

Research Article

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Effect of Fungicides in Controlling Wilt Disease of Cumin

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ABSTRACT

The experiment was conducted at Spices Research Centre, BARI, Shibganj, Bogra, Bangladesh during 2014-15 to find out the effective fungicides in controlling wilt disease of cumin. The treatments were five fungicides viz. Sunvit 50 WP @0.5%, Secure @0.02%, Rovral 50 WP @0.2%, Bavistin DF @0.25%, Provax 200 WP (0.25%) and one control (untreated). Cumin line CN 026 was used in the experiment. Wilt incidence ranged from 13.45 - 37.69%, while the lowest incidence was recorded in Bavistin treated plots which was statistically similar to Provax and Sunvit, and the highest incidence was recorded in control. Bavistin (0.25%) gave the highest number of umbels/plant, number of umbel lets/plant, number of seeds/umbel, number of seeds/plant, weight of seeds/plant and seed yield (586.5 kg/ha) which was followed by Provax and Sunvit, and the lowest of these parameters were obtained from control treatment.

Key words: Fungicides, Wilt Disease, Cumin

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INTRODUCTION

Cumin or Jeera (*Cuminum cyminum* L.) is an important seed spice crop. It belongs to the family Umbellifereae and is believed to be a native of the Mediterranean and Near Eastern regions. It is mainly cultivated in India, Egypt, Libya, Iran, Pakistan and Mexico. In India, cumin is mainly cultivated in the states of Rajasthan, Gujarat, Madhya Pradesh, Haryana, Punjab, Uttar Pradesh and Bihar. Cumin is the dried yellowish to grayish brown seeds of a small slender annual herb. Cumin seeds have an aromatic odour and a spicy and somewhat bitter taste. These are largely used as condiment and form an essential ingredient in all mixed spices and curry powders for flavoring soups, pickles, curries, and for seasoning breads, cakes and so on. Aqueous extract of cumin seed is frequently used for removing intestinal worms. The seeds have been considered as stimulant, carminative, stomachic, astringent and useful in diarrhoea and dyspepsia. The essential oil is similarly used for flavoring various food items and as a basic perfume. The oil cake is a good cattle fodder.

But cumin cultivation is not being adapted in Bangladesh. The principal constraints to achieve high productivity are high yielding varieties, improper nutrient management, climatic factors and susceptibility of cumin to devastating diseases viz., Fusarium wilt, Alternaria blight and powdery mildew etc., which are the major yield reducing factors. Cumin is seriously affected by the Fusarium wilt caused by *F. oxysporum* f.sp. *cumini* is a destructive disease of this crop and results in yield losses of up to 80% (Divakara Sastry and Anandaraj 2013). Fusarium wilt disease usually increases in warm areas and under dried conditions. The fungi can attack the crop during any time from seedling to maturity stage and are comparatively more destructive at the seedling stage. Infected plants show peculiar symptoms of dropping leaves, yellowing, damage vascular tissue and leading to mortality of the entire plant. This disease has been reported as a problem limiting cumin production worldwide including Argentina (Gaetan and Madia, 1993), Greece (Pappas and Elena, 1997) and India (Champawat and Pathak, 1990). The pathogenic fungi are soil-borne in nature; hence, seed treatment and spraying at soil level of plants with fungicides may be beneficial in controlling the disease. Wilt of chickpea caused by *Fusarium oxysporum* f. sp. *dianthi* was effectively managed by the combined use of Carbendazim and *T. harzianum*, when the bioagent was applied 14 to 16 days before transplanting along with the dipping of cuttings in Carbendazim (Pratibha Sharma 2000). Aimcozim 50 WP (Carbendazim) at lowest concentration inhibited the fungal growth successfully in *in vitro* condition and Vitavax 200 was also one of the effective fungicides in

inhibiting the radial growth of *Fusarium oxysporum* f. sp. *phaseoli* (Siddique *et al.*, 2014). Considering the above facts, these types of research work are not available in Bangladesh. So, the present study was undertaken to find out the effective fungicides in controlling wilt disease of cumin through seed treatment and soil drenching.

