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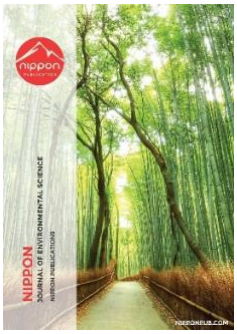

Full Length Research Paper

Management of foot and root rot disease of fennel

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Abstract. This study was conducted at Spices Research Centre, BARI, Shibganj, Bogura, Bangladesh during Rabi season of 2018-2019 to find out the suitable control measures in controlling foot and root rot disease of fennel (*Foeniculum vulgare* Mill.).. Four fungicides, turmeric powder, poultry refuse and one control were the treatment. Foot and root rot incidence of fennel under different treatments ranged from 7.14 - 29.39%, while the lowest incidence was observed in seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25%, which was followed by Seed treatment and soil drenching with Autostin 50 WDG (Carbendazim) at 0.25%, and the highest foot and root rot incidence was observed in untreated control. Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% gave the highest number of seeds per plant (6588), weight of seeds per plant (20.57 g) and seed yield (2.01 t/ha) which was followed by seed treatment and soil drenching with Cabriotop (0.3%) and seed treatment and soil drenching with Autostin (Carbendazim) at 0.25%, and the lowest of these parameters were recorded in Control plots. So, farmers and researchers may Provax 200 WP (0.25%) or Autostin 50 WDG (0.25%) to decrease foot and root rot disease and increase seed yield of fennel.

Keywords: Management; Provax 200 WP; Autostin 50 WDG; foot and root rot; fennel

1. INTRODUCTION

Fennel (*Foeniculum vulgare* Mill.) is one of the most important perennial, pleasant-smelling herb with yellow flowers seed spice crop in the family Apiaceae (Khan and Musharaf, 2014). It has digestive, stomachic, carminative, stimulant, appetizer properties, and is used in 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, bred rolls, pastries and confectionary, cordials and liquors (Khan and Musharaf, 2014). Cool and dry climate is best for the cultivation of fennel crop. Dry and cool weather during the seed set increases seed yield as well as the quality of the produce. Diseases are the major constraints in economic crop production as they inflict heavy losses. Like other crops, fennel is also attacked by many fungal diseases. Average yield of fennel is low due to various diseases. Among the diseases, foot and root rot of fennel caused by *Fusarium solani* and *Sclerotium rolfsii* are the common and most serious disease of fennel in Bangladesh. It causes seedling death at early stage resulting very poor plant stand which ultimately produces very low yield. *F. solani* and *S. rolfsii* are soil-borne pathogens commonly occurs in the tropics and sub-tropics regions of the world causing root and foot rot of many crops (Khare et al., 2014). It causes seedling death at early stage resulting very poor plant stand which ultimately produces very low yield. *F. solani* and *S. rolfsii* are soil-borne pathogens commonly occurs in the tropics and sub-tropics regions of the world causing root and foot rot of many crops (Aycock, 1966; Khare et al., 2014; Khalequzzaman, 2016; Khalequzzaman et al., 2016). Foot and root rot diseases may cause 100% seedling mortality in monoculture under conducive weather conditions for disease development (Begum, 2003). The diseases are one of the main constrains for the low production of this crop (Godhani et al., 2010). However, the fungi can attack the crop during any time from seedling to flowering stage and are comparatively more destructive at the seedling stage (Khalequzzaman et al., 2017). For being pathogenic fungi are soil-borne in nature; hence, seed treatment by botanicals and chemicals may be beneficial in controlling the disease (Khalequzzaman et al., 2017). Moreover, by seed treatment and soil drenching, very low quantities of materials are required compared to foliar application. Again, it reduces the risk of environmental pollution, health hazard and not much costly to the growers (Khalequzzaman et al., 2017). As there is no resistant variety available in Bangladesh against this disease, it has become inevitable to go for the use of

