

# EFFECT OF FUNGICIDES IN CONTROLLING ALTERNARIA LEAF AND UMBEL BLIGHT OF FENNEL

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## ABSTRACT

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Seven fungicides viz. Rovral 50 WP (Iprodion) @0.2%, Companion (Carbendazim + Mancozeb) @0.2%, Nativo (Tebuconazole + Trifloxystobin 100) @0.1%, Secure 600 WG (Fenamidone + Mancozeb) @0.15%, Score (Difenoconazole) @0.1%, Cabriotop (Pyraclostrobin 5% + Metiram 55% WG) @0.3%, and Amistar Top 325 SC (Azoxystrobin + Difenoconazole) were tested at Spices Research Centre, BARI, Shibganj, Bogura, Bangladesh during Rabi season of 2017-18 to find out the effective fungicides in controlling Alternaria leaf and umbel blight of Fennel (BARI Mouri-1). Seed treatment and five times foliar spraying of the fungicides significantly reduced disease incidence up to 75.28%

and thereby increased 82.24% seed yield of Fennel. Alternaria leaf and umbel blight incidence of Fennel was reduced up to 75.28% by Secure 600 WG (0.15%), 69.85% by Amistar Top 325 SC (0.1%) and 71.79% by Rovral 50 WP (0.2%). These fungicides also gave better vegetative growth of Fennel and increased seed yield up to 82.24%, 63.55% and 76.63% by Secure 600 WG, Amistar Top 325 SC, and Rovral 50 WP, respectively. Therefore, Secure 600 WG (0.15%) or Amistar Top 325 SC (0.1%) or Rovral 50 WP (0.2%) may be used to control Alternaria leaf and umbel blight and thereby increased seed yield of Fennel.

Keywords: Secure 600 WG, Amistar Top 325 SC, Rovral 50 WP, Alternaria leaf and umbel blight, Fennel

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## INTRODUCTION

Fennel (*Foeniculum vulgare* Mill.) is one of the most important perennial, pleasant-smelling herb with yellow flowered seed spice crop in the family Apiaceae. It has digestive, stomachic, carminative, stimulant, appetizer properties and is used against diseases like cholera, biliousness, dysentery, diarrhoea, cough, cold, constipation and ailment of chest, lungs and kidney. Fennel is used as masticatory or for chewing alone or with betel leaf. It is also used for flavouring soups and liquors, making pickles, meat dishes, sauces, bread rolls, pastries and confectionary, cordials and liquors. Cool and dry climate is best for the cultivation of fennel crop. Dry and cool weather during seed setting increases seed yield as well as the quality of the produce. Diseases are the major constraints in economic crop production as they inflict substantial losses. Like other crops, fennel is also attacked by many fungal diseases. Among the major diseases of Fennel, Alternaria leaf and umbel blight caused by *Alternaria brassicicola* is most devastating disease of Fennel. Blight appears with very minute brownish necrotic spots on leaves and stems, which later turn to blackish, whereby the stem tips bend

downwards. Most of the diseased plants produce shriveled, light weight, dark coloured seeds and produce no seed in case of severe infection. Cloudy weather with warm-wet conditions at flowering stage increases the incidence and spread of disease in the whole field rapidly causing complete failure of the crop (Jadeja and Pipliya 2008). The disease severity varied from 16-65% causing serious damage to the crop (Kalpana 1993). At least 20% of agricultural spoilage is caused by Alternaria species, most severe losses may reach up to 80% of yield (Anonymous 2020).

The pathogenic fungus attacks both leaves and stems of Fennel, and therefore, foliar spray of fungicides may be beneficial in controlling the disease. No resistant variety of Fennel is available in Bangladesh and it is inevitable to use fungicides for the management of the disease. It was reported that Rovral 50 WP (0.2%) or Companion (0.2%) sprayed seven times at seven days interval from disease initiation (flowering stage) decreased Alternaria blight and increased seed yield of Cumin (Khalequzzaman 2016). Similarly, Iprodione and Anilazine significantly reduced the incidence of *Alternaria* spp.

on surface-sterilized seeds (Babadoost *et al.* 1993). Few other fungicides were reported earlier for the management of the disease (Solanki *et al.* 1973; Akbari *et al.* 1996), but the disease is still causing severe yield losses under favourable environmental conditions. Foliar spraying with Amistar Top 325 SC (0.1%) six times at an interval of eight days from disease initiation (Pre-flowering stage) decreased Alternaria blight and increased seed yield of cumin (Wadud *et al.* 2017). Therefore, the present study was undertaken to find out an effective fungicide in controlling Alternaria leaf and umbel blight and thereby boost up the production of Fennel in Bangladesh.

