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EFFECT OF FUNGICIDES, BOTANICALS AND NUTRIENTS ON PURPLE BLOTCH OF ONION

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ABSTRACT

A field experiment was conducted to evaluate the nine treatments using botanicals, nutrients and fungicides against purple blotch of onion caused by *Alternaria porri*. Both fungicides and botanicals were used as seed bulb treatments and foliar spray while the three nutrients B, S and Zn were applied to the soil of unit plots under all treatments as basal dose except control. The experiment was laid out in a randomized complete block design (RCBD) comprising three replications. The highest reduction of disease severity of purple blotch of onion was obtained by the application of Rovral 50 WP @ 0.2% in combination of nutrients followed by Ridomil Gold MZ-72 @ 0.2% with nutrients and gave the maximum height of umbel stalk, number of onion seed stalk^{-1}, number of umbel plot^{-1}, umbel diameter, 1000 seed weight and seed yield. The highest onion seed yield 650 kg ha^{-1} was recorded from the application of Rovral 50 WP @ 0.2% combination with nutrients followed by 590 kg ha^{-1} from Ridomil Gold MZ-72 @ 0.2% adding with nutrients. Neem leaf extract gave the better performance than Allamanda leaf extract in reducing the disease incidence, severity and increasing seed yield and improving yield contributing characters of onion. The most effective fungicide was Rovral 50 WP followed by Ridomil Gold MZ-72 and Dithane M-45 gave 61.11, 48.15 and 42.65% reduction in disease severity and 58.64, 43.90 and 39.83% increase in seed yield, respectively. At least eight sprays with seven days interval are required to achieve satisfactory results.

Keywords: *Allium cepa*, chemicals, onion bulb, plant extract

INTRODUCTION

Onion (*Allium cepa* L.) is an important and widely used spice in Bangladesh as well as all over the world. The annual yield is only 6.644 t ha^{-1} in Bangladesh (BBS, 2006) which is quite low compared to other onion growing countries of the world. Onion suffers from several diseases (Meah and Khan, 1987; Ahmed and Hossain, 1985). Among them purple blotch of onion caused by *Alternaria porri* (Ellis) Cif. is one of the major constraints for low yield (Ahmed and Hossain, 1985; Meah and Khan, 1987; Castellanes *et al.*, 1988). The disease is considered as a serious problem for seed production in tropical countries like Bangladesh (Rahman *et al.*, 1988; Anonymous, 1985). Seed production is severely affected because the disease causes breaking of floral stalks (Munoz *et al.*, 1984). Damage of foliage and breaking of floral stalks due to purple blotch resulting failure of seed production of onion are common (Munoz *et al.*, 1984; Ashrafuzzaman and Ahmed, 1976). Yield loss of onion due to purple blotch was estimated 41–44% in Bangladesh (Hossain and Islam, 1993). Bangladeshi cultivars Faridpuri and Taherpuri are susceptible to the disease (Rahman *et al.*, 1988).

Some researchs have been carried out to find a suitable control measures for onion, through cultivation of resistant variety, manipulation of the date of planting, management of fertilizers, bulb size, protective spray of fungicides, etc. (Srivastava *et al.*, 1991; Mishra, 1989; Gupta and Pathak, 1988; Martinez *et al.*, 1987). However, research on successful production of onion seed are scanty in Bangladesh using fertilizers, time of planting and protective spraying of fungicides (Rahim and Siddique, 1991; Rahman *et al.*, 1988; Bakshi *et al.*, 1989). Plant extracts is a useful with eco-friendly tools which has antifungal activities against plant pathogens and drawn special attention to the researchers in order to minimize the yield losses of many crops (Ahmed,

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2007; Fakir, 1999; Hossain *et al.*, 1997; Suratuzzaman, 1995; Miah *et al.*, 1990). In view of the above facts, a study was under taken to test the efficacy of fungicides, botanicals and nutrients to reduce the disease incidence, severity and in improving seed yield and yield contributing characters of onion seed crop.

