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Effect of Different Fungicides in Combination with Poultry Manure and Neem Seed Extract on Purple Blotch Disease of Onion Caused by *Alternaria porri*

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Abstract: A field experiment was conducted during the Robi season The experimental field is located at 90°33′ E longitude and 23°77′ N latitude at a height of 9 meter above the sea level. The soil was medium high and well drained. The soil of the experimental site belongs to the Agro-Ecological Region of "Madhupur Tract" (AEZ No. 28).There was 18 treatments in the experiment. These treatments were fungicides, *i.e.* Rovral 50 WP, Bavistin DF, Ridomil Gold (MZ-72) and poultry manure individually or in combinations. The lowest disease incidence and disease severity were observed in Dipping + Rovral 50 WP + Poultry manure + Seven days interval. The highest disease incidence and disease severity were recorded in control treatment. On the basis of present findings it may be concluded that the onion growers may by suggested applying Rovral 50 WP (0.2%) along with Poultry manure in controlling purple blotch of onion for bulb production. However, further studies need to be carried in different Agro-ecological zones taking more options to justify the present findings.

Key words: Fungicides · Poultry manure · Neem seed extract · Onion and *Alternaria porri*

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important and familiar spices crop throughout the world. It is member of the family Alliaceae. It is also used as popular vegetable in our country of Asia and very common and favorite spices in Bangladesh. Onion has manifold uses such as spices, vegetables, salad dressing etc. It also used as condiments for flavoring a number of foods and medicines [1].

In terms of global weight of vegetable production, nearly 28 million tons onion bulbs per annum next to tomatoes and cabbages bear importance. In Bangladesh onion is mainly grown in winter season as a spice crop. The world average yield of onion is 17.5t/ha. In Bangladesh, it is grown in 51, 820 hectares of land with an annual production of 2, 72, 000 metric tons. The average yield of onion in Bangladesh is 5.2 t/ha, which is too low compared to the world average. In Bangladesh, the production of onion is nearly 8, 89, 000 M tons in 3, 09, 000 acres of land [2]. The national annual yield is only 5.71 t/ha [2] which is quite low compared to other onion growing countries of the world. Our annual requirement of onion is around 14, 00,000 tons [3]. The 23 districts of onion growing areas of the country are Faridpur, Comilla, Manikganj, Dinajpur, Jessore, Pabna, Rajshshi, Mymensingh, Jamalpur, Patuakhali, Kishorganj, Tangail, Borishal, Bandarban, Khagrachari, Sylhet, Bogra, Rangamati, Kustia, Dhaka, Chittagong and Rangpur. The highest yield 2, 08,935 metric ton was in Faridpur in 78,695 acre of land [4].

Onions are attacked by several diseases caused by various pathogens [5, 6]. Most of the disease caused by the fungi and among the fungal diseases, the most important and damaging ones are seed borne. Various diseases were reported as seed borne viz. purple blotch, seed rot, black mould and white rot. Proper disease control measures can improve the quality of onion bulbs and significantly increase the yield.

Purple blotch of onion is noted as a major disease throughout the world including Bangladesh [5-8]. In India purple blotch of onion is a major devastating and widespread disease and causes serious yield reduction [9]. The disease is also a threat for seed production of onion [10-12].

In Bangladesh, limited attempts have been made to find out the suitable control measures of this disease for bulb and seed production [13,11,14] also found Rovral and Dithane M-45 effective against the disease. A good number of fungicides, cultural practices are yet remained

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untested against this disease. Considering the present situation of the disease in the country, further selection of fungicides against leaf blotch of onion is urgently necessary. Fertilizer management like use of poultry manure, ash, cow dung, mustard oil cake and NPK, Zn, S and B could be the options for the management of purple blotch of onion. In this context, many poultry farms have been established recently surrounding Dhaka to meet increasing demand and waste management is a concern. Thus appropriate incorporation of this organic waste into soil may benefit both onion farmers and poultry producers.