fungicides for the management of the disease. Provax 200 (Carboxin + Thiram) was the most effective followed by Bavistin 50 WP (Carbendazim), Neem leaf extract and Garlic extract with respect to disease reduction and increase of seed yield (Rahman et al., 2012). Seed treated with Provax 200 (Carboxin + Thiram) showed least foot and root rot incidence of lentil at Madaripur and Jessore in Bangladesh (Anonymous, 2010). Integrated use of Vitavax 200 (Carboxin + Thiram) and biocontrol agents were effective in improving seedling emergence and yield as well as in reducing wilt incidence of chickpea (Gupta, 2006). Bavistin (Carbendazim) decreased foot and root rot incidence and increased yield of lentil (Hossain et al., 1999). Vitavax 200 (Carboxin + Thiram) significantly decreased damping off disease and increased percentage of surviving plants of faba bean, lentil and chickpea (Zeid et al., 2003). Seed treatment and five times soil drenching with Bavistin DF (Carbendazim) at 0.25% and Provax 200 WP (Carboxin + Thiram) at 0.25% at an interval of 10 days from seedling to flowering stage decreased wilt incidence and increased seed yield of Cumin (Khalequzzaman et al., 2016). From the above facts, this type of research has so no far been conducted in Bangladesh. Therefore, the present study was undertaken to find out the control measures of foot and root rot of fennel.

2. MATERIALS AND METHODS

The experiment was conducted at Spices Research Centre, BARI, Shibganj, Bogura, Bangladesh during Rabi season of 2018-2019. 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 collected and removed from the soil. Cowdung at 5 t/ha, Urea at180 kg/ha, TSP at 175 kg/ha and MOP at 140 kg/ha were applied. The entire quantity of cowdung, TSP and MOP was applied during final land preparation. Urea was applied in two equal splits one half at 20 days after germination and the other half at flowering stage followed by irrigation (Anonymous, 2017). The experiment was carried out following Randomized Complete Block Design (RCBD) with three replications. Size of the unit plot was 2.5 m × 1.2 m and plant spacing was 40 cm × 10 cm. BARI Mouri-1 was used in the experiment. The treatments were T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%, T_2= Poultry refuse at 3.5 t/ha (Soil amendment before 3 weeks of seed sowing), T_3= Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25%, T_4= Seed treatment and soil drenching with Cabriotop (Matiram 55% + Pyraclostrobin 5%) at 0.3%, T_5= Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25%, T_6= Seed treatment and soil drenching with Iminant Pro (Tetraconzole + Carbendazim) at 0.1% and T_7= Control. Seeds were treated before sowing as per treatment and crop base at soil level was sprayed with the fungicides five times at an interval of 7 days from seedling stage. Treated seeds were sown on November 8, 2018. Three weedings were done at 25, 50, and 75 days after emergence and three 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. The plots were inspected regularly to take observations on foot and root rot disease from seedling to maturity stage of the crop. Dead plants were counted and removed from the field. Disease plant parts were collected in the laboratory for identifying foot and root rot causal pathogens. The crop was harvested from April 15-20, 2019. Data were recorded on foot and root rot incidence, plant survival, number of primary and secondary branches per plant, plant height at harvest, number of umbels per plant, number of umbel lets per umbel, number of umbel lets per plant, number of seeds/umbel, weight of seeds/umbel, number of seeds per umbel, weight of seeds per umbel, number of seeds per plant, weight of seeds per plant, and seed yield. The incidence of foot and root rot of fennel was recorded at every alternate day. The incidence of foot and root rot of fennel was calculated by the following formula:

$$\text{Incidence of foot and root rot (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \text{ X } 100$$

The recorded data were analyzed statistically using Duncan's New Multiple Range Test (DMRT) according to Gomez and Gomez (1984).

