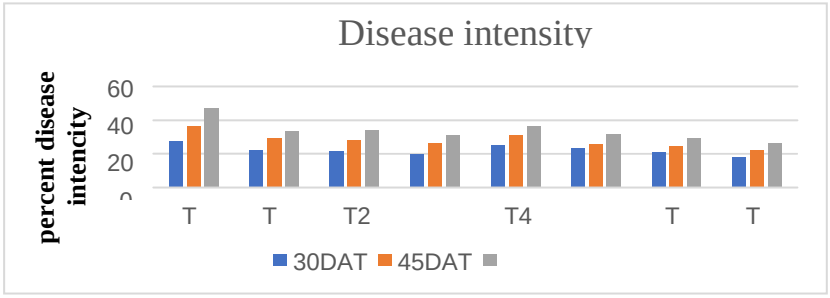


Fig.4 Head weight (g) of cabbage as affected by treatments

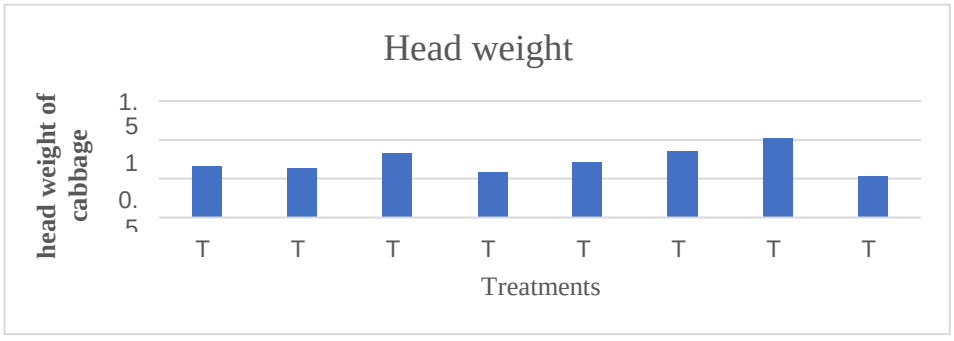
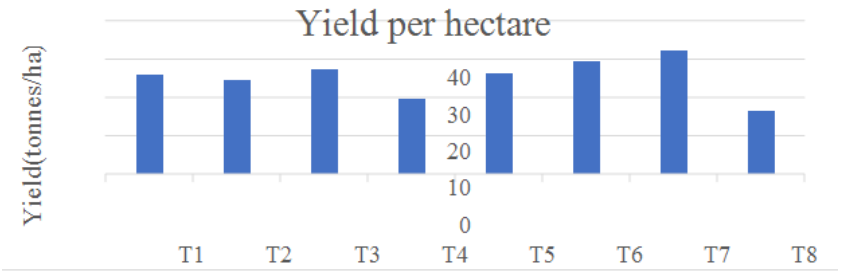


Fig.5 Cabbage yield (tones/ha) as affected by treatments



Effect of treatments on the yield (tonnes/ha) of cabbage

The maximum disease intensity (%) with yield of cabbage was recorded in T_4 eucalyptusoil (29.21) (tonnes/ha) followed by T_3 *Trichoderma viride* + Neem oil (27.15 tonnes/ha) T_5 Clove oil (26.29 tonnes/ ha) T_1 *Trichoderma viride* + Clove oil (25.68 tonnes/ha), T_2 *Trichoderma viride* + eucalyptus oil (24.37 tonnes/ha) as compared to treated T_4 *Trichoderma viride* (19.53 tonnes/ha) and unt reated control T_0 control (16.41tonnes/ha). All the treatments were significant over untreated control (Fig. 5 and Table 4).

Cost Benefit Ratio

The yield (tons per hector) among the treatment was significant. The highest yield was recorded in T_7 Neem oil (32.14) followed by the T_6 Eucalyptus oil (29.21), T_3 *Trichoderma viride* + Neem oil (27.15), T_4 Clove oil (26.29), T_1 *Trichoderma viride* + clove oil (25.68), T_2 *Trichoderma viride* + Eucalyptus oil (24.37), *Trichoderma viride* (19.53) and the lowest was recorded in treatment T_0 control (16.41) .

In conclusion, according to this single trial T_7Neem oil (5%) is highly cost benefited 1:3.26 and that of T_6 Eucalyptus oil (5%) gave b: c 1**:**2.93 ratio which is not much lower to Neem oil.

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