## MATERIALS AND METHODS

The experiment was conducted at Spices Research Centre, BARI, Shibganj, Bogura, Bangladesh during Rabi season of 2017-18. The experimental plot was prepared with five ploughing and cross ploughing followed by laddering to break the clods as well as level the soil. The weeds and stubbles of previous crops were removed from the soil and the fertilizers viz. cowdung @5 t/ha, N @80 kg/ha, P @35 kg/ha and K @70 kg/ha were applied. The entire quantity of cowdung, P and K was applied during final land preparation. Nitrogen was applied in two equal splits, one half at 20 days after germination and the other half at flowering stage followed by irrigation. The experiment was carried out following Randomized Complete Block Design with three replications. The unit plot was 2.5 m × 1.6 m and plant spacing was 40 cm × 10 cm. BARI Mouri-1 was used in the experiment. Seven fungicides were applied as seed treatment as well as foliar spray and one control were used as treatments. The treatments were T<sub>1</sub>= Rovral 50 WP (Iprodion) @0.2%, T<sub>2</sub>= Companion (Carbendazim + Mancozeb) @0.2%, T<sub>3</sub>= Nativo (Tebuconazole + Trifloxystobin 100) @0.1%, T<sub>4</sub>= Secure 600 WG (Fenamidone + Mancozeb) @0.15%, T<sub>5</sub>= Score (Difenoconazole) @0.1%, T<sub>6</sub>= Cabriotop (Pyraclostrobin 5% + Metiram 55% WG) @0.3%, T<sub>7</sub>= Amistar Top 325 SC (Azoxystrobin + Difenoconazole) @0.1% and T<sub>8</sub>= Control (Untreated). The fungicides were applied as seed treatment followed by five sprays at 7 days interval starting from disease initiation (flowering stage).

Seeds were sown on 20 November, 2017. Weeding was done at 25, 50 and 75 days after emergence and irrigated after five days of each weeding. Other intercultural operations were done to maintain clean cultivation of crop. Autostin (0.2%) was sprayed at plant base at soil level four times at 7 days interval from seedling stage to control wilt of Fennel. The plots were monitored regularly to take

observations on blight disease from seedling to maturity stage of the crop. Disease plant parts were collected and brought in the laboratory to identify blight causal pathogens. The crop was harvested at 25 April, 2018. Data were recorded on the incidence of Alternaria leaf and umbel blight, number of primary and secondary branches per plant, plant height at harvest, number of umbels per plant, number of umbellets per umbel, number of umbellets per plant, number of seeds per umbel, weight of seeds per umbel, number of seeds per plant, weight of seeds per plant and seed yield per plot. The recorded data were analyzed statistically and the means were compared following Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984).

## RESULTS AND DISCUSSION

### Effect of fungicides on Alternaria leaf and umbel blight incidence of Fennel

Alternaria leaf and umbel blight incidence of Fennel under different treatments varied from 15.67 - 63.39%, while the lowest incidence was recorded in seed treatment and foliar spray with Secure 600 WG (0.15%) which was followed by Amistar Top 325 SC (0.1%) and Rovral 50 WP (0.2%), and the highest incidence was obtained from control (water) plot (Table 1). Seed treatment and foliar spray with Secure 600 WG (0.15%) gave the highest (75.28%) disease reduction over control where Nativo (0.1%) gave the lowest (54.96%) disease reduction over control.

Table 1. Effect of fungicides on Alternaria leaf and umbel blight incidence of Fennel

Treatments	Alternaria leaf and umbel blight (%)	Disease reduction over control (%)
Rovral 50 WP (0.2%)	17.88 f (24.13)	71.79
Companion (0.2%)	26.47 c (29.87)	58.24
Nativo (0.1%)	28.55 b (31.16)	54.96
Secure 600 WG (0.15%)	15.67 g (22.49)	75.28
Score (0.1%)	24.00 d (28.30)	62.13
Cabriotop (0.3%)	21.33 e (26.54)	66.35
Amistar Top 325 SC (0.1%)	19.11 f (25.01)	69.85
Control (water)	63.39 a (50.90)	-
CV (%)	9.28	-

The values with similar letter(s) did not differ significantly at 1% level of probability.

### Effect of fungicides on growth parameters of Fennel

The number of primary as well as secondary braches of Fennel did not differ statistically with seed treatment and foliar spray of fungicides. But the treatment and foliar spray showed significant effect on plant height giving highest plant height (134.33 cm) by Secure 600 WG (0.15%) followed by Amistar Top 325 SC (0.1%) and Rovral 50 WP (0.2%), and the lowest plant height (110.44 cm) was recorded in control plots (Table 2).