MATERIALS AND METHOD

The experiment was conducted at the farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, during the winter cropping season of 2007–2008 and was laid out in RCBD comprising three replications. Taherpuri, a local variety was used in this study. Fertilizer application was done @ TSP 415 kg ha^{-1} and MOP 168 kg ha^{-1} before planting while Urea 320 kg ha^{-1} was applied in four installments (BARC, 1997). The whole quantity of nutrients viz. Gypsum, ZnO and Boric acid powder were applied during final plot preparation @ 100 kg ha^{-1}, 5 kg ha^{-1} and 5 kg ha^{-1}, respectively except control plot. Before planting, onion bulbs were treated with different plant extracts and fungicides and allowed them 20 minutes by dipping method. Bulbs were treated with plain water and used as control. The bulbs were then drained off, shade dried and sown in the field immediately on 1st November, 2007 maintaining row spacing 30 cm and bulb spacing 15 cm in each plot as per experimental treatments. Subsequent weeding, mulching and irrigation were done as and when necessary. There were altogether nine treatments namely, (1) Allamanda leaf extract-1:6 (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (2) Neem leaf extract-1:6 (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (3) Cupravit 50 WP @ 0.7% (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (4) Rovral 50 WP @ 0.2% (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (5) Dithane M-45 @ 0.45% (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (6) Ridomil Gold MZ-72 @ 0.2% (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (7) Bavistin 50 WP @ 0.1% (Bulb treatment + Foliar spraying) + nutrients (applied as basal dose), (8) only nutrients (applied as basal dose) and (9) untreated control (bulb treated and foliar spraying with plain water and no micronutrient). The suspension of Allamanda leaf extract (w/v-1:6), Neem leaf extract (w/v-1:6), Cupravit 50 WP @ 0.7%, Rovral 50 WP @ 0.2%, Dithane M-45 @ 0.45%, Ridomil Gold MZ-72 @ 0.2% and Bavistin 50 WP @ 0.1% were prepared in tap water for spraying in the field. Spraying of botanicals and fungicides were started from 34 days after bulb planting. In total eight spraying were done at seven days intervals with a hand sprayer. One liter of suspension of each plant extract and fungicide were used to spray the plants under each treatment. To avoid the drifting of the fungicides during application, temporary fencing was made with polyethylene sheet surrounding the unit plot. A control was maintained in each block where spraying was done with plain water only.

In each replication, one plot was kept as control where plain water was sprayed. Eight sprays were done at seven days interval starting from the first appearance of the disease in the field with a hand sprayer. The disease first appeared 34 days after planting of onion bulb. For assessment of disease severity ten stalks were taken from each unit plot under each treatment and were rated '0–5' disease scoring scale (Sharma, 1986) for estimation of PDI (Leaf & Stalk), where 0 = No disease symptoms, 1 = A few spots towards the tip, covering less than 10% leaf/stalk area, 2 = Several dark purplish brown patches covering 10% to less than 20% leaf/stalk area, 3 = Several patches with paler outer zone, covering 20 to 40% leaf/stalk area, 4 = Long streaks covering 40 to 75% leaf/stalk area or breaking of leaf/stalk and 5 = complete blotching of leaf/stalk.

The percent disease index (% PDI) was calculated using the following formula:

$$\text{PDI (leaf/stal k)} = \frac{\text{Total sum of numerical ratings}}{\text{No. of observatio n} \times \text{Maximum disease rating in the scale}} \times 100$$

Before and after harvest, data on seed yield and yield contributing characters (height of onion seed stalk, number of onion seed stalk $hill^{-1}$, number of umbel $plot^{-1}$, umbel diameter and thousand seed weight were recorded. The data were analyzed statistically by using MSTAT-C computer package program and means

were compared with Duncan's Multiple Range Test (DMRT) when F values indicated significant differences at 5% level of probability.