People globally are conscious about environmental hazards due to use of costly and toxic chemicals. The increasing public awareness about these problems has stimulated research on the use of biocontrol agents and development of commercial byproducts. The goal of biocontrol research in combination with chemical control is to provide an additional tool for integrated approach of disease management. To save the nature and environment, a judicial use of fungicides, organic amendments and plant extracts are to be employed. In this context, the present study was develop an integrated approach for controlling the principal disease of onion and to achieve the following objectives: To focus the effective fungicides, organic amendments and botanicals for control purple blotch of onion caused by *Alternaria porri* and To apply the IPM components for the management of purple blotch disease of onion caused by *Alternaria porri.*

MATERIALS AND METHODS

The research was conducted during the period from winter session. The experimental field is located at 90°33′ E longitude and 23°77′ N latitude at a height of 9 meter above the sea level. The land was medium high and well drained. The experimental plots were arranged in Randomized Complete Block Design (RCBD) with three (3) replications. The soil of the experimental site belongs to the Agro-Ecological Region of "Madhupur Tract" (AEZ No. 28). It was Deep Red Brown Terrace soil and belongs to "Nodda" cultivated series. The top soil is slightly clay loam in texture. Organic matter content was very low (0.82%) and soil pH varied from 5.07-5.63. The experiment was conducted with a local onion variety Taherpuri collected from Manikgonj, Dhaka. This onion variety is most popular in Bangladesh and its quality is more standard than other local or high yielding variety. Altogether there were 18 different treatments as stated bellow. The treatments were applied into the assigned plots as per design of the experiment.

Treatments:

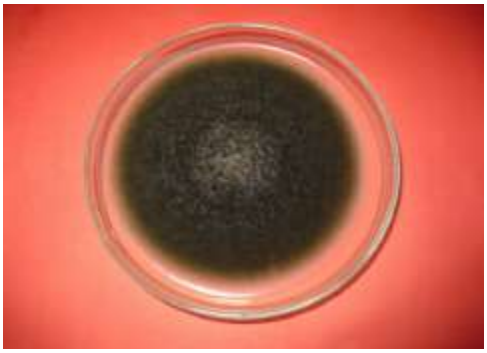
T_1 = DoFoPo = Control
T_2 = DoFoP = No transplants dipping + No fungicide + poultry manure
T_3 = DF_1PoS_7 = Dipping + Rovral 50 WP + No poultry manure + Seven days interval
T_4 = DF_2PoS_7 = Dipping + Bavistin DF + No poultry manure + Seven days interval
T_5 = DF_3PoS_7 = Dipping + Ridomil Gold (MZ-72) + No poultry manure + Seven days interval
T_6 = DF_1PS_7 = Dipping + Rovral 50 WP + Poultry manure + Seven days interval
T_7 = DF_2PS_7 = Dipping + Bavistin DF + Poultry manure + Seven days interval
T_8 = DF_3PS_7 = Dipping + Ridomil Gold (MZ-72) + Poultry manure + Seven days interval
T_9 = DF_1PoS_{15} = Dipping + Rovral 50 WP + No Poultry manure + Fifteen days interval
T_{10} = DF_2PoS_{15} = Dipping + Bavistin DF + No Poultry manure + Fifteen days interval
T_{11} = DF_3PoS_{15} = Dipping + Ridomil Gold (MZ-72) + No Poultry manure + Fifteen days interval T_{12} = DF_1PS_{15} = Dipping + Rovral 50 WP + Poultry manure + Fifteen days interval
T_{13} = DF_2PS_{15} = Dipping + Bavistin DF + Poultry manure + Seven days interval
T_{14} = DF_3PS_{15} = Dipping + Ridomil Gold (MZ-72) + Poultry manure + Seven days interval
T_{15} = $DNPoS_7$ = Dipping + Neem seed extract + No poultry manure + Seven days interval
T_{16} = $DNPS_7$ = Dipping + Neem seed extract + Poultry manure + Seven days interval
T_{17} = $DNPoS_{15}$ = Dipping + Neem seed extract + No poultry manure + Seven days interval
T_{18} = $DNPS_{15}$ = Dipping + Neem seed extract + Poultry manure + Fifteen days interval

Isolation and Identification of Pathogen from Leaf Tissue:
Isolation and identification of pathogen were made in two ways

- By direct inspection.
- By inoculating diseased tissues on Potato Dextrose Agar (PDA) medium.