MATERIALS AND METHODS

The experiment was conducted at Spices Research Centre, BARI, Shibganj, Bogra, Bangladesh during Rabi season of 2014-15 to find out the effective fungicides in controlling wilt disease of cumin through seed treatment and soil drenching. The experimental plot was prepared with five ploughings and cross ploughings followed by laddering to break the clods as well as level the soil. The weeds and stubbles of previous crops were collected and removed from the soil. Cowdung 5 t/ha, N @ 70 kg/ha, P @ 25 kg/ha and K @ 50 kg/ha were applied. The entire quantity of cowdung, P and K were applied during final land preparation. Nitrogen was applied in two equal splits one 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. Size of the unit plots was 3.0 m × 1.2 m and plant spacing was 30 cm × continuous sowing. Cumin line CN 026 was used in the experiment. Five seed treating fungicides and one control were used as treatment. The treatments were T₁=Sunvit 50 WP (Copper Oxichloride) @0.5%, T₂=Secure 600 W (Phenamidone + Mancozeb) @0.2%, T₃=Rovral 50 WP (Iprodion) @0.2%, T₄=Bavistin DF (Carbendazim) @0.25%, T₅=Provax 200 WP (Carboxin + Thiram) @0.25% and T₆=Control (untreated). Seeds were treated before sowing as per treatment and soil drenching with the fungicides five times at an interval of 10 days from seedling to flowering stage. Treated seeds were sown on November 18, 2014. Five weedings were done at 15, 30, 45, 60 and 75 days after emergence and five light irrigations were also applied just after five days of each weeding. Other intercultural operations were done to maintain the normal hygienic condition of crop in the field. Rovral 50 WP (0.2%) was sprayed five times at an interval of 10 days to control Alternaria blight of cumin. The plots were inspected regularly to take observations on wilt disease from seedling to maturity stage of the crop. Dead plants were counted and removed from the field. Disease plant parts were collected in laboratory for identifying wilt causal pathogens. The crop was harvested from March 25-30, 2015. Data were recorded on wilt incidence, plant survival, number of primary branches/plant, plant height at harvest, number of umbels/plant, number of umbel lets/plant, number of seeds/umbel, number of seeds/plant, weight of seeds/plant and seed yield (kg/ha). The incidence of wilt of cumin was recorded at every alternate day. The incidence of wilt disease of cumin was calculated by the following formula:

$$\text{Incidence of wilt (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Percentage data were converted into angular or arcsign transformation. The recorded all data were analyzed statistically to find out the level of significance and the variations among the respective data were compared following Duncan's New Multiple Range Test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of fungicides on wilt disease of cumin

Results on effect of fungicides on wilt disease of cumin are presented in Table 1. Wilt incidence was significantly influenced by the treatments. Wilt incidence ranged from 13.45 - 37.69%, while the lowest incidence was recorded in Bavistin treated plots (Plate 1) which was statistically similar to Provax (17.10%) (Plate 2) and Sunvit (19.92%), and the highest incidence was recorded in control treatment (Plate 3) which was followed by Secure (25.85%) and Rovral (30.43%). The highest plant survival (86.55%) and disease reduction over control (64.31%) was obtained from Bavistin treated plots, and the lowest were obtained from untreated control plots (62.31%) and Rovral 50 WP (19.26%), respectively.

Table 1: Effect of fungicides on wilt disease of cumin

Fungicides	Wilt (%)	Plant survival (%)	% Disease reduction over control
Sunvit 50 WP (0.5%)	19.92 bc (26.44)	80.08	47.17
Secure 600 WP (0.2%)	25.85 b (30.53)	74.15	31.41
Rovral 50 WP (0.2%)	30.43 a (33.43)	69.57	19.26
Bavistin DF (0.25%)	13.45 c (21.45)	86.55	64.31
Provax 200 WP (0.25%)	17.10 bc (24.38)	82.90	54.62
Control	37.69 a (39.94)	62.31	-
Level of significance	*	-	-
CV (%)	8.32	-	-

In a column, similar letter(s) do not differ significantly at 5% (*) level of provability. Data represent in parentheses of Angular or Arcsign transformation.