RESULTS AND DISCUSSION

Treatment of seed bulbs and foliar spray with two botanicals and five fungicides, and application of nutrients as basal dose reduced severity of purple blotch of onion significantly ($p<0.05$) over control. The highest reduction was achieved with Rovral 50 WP followed by Ridomil Gold MZ-75 WP and Dithane M-45. Efficacy of three fungicides was significantly different. Efficacy of Dithane M-45, Cupravit, Bavistin 50 WP and Neem leaf extract was statistically similar but significantly higher as compared to Allamanda leaf extract and micronutrient treatments. The least effective materials were micronutrient followed by Allamanda but their efficacy was different ($p<0.05$) (Table 1).

Height of flower stalk ranged 51.76–65.63 cm under different treatments including control. The maximum height was found under the treatments with Rovral 50 WP. The shortest stalk was recorded under control where water treated bulbs were planted; plants were sprayed with only plain water and did not receive any nutrients (B, S and Zn), which was statistically similar to the treatments with two plant extracts, nutrients and Cupravit. Significant increase in the parameter over control was obtained with, in order of efficacy, Rovral, Ridomil Gold, Dithane M-45 and Bavistin (Table 2).

Significant increase in number of flower stalks per hill as well as production of umbels per plot were obtained with all treatments with plant extract and fungicides compared to control and treatment with only micronutrient. Minimum of 0.98 flower stalk per hill and 65.33 umbels per plot were recorded from control plot, which were statistically similar to the same parameters under the treatment with only micronutrient. The highest number of 1.54 stalks per hill and 102.0 umbels per plot was obtained with Rovral, which was statistically similar to Ridomil Gold. The efficacy of two treatments were higher ($p<0.05$) compared to other treatments (Table 1).

Umbel diameter and 1000-seed weight ranges 5.33–6.28 cm and 2.95–3.50 g, respectively. The lower size of umbel and seed were observed under control, which was statistically similar to the treatment with only nutrients. All treatments with plant extracts and fungicides gave higher ($p<0.05$) umbel size and seed size compared to control. The highest increase was obtained with Rovral followed by Ridomil Gold, and Dithane M-45. The least effective fungicide Cupravit followed by Bavistin.

Table 1. Effect of fungicides, botanicals and nutrients on purple blotch disease severity, stalk height and production of flower stalk and umbel of onion

Treatments	Percent Disease Index (PDI)	Reduction in PDI	Height of flower stalk (cm)	Flower stalk per hill	Umbel per plot
Allamanda leaf extract-1:6 (w/v)	54.00 c	25.00	55.71 bcd	1.15 d	76.00 d
Neem leaf extract-1:6 (w/v)	46.00 d	36.11	56.40 bcd	1.19 d	79.00 d
Cupravit 50 WP @ 0.7%	46.00 d	36.11	56.43 bcd	1.28 c	85.00 c
Rovral 50 WP @ 0.2%	28.00 f	61.11	65.63 a	1.54 a	102.00 a
Dithane M-45 @ 0.45%	42.67 d	40.74	59.63 b	1.38 b	91.67 b
Ridomil Gold MZ-72 @ 0.2%	37.33 e	48.15	60.14 b	1.48 a	98.00 a
Bavistin 50 WP @ 0.1%	42.67 d	40.74	56.70 bc	1.31 bc	87.00 bc
Application of B, Zn and S	66.67 b	7.40	54.59 cd	1.06 e	70.00 e
Control[3]	72.00 a	-	51.76 d	0.98 e	65.33 e

Values within the same column with a common letter(s) do not differ significantly (p=0.05)

All treatments with five fungicides and two plant extracts gave significant increase in seed yield over control. However, efficacy of plant extract was lower than that of fungicides. The seed yield was 410.0 kg ha^{-1} under control, which was statistically similar to the treatment with only nutrients. The highest seed

yield 650 kg ha^{-1} was achieved by applying Rovral followed by 590 and 573.3 kg ha^{-1} from Ridomil Gold and Dithane M-45, respectively (Table 2).