3. RESULTS AND DISCUSSION

3.1. Effect of treatments on foot and root rot incidence of fennel

Results on effect of treatments on foot and root rot incidence of fennel are presented in Table 1. Treatments differed significantly with each other in respect to foot and root rot incidence. Foot and root rot incidence of Fennel under different treatments ranged from 7.14 - 29.39%, while the lowest incidence was observed in seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% which was followed by seed treatment and soil drenching with Autostin 50 WDG (Carbendazim) at 0.25% and Seed treatment and soil drenching with

Cabriotop at 0.3% treated plots, and the highest foot and root rot incidence was observed in untreated control. Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% showed the highest plant survival (92.86%) and highest disease reduction over control (75.71%) which was followed by seed treatment and soil drenching with Autostin (0.25%) and seed treatment and soil drenching with Cabriotop (0.3%). The lowest plant survival (70.61%) was found in untreated control. Seed treatment and soil drenching with Turmeric powder (0.5%) resulted the lowest (35.56%) disease reduction compared with the control treatment.

Table 1. Effect of treatments on foot and root rot incidence of fennel

Treatments	Foot & root rot (%)	Plant Survival (%)	Disease reduction over control (%)
T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%	18.94 b	81.06	35.56
T_2= Poultry refuse at 3.5 t/ha	16.13 c	83.87	45.12
T_3= Seed treatment and soil drenching with Autostin at 0.25%	9.52 e	90.48	67.61
T_4= Seed treatment and soil drenching with Cabriotop at 0.3%	12.35 d	87.65	57.98
T_5= Seed treatment and soil drenching with Provax 200 WP at0.25%	7.14 f	92.86	75.71
T_6= Seed treatment and soil drenching with Iminant Pro at 0.1%	13.90 d	86.10	52.70
T_7= Control	29.39 a	70.61	-
Level of Significance	*	-	-
CV (%)	6.99	-	-

Similar letter(s) did not differ significantly at 5% level of probability.

3.2. Effect of treatments on growth parameters of fennel

As presented in Table 2, the treatments did not show any significant effect on number of primary branches per plant, number of secondary branches per plant and plant height at harvest. The highest number of primary branches per plant (2.5) and highest number of secondary branches per plant (9.5) were observed in seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% treated plots which were followed by seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and seed treatment and soil drenching with Cabriotop at 0.3% treated plots. The highest plant height at harvest (134 cm) was obtained from Poultry refuse (3.5 t/ha) applied plots and the lowest of this parameters were recorded in untreated control.

Table 2. Effect of treatments on growth parameters of fennel

Treatments	No. of primary branches/Plant	No. of secondary branches/Plant	Plant height (cm) at harvest
T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%	2.3	8.2	125
T_2= Poultry refuse at 3.5 t/ha	2.5	8.5	134
T_3= Seed treatment and soil drenching with Autostin at 0.25%	2.3	9.0	129
T_4= Seed treatment and soil drenching with Cabriotop at 0.3%	2.4	9.1	128
T_5= Seed treatment and soil drenching with Provax 200 WP at 0.25%	2.5	9.5	126
T_6= Seed treatment and soil drenching with Iminant Pro at 0.1%	2.3	8.1	127
T_7= Control	2.1	8.0	123
Level of Significance	NS	NS	NS
CV (%)	6.20	5.99	7.08

NS=Not significant.

3.3. Effect of treatments on number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant of fennel

Results on effect of treatments on the number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant of fennel are presented in Table 3. Number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant of fennel were significantly affected by the treatments. The highest number of umbels per plant (45.36), number of umbel lets per umbel (27.94) and number of umbel lets per plant (1124.98) were obtained from seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% treated plots which was followed by Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at 0.3% treated plots, and the lowest of these parameters were recorded in control plots.