By Direct Inspection: The diseased leaves of onion plants were collected and kept in polythene bags and tagged. Then slides were prepared from the diseased samples, observed under microscope and identify the pathogen according to CMI description (Vol. no. 338).

By Growing on Potato Dextrose Agar (PDA) Medium: The diseased leaves were cut into pieces (4 mm diameter) and surface sterilized with $HgCl_2$ (1:1000) for 30 seconds. Then the cut pieces were washed in sterile water thrice and were dried in keeping untreated blotting paper then placed on to acidified PDA in Petridish. The plates containing leaf pieces were placed at room temperature for seven days. When the fungus grew well and sporulated, then the pathogen slide was prepared and was identified under microscope with the help of relevant literature to CMI description (Vol. No. 338)



Pure culture of *Alternaria porri*

Conidia of *Alternaria porri* (x 40)

Calculation of Disease Incidence of Different Treatment: The percent disease incidence was calculated using the following formula:

$$\%\text{plant infection} = \frac{\text{Number of infected plant}}{\text{Total number of inspected plant}} \times 100$$

Added No. Of Infected Leaf/plant at Different Treatment: Number of leaf infected per plant were recorded and used for calculation of disease severity. The leaf with characteristic purple colored spot or blighted tip was denoted as diseased leaf.

$$\%\text{ disease severity} = \frac{\text{Number of infected leaf}}{\text{Total number of inspected leaf}} \times 100$$

Leaf Area Diseased (LAD)/plant in different treatment Leaf area diseased of the ten selected plants in each plot against each treatment were measured and recorded by conversion to percentage. Mean percentage of leaf area diseased was calculated by dividing number of total observation.

Analysis of Data/Statistical Analysis: Data were analyzed statistically using MSTAT Computer Program. Data were transformed, whenever necessary, following Arcsine transformation. Means of treatment were separated using Duncan's Multiple Range Test (DMRT), Gomez [15].

RESULTS

Percent Plant Infection: Results obtained on the effect of spraying Rovral 50 WP, Bavistin DF, Ridomil gold (MZ-72) and neem seed extract in combination with poultry manure for controlling purple blotch of onion in terms of% plant infection were observed and recorded in Table 1at 34, 41, 48, 55, 62 and 69 days after planting (DAP). The effects differed significantly among the treatments with some extent. At 69 DAP the treatments effect in respect of% plant infection differed significantly. The lowest plant infection (74.33%) was observed in the treatment of Dipping + Rovral 50 WP + Poultry manure + Seven days interval, followed by the treatment of Dipping + Rovral 50 WP + No poultry manure + Seven days interval (78.67%) and by the treatment of Dipping + Neem seed extracts + No poultry manure + Fifteen days interval (79.00%) which were statisticslly same. The highest plant infection (100%) was observed in control treatment and same by the treatment of No dipping + No fungicide + Poultry manure. In case of poultry manure treatments T_7 (DF_2PS_7) and T_{18} ($DNPS_{15}$) showed better performance for controlling purple blotch of onion. It was noted that the percent infected plant was gradually increased with the age of the crop and increasing rate was comparatively slower in treatment T_6 (DF_1PS_7) at 62 and 69 DAP than control.

Table 1: Effect of different treatments on disease incidence (% plant infection) of purple blotch of onion at different days after planting (DAP)