Table 2. Effect of fungicides, botanicals and nutrients on yield and yield contributing parameters of onion as affected by purple blotch disease

Treatments	Umbel diameter (cm)	1000-seed weight (g/plant)	Seed yield (kg ha^{-1})	% Increase of seed yield
Allamanda leaf extract-1:6 (w/v)	5.44 de	3.05 ef	470.00 e	14.63
Neem leaf extract-1:6 (w/v)	5.54 d	3.10 de	480.00 e	17.07
Cupravit 50 WP @ 0.7%	5.69 c	3.15 c-e	520.00 d	26.83
Rovral 50 WP @ 0.2%	6.28 a	3.50 a	650.00 a	58.54
Dithane M-45 @ 0.45%	5.97 b	3.27 bc	573.30 b	39.83
Ridomil Gold MZ-72 @ 0.2%	6.03 b	3.32 b	590.00 b	43.90
Bavistin 50 WP @ 0.1%	5.72 c	3.18 cd	540.00 c	31.71
Application of B, Zn and S	5.37 e	2.96 f	419.30 f	2.20
Control	5.33 e	2.95 f	410.00 f	-

Values within the same column with a common letter(s) do not differ significantly (p=0.05)

The findings of the study demonstrated that the treatment with nutrients (B, S and Zn) reduced severity of purple blotch to some extend but the treatment did not influence the seed yield and yield attributes appreciably compared to control. Treatment of seed bulbs and foliar spray with five fungicides and two plant extract effectively reduced severity of purple blotch of onion seed crop. However, effectiveness of plant extracts was lower than fungicides. Among the fungicides Rovral 50 WP @ 0.2% was most effective to reduce disease severity and to increase seed yield and yield attribute followed by Ridomil Gold MZ-75 WP @ 0.2%, Dithane M-45 @ 0.45%, and Bavistin 50 WP @ 0.1%. The similar results could be observed in previous studies while used chemicals as well as plant extracts (Meah *et al.* 1990; Srivastava *et al.*, 1991; Hossain *et al.*, 1997; Fakir, 1999; Ahmed, 2007).

Barnoczki *et al.* (1989) conducted a field experiment spraying with fungicides at different blooming stages of onion flowers and reported that Rovral 50 WP and Ridomil plus 50 WP (Methyl + Copper oxychloride) are effective in controlling purple blotch disease of onion seed crop. Georgy *et al.* (1983) also reported that the iprodione group and Ridomil MZ proved most effective in reducing the disease severity and increasing bulb and seed yield of onion.

Between the two botanicals, Neem leaf extract (1:6 w/v) gave the better result compared to Allamanda leaf extract (1:6 w/v) for reducing severity of purple blotch and increasing seed production of onion. The present findings were well supported by Prasad and Barnwal (2004). They reported that bulb yields were the highest in plots sprayed with 20% leaf extract of *Datura metel* L. (177.8 and 173.3 q ha^{-1}), followed by spray of 2.0% *A. indica* (Neem) leaf extract.

The present investigation gave the promising effect of fungicides on reduction in severity of purple blotch of onion and promoting seed yield and yield contributing characters of the crop. The most effective fungicides were Rovral 50 WP and Ridomil Gold @ 0.2%.

Rovral 50 WP from the iprodione group was promising fungicidal effectiveness in reducing the disease severity of purple blotch of onion and in promoting yield contributing characters and increasing onion seed production while spraying @ 0.2% at 7 days interval. Neem leaf extract (1:6 w/v) in combination with nutrients and Allamanda leaf extract (1:6 w/v) adding with nutrients (B, S and Zn) significantly reduced the severity of purple blotch and increased seed yield of onion over control. At least eight sprays with seven days interval are required to achieve satisfactory results.

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