Bangladesh J. Bot. **51**(3): 541-546, 2022 (September) DOI: https://doi.org/10.3329/bjb.v51i3.62000

ECO-FRIENDLY MANAGEMENT OF PURPLE BLOTCH (*ALTERNARIA PORRI* (ELLIS) DISEASE OF ONION (*ALLIUM CEPA* L.)

DIVYA*, SHASHI TIWARI, JITENDRA KUMAR TIWARI[1] AND ARUN KUMAR[2]

Division of Plant Pathology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (UP), India

Keywords: Onion, Purple blotch, Intensity, Bio agent, Essential oils

Abstract

Purple blotch caused by *Alternaria porri* is one of the most destructive diseases of onion which inflicting considerable bulb yield loss. To find the suitable biointensive management option, efficacy of different essential oils and bio-agents was evaluated. Effects of various treatments were assessed in terms of quality attribute of plant and disease magnitude. The combined application of essential oil and *Trichoderma viride* was found to be supportive to increase the plant height, neck thickness and foliage in two varieties e.g., Agrifound Light Red and NHRDF Red-3. The mean incidence of purple blotch (40.7 and 38.9%) was observed in both the varieties in response of combined application Neem oil and *T. viride*. In result of lowest disease pressure, the highest yield 343.86 and 304.08Q/ha was found in NHRDF Red-3 and Agrifound Light Red, respectively. In study of temporal dynamics of blotch severity, an exponential increase in severity was found between 60 to 90-DAT. The information generated in the present study may be helpful to develop a biointensive management module which will facilitate the onion production.

Introduction

Onion which is grown in various ecological regions around the world has a great significance. In India, onion is predominantly cultivated in *Rabi* and *Kharif seasons*. Onion cultivation is severely affected by purple blotch (*Alternaria porri*). The disease poses serious threat to all growing countries of the world. High relative humidity >80 to 90% and ambient temperature of 24±10°C favours for purple blotch disease. It is an important disease in warm, humid onion-growing regions of the world. About 50 to 100% yield loss has been reported due to this disease (Shahanaz *et al.* 2007). Since, the management of the disease using systemic fungicides are posing resistance in fungi; therefore, difficulty arises in quality production. Additionally, the harmful side effects like phytotoxicity and environmental pollution are challenging (Rial-Otero *et al.* 2005). However, researcher are trying to find the solution using integrated approach to manage the crop. In order to manage the disease various biological control agents e.g., *Trichoderma*, *Pseudomonas* and *Bacillus* were used (Pal *et al.* 2006). *Trichoderma harzianum* has been reported to reduce the purple blotch intensity and increase the yield (Prakasam *et al.* 2012). Moreover, an antagonistic effect of neem oil on fungus has also been investigated in *invitro* studies (Chethana *et al.* 2015, Chethana *et al.* 2013). Considering the effect of biological agents on disease, a field experiment was carried out to find sustainable purple blotch management option in onion.

Materials and Methods

The field investigations were carried out at the Central Research Field of the Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during *Rabi* 2019-20. The nursery preparation was done during the second

*Author for correspondence: <divyadt72@gmail.com>. [1]National Horticultural Research and Development Foundation, Patna (Bihar), India.[2]Bihar Agriculture University Sabour, Bhagalpur (Bihar), India.

fortnight of October, 2019. About eight weeks old healthy seedlings were selected for transplanting in 2 x 2m experimental plots. The seedlings were transplanted maintaining row to row distance of 20 cm and plant to plant 10 cm. The seedlings were transplanted in the 3rd week of the December, 2019. In order to assess the effect of various treatment combination, seven modules were designed e.g., Neem oil 5% (T-1), Castor oil 5% (T-2), Clove oil 5% (T-3), TV10% (T-4), TV 2.5% +Neem oil 2.5% (T-5), TV 2.5%+Castor oil 2.5% (T-6) and TV 2.5% +Clove oil 2.5% (T-7) and untreated control plot (T0). Effects of all these treatments were assessed on two onion varieties e.g.,Agrifound Light Red and NHRDF Red-3. The whole experiment was plotted in Randomized Block Design (RBD) with three replicates.