Table 3. Effect of treatments on number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant of fennel

Treatments	No. of umbels/plant	No. of umbel lets/umbel	No. of umbel lets/plant
T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%	33.36 d	18.38 e	712.98 e
T_2= Poultry refuse at 3.5 t/ha	34.46 cd	20.10 d	793.76 d
T_3= Seed treatment and soil drenching with Autostin at 0.25%	41.66 b	25.32 ab	1024.73 b
T_4= Seed treatment and soil drenching with Cabriotop at 0.3%	40.26 b	23.39 c	912.52 c
T_5= Seed treatment and soil drenching with Provax 200 WP at 0.25%	45.36 a	27.94 a	1124.98 a
T_6= Seed treatment and soil drenching with Iminant Pro at 0.1%	36.54 c	22.10 c	829.28 d
T_7= Control	30.40 e	16.10 f	670.04 f
Level of Significance	**	**	**
CV (%)	8.11	7.58	9.09

Similar letter(s) did not differ significantly at 1% level of probability.

3.4. Effect of treatments on number of seeds per umbel and weight of seeds per umbel of Fennel

Treatments had a significant effect on the number of seeds per umbel and weight of seeds per umbel of fennel (Table 4). Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% gave the highest number of seeds per umbel (599.66) and weight of seeds per umbel (5.57 g) which were followed by seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at 0.3% treated plots, and the lowest of these parameters were recorded in control plots.

Table 4. Effect of treatments on number of seeds per umbel and weight of seeds per umbel of fennel.

Treatments	No. of seeds/umbel	Wt. of seeds (g) /umbel
T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%	501.83 e	3.58 e
T_2= Poultry refuse at 3.5 t/ha	530.66 d	3.90 d
T_3= Seed treatment and soil drenching with Autostin at 0.25%	579.13 b	5.25 b
T_4= Seed treatment and soil drenching with Cabriotop at 0.3%	568.24 b	4.74 c
T_5= Seed treatment and soil drenching with Provax 200 WP at 0.25%	599.66 a	5.57 a
T_6= Seed treatment and soil drenching with Iminant Pro at 0.1%	549.13 c	3.93 d
T_7= Control	429.44 f	3.06 f
Level of Significance	**	**
CV (%)	10.06	5.95

Similar letter(s) did not differ significantly at 1% level of probability.

3.5. Effect of treatments on yield and yield contributing characters of fennel

Yield and yield contributing characters of fennel were significantly affected by the treatments (Table 5). The highest number of seeds per plant (6588), weight of seeds per plant (20.57 g) and seed yield (2.01 t/ha) were observed in Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% followed by seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and seed treatment and soil drenching with Cabriotop @0.3%, and the lowest of these parameters were recorded in untreated control plots. Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% resulted the highest yield increased (66.12%) over control where seed treatment and soil drenching with Turmeric powder (0.5%) resulted the lowest yield increased (19.00%) over control.

Table 5. Effect of treatments on yield and yield contributing characters of fennel

Treatments	**No. of seeds/plant**	**Wt. of seeds/plant (g)**	**Seed yield (t/ha)**	**% yield increased over control**
T_1= Seed treatment and soil drenching with Turmeric powder at 0.5%	5813 f	15.23 cd	1.44 d	19.00
T_2= Poultry refuse at 3.5 t/ha	5949 e	16.11 bcd	1.50 d	23.97
T_3= Seed treatment and soil drenching with Autostin at 0.25%	6523 b	19.66 a	1.79 b	47.93

T_4= Seed treatment and soil drenching with Cabriotop at 0.3%	6347 c	17.51 b	1.70 bc	40.49
T_5= Seed treatment and soil drenching with Provax 200 WP at 0.25%	6588 a	20.57 a	2.01 a	66.12
T_6= Seed treatment and soil drenching with Iminant Pro at 0.1%	6209 d	17.18 bc	1.64 c	35.54
T_7= Control	4450 g	13.94 e	1.21 e	-
Level of significance	**	**	**	-
CV (%)	8.05	7.73	5.96	-

Similar letter(s) did not differ significantly at 1% level of probability.