	% plant infection (Data taken on 7 days interval)					
Treatmens	34 DAP	41 DAP	48 DAP	55 DAP	62 DAP	69 DAP
T_1=DoFoPo	63.72 a	71.67 a	74.98 a	80.65 a	90.95 a	100.00 a
T_2=DoFoP	62.75 ab	71.28 a	74.72 a	79.99 ab	90.08 a	100.00 a
T_3=DF_1PoS_7	59.33 a-c	52.75 bc	62.50 b-d	71.21 c-e	77.51 e-g	78.67 fg
T_4=DF_2PoS_7	58.74 a-d	54.06 bc	63.46 bc	73.08 b-d	81.49 b-e	90.00 bc
T_5=DF_3PoS_7	57.79 a-d	55.02 bc	65.43 b	74.66 a-c	84.57 b	93.00 b
T_6=DF_1PS_7	53.74 a-e	44.67 d	51.59 ef	64.88 ef	70.71 h	74.33 g
T_7=DF_2PS_7	45.66 e	54.12 bc	55.98 d-f	67.61 c-f	75.79 fg	83.00 ef
T_8=DF_3PS_7	49.07 c-e	52.75 bc	57.52 c-e	68.76 c-e	79.42 d-f	85.67 c-e
T_9= DF_1PoS_{15}	48.67 c-e	55.00 bc	61.83 b-d	68.78 c-e	80.08 c-e	84.00 d-f
T_{10}=DF_2PoS_{15}	51.33 b-e	52.79 bc	60.36 b-d	68.88 c-e	82.42 b-d	87.33 b-e
T_{11}=DF_3PoS_{15}	53.67 a-e	53.24 bc	61.47 b-d	69.13 c-e	85.29 b	89.33 b-d
T_{12}= DF_1PS_{15}	47.45 de	52.33 bc	60.60 b-d	67.81 c-f	83.41 b-d	87.00 c-e
T_{13}= DF_2PS_{15}	54.88 a-e	54.32 bc	63.75 bc	69.39 c-e	83.55 b-d	88.67 b-e
T_{14}= DF_3PS_{15}	54.28 a-e	54.67 bc	64.46 bc	70.91 c-e	83.94 bc	88.67 b-e
T_{15}=$DNPoS_7$	56.55 a-e	58.74 b	64.96 bc	69.15 c-e	81.50 b-e	83.67 d-f
T_{16}=$DNPS_7$	49.89 c-e	50.02 c	62.30 b-d	66.90 d-f	75.17 g	84.33 d-f
T_{17}=$DNPoS_{15}$	51.33 b-e	51.68 c	62.98 b-d	66.28 d-f	75.09 g	79.00 fg
T_{18}= $DNPS_{15}$	53.36 a-e	53.79 bc	64.71 bc	67.20 c-f	78.12 e-g	83.00 ef
LSD (0.05)	9.86	5.58	6.32	6.62	3.70	5.12
CV (%)	11.00	6.13	6.11	5.71	2.76	3.58

Table 2: Effect of different treatments on disease severity (%leaf infection) of purple blotch of onion at different days after planting (DAP)

	%leaf infection (Data taken on 7 days interval)					
Treatmens	34 DAP	41 DAP	48 DAP	55 DAP	62 DAP	69 DAP
T_1=DoFoPo	28.53 a	35.15 a	45.35 a	55.89 a	70.48 a	81.04 a
T_2=DoFoP	26.76 ab	33.91 ab	42.44 ab	54.93 ab	69.49 a	79.52 ab
T_3=DF_1PoS_7	22.37 de	30.59 de	38.52 bc	50.90 b-e	61.99 gh	73.76 d-f
T_4=DF_2PoS_7	24.26 b-d	32.53 b-d	40.45 bc	53.31 a-d	63.98 d-g	75.86 cd
T_5=DF_3PoS_7	25.10 bc	33.40 a-c	39.06 bc	54.59 a-c	64.39 d-f	76.06 cd
T_6=DF_1PS_7	17.94 f	25.27 h	34.32 d	44.83 g	58.56 j	69.33 g
T_7=DF_2PS_7	19.76 ef	26.64 gh	37.99 c	48.22 fg	61.12 hi	71.86 fg
T_8=DF_3PS_7	20.75 e	28.02 fg	38.40 bc	50.02 d-f	62.65 f-h	74.00 d-f
T_9= DF_1PoS_{15}	21.43 e	27.86 fg	39.86 bc	51.51 b-f	63.59 e-g	75.33 c-e
T_{10}=DF_2PoS_{15}	22.12 de	27.12 gh	39.80 bc	52.19 a-f	64.76 c-f	75.43 c-e
T_{11}=DF_3PoS_{15}	22.63 c-e	29.63 ef	40.86 bc	52.71 a-e	65.85 b-d	76.12 cd
T_{12}= DF_1PS_{15}	24.52 b-d	30.15 e	40.74 bc	51.93 a-f	67.04 b	77.33 bc
T_{13}= DF_2PS_{15}	22.11 de	30.71 de	40.35 bc	50.61 b-f	66.76 bc	74.42 c-f
T_{14}= DF_3PS_{15}	21.11 e	31.43 c-e	40.41 bc	48.52 e-g	65.38 b-e	73.20 d-f
T_{15}=$DNPoS_7$	20.67 e	31.63 c-e	42.42 ab	50.50 c-f	65.70 b-e	73.46 d-f
T_{16}=$DNPS_7$	20.63 e	27.55 g	39.18 bc	50.16 b-f	59.29 ij	72.65 e-g
T_{17}=$DNPoS_{15}$	19.85 ef	27.53 g	38.94 bc	49.46 d-f	62.02 gh	72.33 e-g
T_{18}= $DNPS_{15}$	20.65 e	27.98 fg	41.08 bc	50.35 c-f	63.99 d-g	73.32 d-f
LSD (0.05)	2.44	1.81	3.62	3.72	1.87	2.83
CV (%)	6.65	5.68	5.49	4.41	1.76	2.29