All the solutions were prepared freshly in the field at the time of transplanting. Seedling treatment with *T. viride*, neem oil, castor oil and clove oil were done at the time of transplanting by dipping the plants for 5-10 min in solutions. In response to various treatments different growth parameters like Plant height (cm), number of leaves/plant and neck thickness (cm) was taken into consideration. Purple blotch incidence was calculated using the formula of DI (Disease incidence).

In order to assess the pattern of purple blotch intensity, five plants were maintained separately in three replications and tagged. The plants were grown in natural condition to develop the disease. Data were recorded at 15-days interval (30-DAT to 90-DAT). The severity was calculated based on the developed scale of Wheeler (1969).

Results and Discussion

Effects of biocontrol agents, essential oils and combinations of both were assessed on plant growth parameters. The combined application of essential oil and *T. viride* was found supportive to increase the plant height in both the varieties. TV (2.5%) + Neem oil (2.5%) applied plots showed the maximum plant height (58.95cm) and (59.60cm) in Agrifound Light Red and NHRDF Red-3, respectively. Similarly, it also increased the foliage in both the varieties (10.67 and 10.80/plant). The neck thickness was also found maximum in TV+ essential oil applied plots where it ranger from 1.48-1.51cm (Agrifound Light Red) (Table 1).

Disease incidence was scored in both the varieties upon application various treatment modules. The lowest mean incidence of purple blotch was observed in TV+NeO applied plots. However, combined application TV+ CaO and TV +ClO were also found in reducing the blotch incidence. Whereas the sole application of essential oil and TV was found in reducing the incidence, it ranged between 44.56 and 53.03% in both varieties. The maximum incidence 62.18 and 60.56% was found in control plots.

It is apparent from Table2 that pre-planting treatment of plants with different essential oils and bio-agents and varieties has pronounced effect on purple blotch disease recorded at different stages of growth. Maximum purple blotch disease (0.90(0.15%) in NHRDF Red-3 (V2) and minimum (0.89 (0.14%) in Agrifound Light Red (V1) at 30 DAT were recorded. Similarly at 60 DAT maximum disease was observed (8.14(22.58%) in V1 and minimum (6.79 (23.84%) in V2 and which did not differ significantly. Data revealed at 90 DAT was maximum and minimum was almost at par in both varieties. An increasing trend of purple blotch could be recorded with treatment of (T5) TV (2.5%) + Neem oil (2.5%), being minimum (10.26(39.85%) and maximum disease observed 19.47(61.37) % in (T0) control. Similar trends were noted at all stage of plant growth. Thus, purple blotch disease of plant was maximum (12.36 (39.76%) and (0.72 (1.14%) in (T0) control at 60DAT, 30DAT respectively. Whereas minimum (4.50 (14.11%) and (0.00(0.00%) in (T5) TV (2.5%) + Neem oil (2.5%) at 60DAT, 30DAT respectively. These findings supported by Rahman (1988) and Chethana *et al.* (2013).

Table 1.Effects of various treatments on growth parameters of onion.