It has been revealed that treatments differed significantly with each other in respect to foot and root rot incidence. Foot and root rot incidence of fennel under different treatments ranged from 7.14 - 29.39%, while the lowest incidence was observed in seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% which was followed by seed treatment and soil drenching with Autostin 50 WDG (Carbendazim) @0.25% and seed treatment and soil drenching with Cabriotop at 0.3% treated plots, and the highest foot and root rot incidence was observed in untreated control.

Khalequzzaman (2008) stated that the best treatment for controlling foot and root rot of lentil and chickpea was seeds dipping in 0.25% suspension of Vitavax 200 (Carboxin + Thiram) for 3 hours. Rahman et al. (2012) found that Provax 200 (Carboxin + Thiram) was the most effective followed by Bavistin 50 WP (Carbendazim) in respect to foot and root rot disease reduction. Seed treated with Provax 200 (Carboxin + Thiram) showed least foot and root rot incidence of lentil at Madaripur and Jessore in Bangladesh (Anonymous, 2010). Khalequzzaman (2016) observed that the lowest foot and root rot (21.67%) was obtained from when seed treatment with Provax 200 (Carboxin + Thiram) (2.5 g/kg seed) in lentil. Anonymous (2014) found that root rot of Fenugreek could be controlled by seed treatment and soil drenching with Carbendazim 0.5 g/l. The highest plant population and the lowest disease incidence per pot or plot exhibited with fungicides Provax (Carboxin + Thiram) and Bavistin (Carbendazim) application (Islam et al., 2018). Tanni et al. (2016) observed that the germination of chickpea was maximum by treating seeds with Bavistin 70 WP (Carbendazim) (81%). The lowest (4.00, 3.33 and 2.33%) seedling mortality rate were observed in plots where Bavistin 70 WP (Carbendazim) sprayed at 10, 20 and 30 days after sowing, respectively. Singh and Rao (2015) conducted field experiments for two years for the management of root rot of fenugreek and it was found that maximum reduction in disease incidence (14.52 and 11.4%, respectively) was observed in the treatment where seeds were treated with Carbendazim (2 g kg-1) + spray at 45, 60 and 75 days after sowing. Gupta (2006) observed that integrated used of Vitavax 200 (Carboxin + Thiram) and biocontrol agents were effective in improving seedling emergence and yield as well as in reducing wilt incidence of chickpea. Hossain et al. (1999) found that Bavistin (Carbendazim) decreased foot and root rot incidence of lentil. Khalequzzaman et al. (2016) found that seed treatment and five times soil drenching with Bavistin DF (Carbendazim) at 0.25% and Provax 200 WP (Carboxin + Thiram) at 0.25% at an interval of 10 days from seedling to flowering stage decreased wilt incidence and increased seed yield of Cumin. Siddique et al. (2013) observed that pre-sowing soil treatment with Poultry litter (5 t/ha) with proper seed treatment by Provax (Carboxin + Thiram) (2 g/kg seed) reduced wilt incidence and also Neem oil cake (100 kg/ha) in combination with Provax (Carboxin + Thiram) also decreased wilt incidence over control in chickpea. Khokhar et al. (2012) observed that seed treatment with Bavistin (Carbendazim) at 1.5g / kg seed and Neem leaf extract at 5 ml/ 10g seed significantly enhanced seed germination, seedling vigour by preventing pre-and post-emergence mortality over control of Fenugreek. Khalequzzaman et al. (2003) reported that the highest foot and root rot (plant mortality) of Bush bean was reduced by Vitavax 200 (Carboxin + Thiram) at 0.3% in the field. Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% showed the highest plant survival and highest disease reduction over control which was followed by Seed treatment and soil drenching with Autostin (Carbendazim) at0.25% and Seed treatment and soil drenching with Cabriotop (0.3%). The lowest plant survival was found in untreated control. Seed treatment and soil drenching with Turmeric powder (0.5%) resulted the lowest disease reduction over control. Zeid et al. (2003) observed that the lowest plant survival was found in untreated control. Vitavax 200 (Carboxin + Thiram) significantly decreased damping off disease and increased percentage of surviving plants of faba bean, lentil and chickpea.