Plate 1: Bavistin treated plot



Plate 2: Provax treated plot



Plate 3: Control plot

Effect of fungicides on growth characters of cumin

Results on effect of fungicides on growth characters of cumin are presented in Table 2. Fungicides did not show any statistical effect on number of primary branches/plant and plant height at harvest. Primary branches of cumin were more or less same (4.30-5.00) among the treatments. The tallest plants (48.30 cm) at harvest were recorded in Provax treated plots and the smallest (43.20 cm) plants were recorded in Bavistin treated plots.

Table 2: Effect of fungicides on growth characters of cumin

Fungicides	No. of primary branches/plant	Plant height at harvest (cm)
Sunvit 50 WP (0.5%)	4.80	46.60
Secure 600 WP (0.2%)	4.37	46.10
Rovral 50 WP (0.2%)	4.40	46.90
Bavistin DF (0.25%)	5.00	43.20
Provax 200 WP (0.25%)	4.30	48.30
Control	4.30	45.20
Level of significance	NS	NS
CV (%)	9.66	5.23

NS=Not Significant

Effect of fungicides on yield contributing characters of cumin

Number of umbels/plant, number of umbel lets/plant, number of seeds/umbel, number of seeds/plant and weight of seeds/plant were significantly influenced by the fungicides (Table 3). The highest number of umbels/plant (57.49) was obtained from Bavistin treated plot which was statistically at par with Provax treated plots (52.00) and the lowest number (34.23) was obtained from control treatment. Bavistin resulted the highest number of umbel lets/plant (183.49) which was followed by Provax (177.78) treated plots. Number of seeds/umbel varied from 19.84 - 30.20, where the highest was recorded in Bavistin and the lowest was recorded in control treatment. Bavistin treated plots showed the highest number of seeds/plant (373.58) and weight of seeds/plant (1.93 g) which was followed by Provax and Sunvit, and control treatment showed the lowest number and weight of seeds/plant with 201.53 and 0.95 g, respectively.

Table 3: Effect of fungicides on yield contributing characters of cumin

Fungicides	No. of umbels/ plant	No. of umbel lets/plant	No. of seeds/ umbel	No. of seeds/ plant	Wt. of seed/ Plant (g)
Sunvit 50 WP (0.5%)	46.73 bc	144.53 b	25.87 abc	304.99 c	1.42 b
Secure 600 WP (0.2%)	42.83 c	135.95 bc	23.67 bcd	290.26 c	1.33 bc
Rovral 50 WP (0.2%)	38.85 cd	128.55 bc	21.11 cd	240.24 d	1.21 c
Bavistin DF (0.25%)	57.49 a	183.49 a	30.20 a	373.58 a	1.93 a
Provax 200 WP (0.25%)	52.00 ab	177.78 a	27.87 ab	346.34 b	1.85 a
Control	34.23 d	111.97 c	19.84 d	201.53 e	0.95 d
Level of significance	*	*	*	*	*
CV (%)	6.75	7.50	7.82	5.08	5.38

In a column, similar letter(s) do not differ significantly at 5% (*) level of provability.

Effect of fungicides on seed yield of cumin

Results on effect of fungicides on seed yield of cumin are presented in Fig. 1. Significantly the highest seed yield (586.5 kg/ha) was recorded in Bavistin treated plots which was followed by Provax (541.7 kg/ha) and Sunvit (525.0 kg/ha) treated plots, and the lowest yield (390.5 kg/ha) was obtained from control plots which was followed by Rovral (486.1 kg/ha).