Treat-ment No.	Treatments	Plant growth parameters					
		Height (cm)		No. of leaves/plant		Neck thickness (cm)	
		Agrifound light red	NHRDF red-3	Agrifound light red	NHRDF red-3	Agrifound light red	NHRDF red-3
T_1	Neem oil (5%)	57.02	57.81	10.27	10.33	1.45	1.41
T_2	Castor oil (5%)	56.40	56.94	10.07	10.20	1.43	1.39
T_3	Clove oil (5%)	55.32	55.87	9.67	9.87	1.44	1.39
T_4	*Trichoderma viride* (10%)	58.15	58.29	10.33	10.47	1.47	1.42
T_5	TV (2.5%) + Neem oil (2.5%)	58.95	59.60	10.67	10.80	1.51	1.46
T_6	TV (2.5%) + Castor oil (2.5%)	58.68	58.91	10.47	10.67	1.48	1.43
T_7	TV (2.5%) +Clove oil (2.5%)	55.85	56.56	9.87	10.07	1.49	1.45
T_8	Control	54.84	55.47	9.47	9.67	1.33	1.18
	CD (5%)	1.07	0.50	0.07	0.11	0.06	0.02
	SE(m)	0.36	0.17	0.02	0.037	0.031	0.00

Table 2.Effect of various treatments on disease (incidence) intensity (%) of onion.

Treatment no.	Treatments/denotations	Mean of three replications to disease intensity (incidence) %		
	A – Varieties	30(DAT)	60(DAT)	90(DAT)
1.	Agrifound Light Red (V1)	0.89 (0.14)	8.14 (22.58)	14.55 (49.80)
2.	NHRDF Red-3 (V2)	0.90 (0.15)	6.79 (23.84)	14.55 (46.63)
	CD (±)	N/A	0.463	0.461
	SEd (±)	0.007	0.226	0.225
	B- Bio-agents			
T_1	Control T0	0.72 (1.14)	12.36(39.76)	19.47 (61.37)
T_2	Neem Oil (5%) T1	0.00 (0.00)	7.65 (22.61)	14.90 (48.75)
T_3	Castor Oil (5%) T2	0.00 (0.00)	9.04 (26.70)	17.44 (52.09)
T_4	Clove Oil (5%) T3	0.00 (0.00)	8.61 (24.11)	15.86 (49.44)
T_5	*Trichodermaviride*(10%) T4	0.00 (0.00)	6.39 (20.82)	13.64 (47.07)
T_6	TV (2.5%) +Neem Oil (2.5%) T5	0.00 (0.00)	4.50 (14.11)	10.26 (39.85)
T_7	TV (2.5%) + Castor Oil (2.5%) T6	0.00 (0.00)	5.93 (19.22)	12.77 (44.46)
T_8	TV (2.5%) + Clove Oil (2.5%) T7	0.00 (0.00)	5.22 (17.64)	12.07 (42.72)
	CD (±)	0.031	0.927	0.922
	SEd (±)	0.015	0.452	0.449

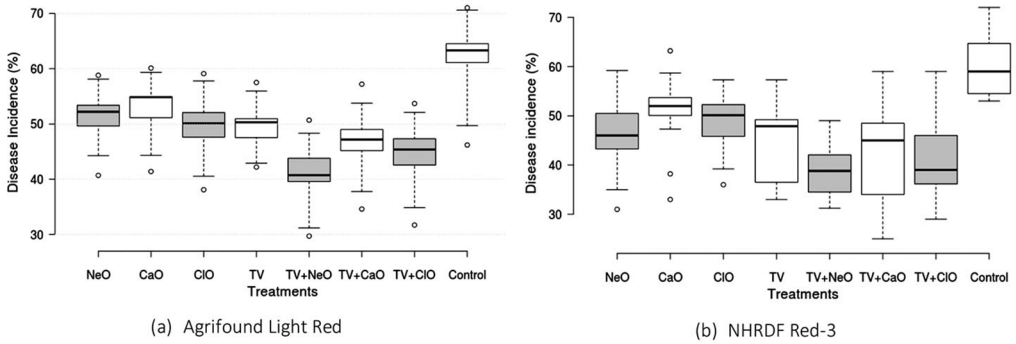

Fig.1.Percent disease incidence of purple blotch of onion owing to different treatments in Agrifound Light Red(a) and NHRDF Red-3(b)Denotes: NeO – Neem Oil, CaO – Castor Oil, ClO – Clove Oil, TV – *Trichoderma viride.*