The treatments did not show any significant effect on number of primary branches per plant, number of secondary branches per plant and plant height at harvest. Yet the highest number of primary branches per plant and highest number of secondary branches per plant were observed in seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% treated plots which were followed by Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at 0.3% treated plots.

The highest plant height at harvest was obtained from Poultry refuse applied plots and the lowest of this parameters were recorded in untreated control.

Number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant of Fennel were significantly affected by the treatments. The highest number of umbels per plant, number of umbel lets per umbel and number of umbel lets per plant were obtained from Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% treated plots which was followed by Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at @0.3% treated plots, and the lowest of these parameters were recorded in control plots.

Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% gave the highest number of seeds per umbel and weight of seeds per umbel which were followed by Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at 0.3% treated plots, and the lowest of these parameters were recorded in Control plots. Khalequzzaman (2016) found that the highest number of pod/ plant (45.26), number of seeds/plant (87.80) and weight of seeds/plant (2.44 g) were recorded in seed treatment with Provax 200 (Carboxin + Thiram) (2.5 g/kg seed) in lentil.

The highest number of seeds per plant, weight of seeds per plant and seed yield were observed in Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% followed by Seed treatment and soil drenching with Autostin (Carbendazim) at 0.25% and Seed treatment and soil drenching with Cabriotop at 0.3%, and the lowest of these parameters were recorded in untreated control plots. Seed treatment and soil drenching with Provax 200 WP (Carboxin + Thiram) at 0.25% resulted the highest yield increased (66.12%) over control where Seed treatment and soil drenching with Turmeric powder (0.5%) resulted the lowest yield increased over control. Gupta (2006) found that Vitavax 200 (Carboxin + Thiram) improved yield of chickpea which was at par with the standard fungicide Bavistin (Carbendazim). Godhani et al. (2010) stated that the diseases were one of the main constrains for the low production of this crop. Rahman et al. (2012) found that Provax 200 (Carboxin + Thiram) was the most effective followed by Bavistin 50 WP (Carbendazim), Neem leaf extract and Garlic extract in respect to increase of seed yield. Hossain et al. (1999) observed that Bavistin (Carbendazim) increased yield of lentil. Khalequzzaman et al. (2003) found that the maximum yield was obtained from Vitavax 200 (Carboxin + Thiram) at 0.3% in Bush bean. Kaur and Gupta (2003) found that Vitavax 75 WP (Carboxin + Thiram) resulted the maximum increase in yield (86.14%) of lentil. It was observed that Provax (Carboxin + Thiram) for seed treatment performed highest yield (Siddique et al., 2013). Khalequzzaman (2016) observed that the highest yield (1845 kg/ha) was obtained from seed treatment with Provax 200 (Carboxin + Thiram) (2.5 g/kg seed) in lentil. Tanni et al. (2016) found that the highest yield (1600 kg/ha) were obtained by spraying Bavistin 70 WP (Carbendazim) at 1 gram/liter with an increase of 52.38% grain yield in Chickpea. Sharma and Sohi (1981) conducted experiment in field trials with 10 seed dressing fungicides against foot and root rot and found Bavistin (Carbendazim) and Vitavax (Carboxin + Thiram) resulted maximum yield.

4. CONCLUSION

From the results obtained in this study, it may be concluded that seed treatment and five times soil drenching at an interval of 7 days from seedling stage with Provax 200 WP (Carboxin + Thiram) @0.25% and Autostin 50 WDG (Carbendazim) @0.25% were found significantly individually reduced foot and root rot disease and increased seed yield of fennel. Therefore, farmers and researchers may use Provax 200 WP (0.25%) or Autostin 50 WDG (0.25%) to decrease foot and root rot disease and increase seed yield of fennel.

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