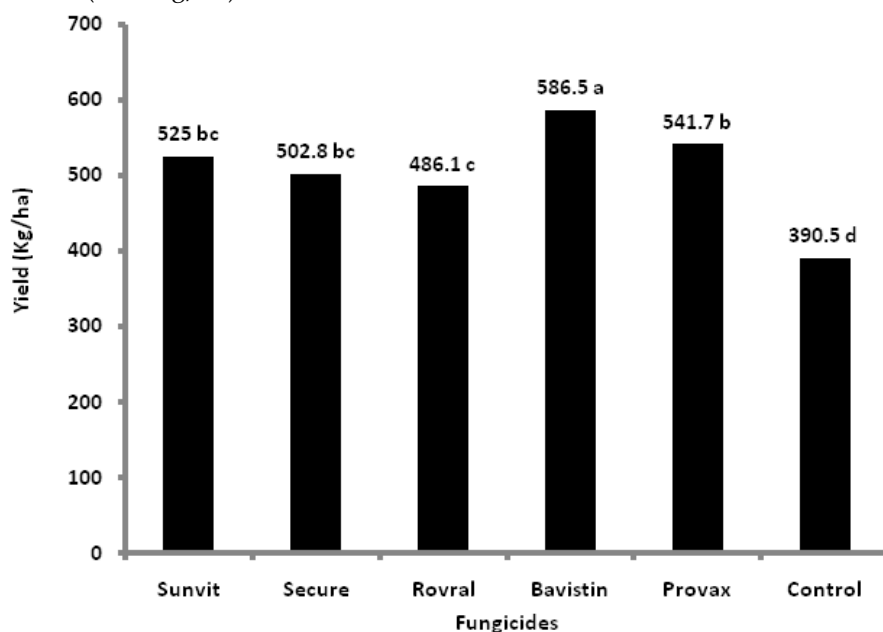


Fig. 1: Effect of fungicides on seed yield of cumin

From the above study, it has been revealed that wilt incidence was significantly influenced by the treatments, while the lowest incidence was recorded in Bavistin treated plots which was statistically similar to Provax and Sunvit, and the highest incidence was recorded in control treatment which was followed by Secure and Rovral. The highest plant survival and disease reduction over control was obtained from Bavistin treated plots, and the lowest were obtained from untreated control plots and Rovral 50 WP, respectively. Pratibha Sharma (2000) found that carnation wilt of chickpea caused by *Fusarium oxysporum* f. sp. *dianthi* was effectively managed by the combined use of Carbendazim and *T. harzianum*, when the bioagent was applied 14 to 16 days before transplanting along with the dipping of cuttings in Carbendazim. Siddique *et al.* (2014) found that Aimcozim 50 WP (Carbendazim) at lowest concentration inhibited the fungal growth successfully in *in vitro* condition and Vitavax 200 was also one of the effective fungicides in inhibiting the radial growth of *Fusarium oxysporum* f. sp. *phaseoli*. Trimethyl thiuram disulphide (0.1 g g⁻¹ seeds) was the best fungicide which was on par with Propiconazole, Carbendazim and Copper oxychloride (0.1 g g⁻¹ seeds) for the control of wilt. The yield was significantly higher in all treatments as compared to control. The highest cost : benefit ratio was obtained (1:40) in Thiophanatemethyl treatment followed by Carbendazim. Hoque *et al.* (2014) carried out an experiment to test the efficacy of four fungicides in controlling foot and root rot of lentil under field condition. The test fungicides were Rovral (0.2%), Secure 600 WG (0.2%), Bavistin 70 WP (0.2%), Captan 50 WP (0.2%). They found that tested fungicides significantly decreased incidence of foot and root rot of lentil. Among the fungicides highest performance was found with Secure 600 WG (0.2%) in controlling the incidence of foot and root rot.

Fungicides did not show any statistical effect on number of primary branches/plant and plant height at harvest. Primary branches of cumin were more or less same among the treatments. The tallest plants at harvest were recorded in Provax treated plots and the smallest plants were recorded in Bavistin treated plots. The highest number of umbels/plant was obtained from Bavistin treated plot which was statistically at par with Provax treated plots and the lowest number was obtained from control treatment. Bavistin resulted the highest number of umbel lets/plant which was followed by Provax treated plots. Number of seeds/umbel varied from 19.84 - 30.20, where the highest was recorded in Bavistin and the lowest was recorded in control treatment. Bavistin treated plots showed the highest number of seeds/plant and weight of seeds/plant which was followed by Provax and Sunvit, and control treatment showed the lowest number and weight of seeds/plant. Significantly the highest seed yield was recorded in Bavistin treated plots which was followed by Provax and Sunvit treated plots, and the lowest yield was obtained from control plots which was followed by Rovral. Hoque *et al.* (2014) found that test fungicides Rovral (0.2%), Secure 600 WG (0.2%), Bavistin 70 WP (0.2%), Captan 50 WP (0.2%) significantly increased yield of lentil.

CONCLUSION

It may be concluded that seed treatment and five times soil drenching with Bavistin DF (0.25%) or Provax 200 WP (0.25%) at an interval of 10 days from seedling to flowering stage decreased wilt incidence and increased seed yield of cumin.

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