### Effect of fungicides on yield attributes of Fennel

The number of umbels per plant, number of umbellets per umbel and number of umbellets per plant of Fennel were significantly influenced by the treatments of fungicides (Table 3). The highest number of umbels per plant (40.06), number of umbellets per umbel (30.49) and number of umbellets per plant (543.24) were obtained from seed treatment and foliar spraying with Secure 600 WG (0.15%) which was followed by Rovral 50 WP (0.2%) and Amistar Top 325 SC

Data in parenthesis indicate angular or arcsign transformation.

(0.1%), and the lowest corresponding values were recorded in control plots.

### Effect of fungicides on seed yield of Fennel

Seed yield and yield contributing characters of Fennel were significantly affected by the fungicides (Table 4). Seed treatment and foliar spraying with Secure 600 WG (0.15%) gave the highest number of seeds per umbel (554.39) and weight of seeds per umbel (3.52 g) which were followed by ROVRAL 50 WP (0.2%) and AMISTAR Top 325 SC (0.1%), and the lowest yield was recorded in Control plots. The highest number of seeds per plant (3950), weight of seeds per plant (17.12 g) and seed yield (1.95 t/ha) were observed in seed treatment and foliar spraying with Secure 600 WG (0.15%) followed by Rovral 50 WP (0.2%) and Amistar Top 325 SC (0.1%). Seed treatment and foliar spray with Secure 600 WG (0.15%) resulted the highest yield increase (82.24%) and Nativo (0.1%) resulted the lowest yield increase (28.97%) over control.

Table 2. Effect of fungicides on growth parameters of Fennel

Fungicides	No. of primary branches/Plant	No. of secondary branches/Plant	Plant height (cm) at harvest
Rovral 50 WP (0.2%)	2.40	10.73	131.41 b
Companion (0.2%)	2.41	9.38	123.44 e
Nativo (0.1%)	2.22	9.52	121.81 e
Secure 600 WG (0.15%)	2.45	11.23	134.33 a
Score (0.1%)	2.19	9.12	125.62 d
Cabriotop (0.3%)	2.35	10.25	127.48 cd
Amistar Top 325 SC (0.1%)	2.33	10.57	129.06 c
Control (Untreated)	2.10	10	110.44 f
CV (%)	NS	NS	6.53

The values with similar letter(s) did not differ significantly at 1% level of probability.  
NS=Not Significant

Table 3. Effect of fungicides on yield attributes of Fennel

Fungicides	No. of umbels/plant	No. of umbel lets/umbel	No. of umbellets/plant
T <sub>1</sub> = Rovral 50 WP (0.2%)	38.15 ab	28.11 b	533.71 a
T <sub>2</sub> = Companion (0.2%)	30.37 de	22.87 de	481.45 d
T <sub>3</sub> = Nativo (0.1%)	29.11 e	21.11 ef	446.86 e
T <sub>4</sub> = 600 WG (0.15%)	40.06 a	30.49 a	543.24 a
T <sub>5</sub> = Score (0.1%)	32.00 d	24.38 cd	495.10 c
T <sub>6</sub> = Cabriotop (0.3%)	34.52 c	26.00 bc	508.31 b
T <sub>7</sub> = Amistar Top 325 SC (0.1%)	36.11 bc	27.30 b	512.60 b

T <sub>8</sub> = Control (Untreated)	25.55 f	19.55 f	391.13 f
CV (%)	6.81	8.32	6.93

The values with similar letter(s) did not differ significantly at 1% level of probability.

Table 4. Effect of fungicides on seed yield of Fennel

Treatments	No. of seeds/ umbel	Wt. of seeds (g)/ umbel	No. of seeds/ plant	Wt. of seeds/ plant (g)	Seed yield (t/ha)	Yield increase (%) over control
Rovral 50 WP (0.2%)	539.55 b	3.40 ab	3704 b	16.18 ab	1.89 a	76.63
Companion (0.2%)	465.34 f	2.45 de	3212 f	13.75 cd	1.45 d	35.51
Nativo (0.1%)	450.78 g	2.30 e	3095 g	13.11 d	1.38 d	28.97
Secure 600 WG (0.15%)	554.39 a	3.52 a	3950 a	17.12 a	1.95 a	82.24
Score (0.1%)	480.74 e	2.54 d	3366 e	14.05 cd	1.59 c	48.59
Cabriotop (0.3%)	495.57 d	2.95 c	3458 d	14.99 bc	1.68 bc	57.00
Amistar Top 325 SC (0.1%)	517.88 c	3.28 b	3612 c	15.75 b	1.75 b	63.55
Control (Untreated)	395.11 h	1.97 f	2525 h	10.33 e	1.07 e	-
CV (%)	8.42	6.91	6.09	7.37	6.98	-

The values with similar letter(s) did not differ significantly at 1% level of probability.