Crop yield owing to TV and essential oils are presented in Fig. 2. Maximum yield (343.86Q/ha) was found in NHRDF Red-3 owing to TV+NeO which was followed by TV+CaO (335.20 Q/ha). A similar pattern was observed in Agrifound Light Red where maximum yield was 304.08 Q/ha. The sole application of TV and essential oils yield ranged between 282.18 and 297.61 Q/ha in Agrifound Light Red and 325.94-333.37 Q/ha in NHRDF Red-3. Lowest production of 273.64 and 311.50 Q/ha was recorded in untreated control plots of Agrifound Light Red and NHRDF Red-3, respectively (Fig. 2).

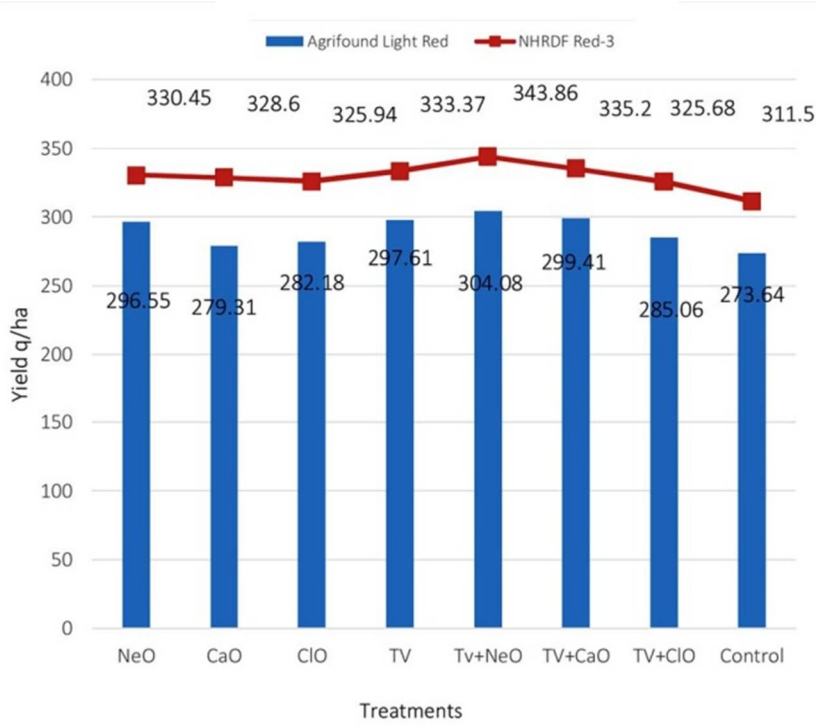

Fig. 2. Yield of onion (Q/ha) from treated plots.

Temporal dynamics of purple blotch severity of onion is presented in Fig. 3. A minor appearance of symptom was found at 45-days after transplanting (DAT) with <5% severity. An abrupt increase in severity was noticed up to 60-DAT with severity range 13.25 and 11.48% in Agrifound Light Red and NHRDF Red-3, respectively. The severity was exponentially increased upto 90-DAT in both the varieties with similar trend. A severity range was noticed between 18.71-21.57% in both the varieties at late maturity stage of Onion.