Table 3: Effect of different treatments on Disease severity (% Leaf Area Diseased) of purple blotch of onion at different days after planting (DAP)

	% leaf area diseased (Data taken on 7 days interval)					
Treatmens	34 DAP	41 DAP	48 DAP	55 DAP	62 DAP	69 DAP
T_1=DoFoPo	15.58 c	25.31 a	35.79 a	45.45 a	57.41 a	72.09 a
T_2=DoFoP	16.11 bc	24.07 b	34.99 ab	44.56 ab	57.18 ab	70.99 a
T_3=DF_1PoS_7	16.54 b	19.57 f	32.95 cd	39.78 c-g	51.36 f-h	65.29 cd
T_4=DF_2PoS_7	11.51 e	21.43 cd	33.89 a-d	41.60 cd	52.46 e-g	66.86 bc
T_5=DF_3PoS_7	18.50 a	23.20 b	34.11 a-c	42.62 bc	53.95 c-e	68.62 b
T_6=DF_1PS_7	13.56 d	16.95 g	29.97 e	32.02 i	46.22 j	59.94 e
T_7=DF_2PS_7	15.51 c	19.55 f	32.27 cd	36.01 h	47.99 ij	63.53 d
T_8=DF_3PS_7	15.34 c	19.97 ef	31.88 d	37.31 f-h	49.54 hi	65.39 cd
T_9= DF_1PoS_{15}	13.94 d	20.50 d-f	33.19 b-d	38.30 e-h	50.61 gh	65.55 cd
T_{10}=DF_2PoS_{15}	15.43 c	20.89 c-f	32.41 cd	39.69 c-g	51.76 fg	67.63 bc
T_{11}=DF_3PoS_{15}	15.24 c	21.20 c-e	33.59 b-d	40.55 c-e	53.20 d-f	67.20 bc
T_{12}= DF_1PS_{15}	15.88 bc	21.15 c-e	33.91 a-d	41.49 cd	54.18 c-e	67.99 bc
T_{13}= DF_2PS_{15}	17.79 a	20.81 c-f	32.11 cd	41.13 c-e	55.19 b-d	67.32 bc
T_{14}= DF_3PS_{15}	17.91 a	22.00 c	32.15 cd	40.51 c-e	55.29 b-d	66.66 bc
T_{15}=$DNPoS_7$	15.52 c	20.79 c-f	33.03 b-d	40.19 c-f	55.45 a-c	67.41 bc
T_{16}=$DNPS_7$	11.91 b	16.55 g	31.11 d	37.38 f-h	47.13 ij	67.09 bc
T_{17}=$DNPoS_{15}$	14.10 d	19.55 f	33.05 b-d	37.04 gh	49.42 hi	63.13 d
T_{18}= $DNPS_{15}$	14.40 d	20.37 d-f	33.26 b-d	38.65 d-h	51.27 f-h	65.43 cd
LSD (0.05)	0.80	1.19	1.74	2.61	1.88	2.34
CV (%)	3.04	3.48	3.20	4.00	2.18	2.14

Percent Leaf Infection: The effect of spraying Rovral 50 WP, Bavistin DF, Ridomil gold (MZ-72) and neem seed extract in combination with Poultry manure in controlling purple blotch of onion in terms of% leaf infection were observed and recorded at 34, 41, 48, 55, 62 and 69 DAP, presented in Table 2.