It has been revealed that *Alternaria* leaf and umbel blight incidence of Fennel under different treatments varied from 15.67-63.39%, while the lowest incidence was recorded in seed treatment and foliar spraying with Secure 600 WG (0.15%) treated plots which was followed by Amistar Top 325 SC (0.1%) and Rovral 50 WP (0.2%), and the highest incidence was obtained from control (untreated) plot. Khalequzzaman (2016) found that seed treatment and foliar spraying with Rovral 50 WP (0.2%) or Companion (0.2%) or Amistar Top 325 SC (0.1%) seven times at an interval of seven days from disease initiation (flowering stage) decreased *Alternaria* blight of Cumin. Babadoost *et al.* (1993) observed that Iprodione and Anilazine significantly reduced the incidence of *Alternaria* spp. on surface-sterilized seeds. Survilience and Dambrauskiene (2006) used Amistar 250 EC against *Alternaria* spp. *in-vitro* and found that the fungicide inhibited the growth of *Alternaria* spp. Islam *et al.* (2007) stated that Rovral 50 WP and Dithane M-45 were most effective in reducing the seed borne infection of *Alternaria* spp. and increasing seed germination of Radish. Humpherson-Jones and Maude (1982) sprayed three times with Iprodione (Rovral 50% w. p.) at 0.5-1 kg a. i./ha to *Brassica oleracea* seed crops at 3 weeks

intervals sharply controlled pod infection caused by *A. brassicicola* and increased seed yields. Arifuzzaman *et al.* (2007) tested fungicides against *Alternaria* blight of radish, among the fungicides, Iprodione (0.2%) was found to be the most effective. Two sprays of Iprodione significantly reduced the leaf area diseased by 76.01% and pod area diseased by 81.87% over control. Wadud *et al.* (2017) observed that foliar spraying with Amistar Top 325 SC (0.1%) six times at an interval of eight days from disease initiation (Pre-flowering stage) decreased *Alternaria* blight of cumin. Babadoost *et al.* (1993) evaluated Iprodione, Anilazine and Chlorothalonil for their potential to control *Alternaria* diseases of brassica seed crops in field trials. Sundar *et al.* (2005) observed that Mancozeb and Iprodione had effectively reduced *Alternaria* leaf blight disease caused by *Alternaria brassicae* in mustard in the sprayed plots. Seed treatment and foliar spraying with Secure 600 WG (0.15%) treated plot gave the highest disease reduction over control where Nativo (0.1%) gave the lowest disease reduction over control.

Significantly the highest plant height of Fennel was found in seed treatment and foliar spraying with Secure 600 WG (0.15%) followed by Amistar Top 325

SC (0.1%) and Rovral 50 WP (0.2%). Similar result was also reported by Khalequzzaman (2016) with Secure (0.15%), Rovral 50 WP (0.2%) and Companion (0.2%) in Cumin. Wadud *et al.* (2017) found that significantly the tallest plants at harvest were recorded in Amistar Top (0.1%) sprayed plots, which was statistically similar to Cabriotop treated plots in Cumin.

Better vegetative and yield attributing traits were obtained from seed treatment and foliar spraying with Secure 600 WG (0.15%) which was followed by Rovral 50 WP (0.2%) and Amistar Top 325 SC (0.1%) and the findings were in agreement with Khalequzzaman (2016) and (Wadud *et al.* 2017).

Wadud *et al.* (2017) also observed that the highest number of seeds/umbel let was recorded in Amistar Top sprayed plots. Khalequzzaman (2016) found that seed treatment and foliar spraying with Rovral 50 WP (0.2%) or Companion (0.2%) or

Amistar Top 325 SC (0.1%) seven times at an interval of seven days from disease initiation (flowering stage) increased seed yield of Cumin.

Seed treatment and foliar spraying with Secure 600 WG (0.15%) gave the highest seed yield followed by Rovral 50 WP (0.2%) and Amistar Top 325 SC (0.1%), which was agreed with Hossain and Hossain (2010). Sundar *et al.* (2005) observed that Mancozeb and Iprodione increased seed yield by 48 and 130% of mustard in the sprayed plots, respectively.

## CONCLUSION

Seed treatment and five times foliar spraying with Secure 600 WG (0.15%) or Rovral 50 WP (0.2%) or Amistar Top 325 SC (0.1%) at an interval of 7 days from flowering stage significantly decreased *Alternaria* leaf and umbel blight and increased seed yield of Fennel.

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