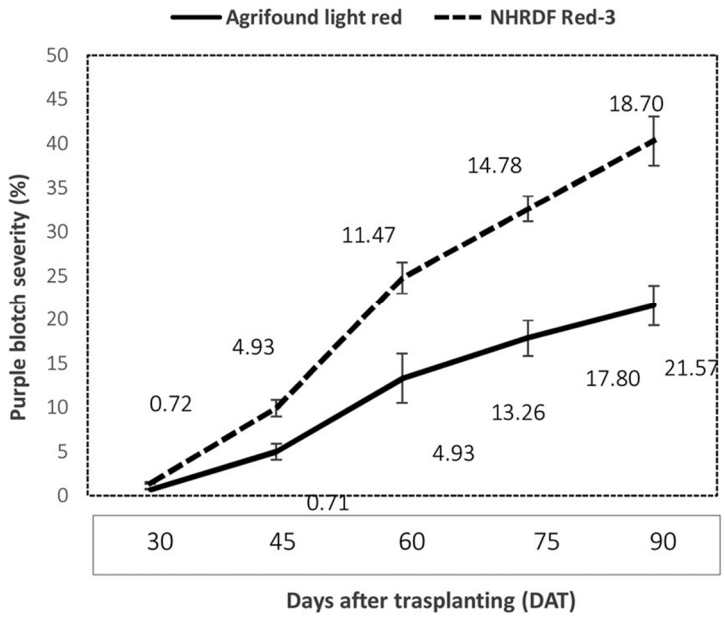

Fig. 3.Purple blotch severity under natural field condition.

The combined effect of neem oil and *T. viride* were found to be effective to control the disease and qualitative attribute of the crop. More than 60% purple blotch incidence was recorded in unmanaged crop. Since, the integrated pest and disease management module for shallots were developed and found to be effective for the crop in southern part of India (Dinakaran *et al.* 2013). However, application of *T. harzarium* was also found effective in controlling the pathogen up to 37.6% disease severity (Brahmane *et al.* 2015).The findings in the present study exclusively targeted the purple blotch which revealed the efficient management using bio intensive approaches. The present finding may be helpful to redevelop sustainable management module in onion and related crops.

References

Brahmane PR, Dandnaik BP and Abhang PB 2015. Efficacy of bioagents and plant extract against *Alternaria porri* causing purple blotch of onion. Int. J. Plant Protec. **8**(2): 265-269.

Chethana BS, Ganeshan G, Archana SR and Bellishree K 2015.Integrated disease management of purple blotch disease of onion. Int. Quart. J. Life Sci. **10**(4): 1729-1733.

Chethana BS, Ganeshan G, Rao AS and Bellishree K 2013. Bioefficacy of botanicals, bio-agents and fungicides in the management of purple blotch disease of onion. Environ. Ecol. **31**(2B): 947-952.

Dinakaran G, Gajendran S, Mohankuma G, Karthikeyan, S, Thiruvudainambi, I E, Jonathan R, Samiyappan G D, Pfeiffer G E, Rajotte W G, Norton S, Miller R, Muniappan 2013. Evaluation of integrated pest and disease management module for shallots in Tamil Nadu, India: a farmer's participatory approach, J. Integr. Pest Manage. **4.**

Pal KK and B. McSpadden GM 2006. Biological Control of Plant Pathogens. The Plant Health Instructor DOI: 10.1094/PHI-A-2006-1117-02.

Prakasam V. and Sharma Pratibha, 2012.*Trichodermaharzianum* (Th-3) a potential strain to manage the purple blotch of onion (*Allium cepa* L.) caused by *Alternaria porri* under North Indian Plains. J. Agricult. Sci.**4**: 10; 2012 ISSN 1916-9752.

Rahman, M. L., Ahmed, H.U. and Mian, I.H. (1988).Efficacy of fungicides in controlling purple leaf blotch of onion. Bangladesh J. Plant Pathol. 4(1&2): 71-76.

Rial-Otero R, Arias-Estévez M., López-Periago E., Cancho-Grande B. and Simal-Gándar J. 2005.Variation in concentrations of the fungicides tebuconazole and dichlofluanid following successive applications to greenhouse-grown lettuces. J. Agricult. Food Chem. **53**: 4471-4475.

Shahanaz E, Razdan VK, and Raina PK 2007. Survival, dispersal and management of foliar blight pathogen of onion. J. Mycol. Plant Pathol. **37**(2): 213-214.

Wheeler, B.E. 1969. An Introduction to Plant Diseases.John Wiley and Sons Ltd. London, 301.

(Manuscript received on 23 August, 2021; revised on 28 August, 2022)