Different treatments showed significant variation in respect of percent leaf infection. The lowest infection (69.33%) was observed in the treatment T_6 = DF_1PS_7 (Dipping + Rovral 50 WP + Poultry manure + Seven days interval). The highest leaf infection (81.04%) was observed in untreated control plot. Fungicide Bavistin DF in combination with poultry manure at seven days interval showed significantly better performance in treatment T_7 = DF_2PS_7(71.86%). The table showed that at 69 DAP treatment T_4=DF_2PoS_7, T_5=DF_3PoS_7 and T_{11}=DF_3PoS_{15} were bear statistically same value.

Persent Leaf Area Diseased (%LAD): Results obtained on the effect of spraying Rovral 50 WP, Bavistin DF, Ridomil gold (MZ-72) and neem seed extract in combination with Poultry manure in controlling purple blotch of onion in terms of% Leaf Area Diseased (%LAD) were observed and recorded at 34, 41, 48, 55, 62 and 69 DAP are presented in Table 3. The effects differed significantly among the treatments with some extent and the treatments showed statistically significant variation in respect of percent leaf area diseased (%LAD). The effect of the treatments differed sharply with the increase of time in reducing% LAD of purple blotch of onion. The results showed that at different DAP treatment T_6, Dipping + Rovral 50 WP + Poultry manure + Seven days interval (59.94%) performed the best result in minimizing percent leaf area diseased of purple blotch of onion. The highest% LAD was observed in control treatment (72.09%) where only water was applied, which was statistically same with the treatment T_2, No dipping + No fungicide + Poultry manure (70.99%) where only poultry manures were applied.

DISCUSSION

In the present experiment, the effect of treatments in controlling purple blotch of onion caused by *Alternaria porri* was assessed on the basis of percent leaf infection, percent plant infection, percent leaf area diseased (% LAD) and yield of onion. The effect of Rovral 50 WP (0.2%) along with poultry manure at seven days interval against purple blotch of onion in terms of percent leaf infection, percent plant infection and percent leaf area

diseased (% LAD) was found promising. The highest reduction of plant infection (25.67%), leaf infection (14.44%), leaf area diseased (16.85%) was recorded in case of Dipping + Rovral 50 WP + Poultry manure + Seven days interval. The results showed that application of poultry manure in combination with the fungicide Rovral 50 WP at seven days interval had contributory effect in reducing the disease incidence and disease severity. The present finding was supported by the reports of the previous researches [16-23]. Ahmed *et al*. [16] reported that the fungicides Rovral 50 WP (0.2%) and Ridomil MZ-72 (0.2%) were effective in reducing incidence and severity of purple blotch of onion. Sugha (1995) reported that Iprodione (0.2%) proved to be highly effective against purple blotch of onion resulting 79.6 - 84.9% control of the disease.

Rahman [19] reported that among 6 fungicides, Rovral 50 WP significantly reduced the disease severity of purple blotch of onion. Srivastava *et al.* [24] observed that seedling dipped in Carbendazim and thiophanate methyl followed by 4 sprays of Rovral 50 WP was effective against purple blotch of onion. Diogzon and Gapasin [18] showed that poultry manure (5-10t/ha) improved the growth of onion and decreased diseases. Islam, *et al.* [21] also reported that Rovral 50 WP gave promising effect in reducing the disease severity of purple blotch of onion. Nahar *et al*. [22] evaluate the effect of soil organic amendments (poultry manure) and fungicides in managing purple blotch disease of onion that produced taller, heavier and healthier onion plants with minimum diseases resulted in about twice the yield of onion of the plots managed using the traditional farmer practice.

CONCLUSION

On the basis of present findings it may be concluded that the onion growers may by suggested applying Rovral 50 WP (0.2%) along with Poultry manure in controlling purple blotch of onion for bulb production. However, further studies need to be carried in different Agro-ecological zones taking more options to justify the present findings.

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