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SHORT COMMUNICATION

Effect of seed treatment with fungicides, nutrients and bio-agents on wilt of lentil (*Lens culinaris* Medikus)

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ABSTRACT

The 10-15 percent yield losses of lentil crop are mainly due to the Fusarium wilt. In the present study, efficacy of seed treatment with fungicide, bioagents and nutrient were evaluated against lentil wilt. Minimum disease incidence (32.33%) was recorded in Carbendazim @ 0.2 g/kg seed followed by *Pseudomonas fluorescens* (34.21%), *Bacillus subtilis* (36.45%), *Trichoderma viride* (41.40%), *Trichoderma harzianum* (44%), *Trichoderma virens* (45.44%) Zn (48.80%) and Mn (50.10) as compared to control (53.60%) at 90 days after sowing in the year 2016-17. Maximum disease control (39.68%) was recorded in Carbendazim followed by *P. fluorescens* (36.17%), *B. subtilis* (31.99%), *T. viride* (22.76 %) and *T. harzianum* (17.91%), Zn (8.95%) and Mn (6.52%).

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INTRODUCTION

Lentil is the most important pulse crop in India, and is a major source of protein, amino acids and folate (Jha et al., 2015). Lentil is known by different names in various countries such as 'Lentille' (Frence), 'Linse'(German), 'Lenteja'(Spanish), A Das' (Arabic), Mercimek'(Turkish), 'Hiramame' (Japanese) and 'Masur'(Hindi). (Abraham, 2015).

Lentil is a rich source of 69 mg of calcium, 300 mg of phosphorus and 7 mg of iron per 100 g of seeds containing minerals. It is also rich in vitamin C (10-15 mg), vitamin A (450 IU), 9% riboflavin (Ali and Mishra, 2000) and 136-182 $mg^{-100\,g}$ folates (Jha et al., 2015). The production of lentils is mostly affected by diseases and insect pests all over the world (Shahiduzzaman, 2016). There are about ten major lentil diseases, among which the major ones are rust (*Uromyces viciae-fabae*), Seedling rots (*Pythium ultimum*) and Fusarium wilt (*Fusarium oxysporum*), (Arasu et al., 2016). Some earlier attempts were made using chemical, biological, varietal and cultural techniques to control this disease (Sinha and Sinha, 2004; Ram and Pandey, 2011; Dolatabadi et al., 2012). Seed treatment with *Rhizobium* and bio-agents are the most commonly used methods in integrated management. Based on the above interests, the present study aimed to evaluate the effect of seed treatment with fungicides, bioagents, and nutrients against lentil Fusarium wilt.

MATERIALS AND METHODS

The seed of a susceptible variety of lentil was treated with systemic fungicides carbendazim 2.0g kg^{-1} seed. Seed treatment was also carried with applications of biocontrol agents. Each treatment had three replications with control in a different treatment pre-soaking of lentil seeds with Mn, and Zn at 80 ppm concentration was done. From the data generated, treatment means and their standard error were calculated for each treatment. The data were subjected to scrutiny with square root transformation.

RESULTS AND DISCUSSION

The effect of seed treatment with fungicide, bioagents and nutrient was tested against lentil wilt. Minimum disease incidence (32.33%) was recorded in Carbendazim @ 0.2g kg^{-1} seed followed by *P. fluorescens* (34.21%), *B. subtilis* (36.45%), *T. viride* (41.40%), *T. harzianum* (44%), *T. virens* (45.44%), Zn (48.80%) and Mn (50.10) as compared to control (53.60%) at 90 days after sowing 2016-17. Maximum disease control (39.68%) was recorded in Carbendazim @ 0.2g kg^{-1} seed followed by *P. fluorescens* (36.17%), *B. subtilis* (31.99%), *T. viride* (22.76%) and *T. harzianum* (17.91%), Zn (8.95%) and Mn (6.52%). (Table 1). Similar trend was also observed in the year 2017-2018 with minimum disease incidence recorded in Carbendazim (36.33%) @ 0.2g kg^{-1} seed followed by *P. fluorescens* (38.30%), *Bacillus subtilis* (39.45%), *T. viride* (44.40%), and *T. virens* (47.35%), Zn (53.70%) and Mn (55.10%) as compared to control (58.60%). Dolatabadi et al. (2012) reported that *T. viride* was effective against Fusarium wilt of lentil, which was in line with the present study results.

The maximum disease control (38%) was recorded in Carbendazim @ 0.2g kg^{-1} seed followed by *P. fluorescens* (34.64%), *B. subtilis* (32.67%), *T. viride* (24.23%), *T. virens* (19.19%), *T. harzianum* (18.08%), Zn (8.36%), and Mn (5.97%) in reducing wilt disease (Table 1). Carbendazim and all biocontrol agents found significantly superior over control treatments. Whereas, Zn and Mn found least effective with control. Therefore, for future studies, combination of

Table 1. Effect of seed treatment with fungicides, nutrients and bio-agents on wilt of lentil

Treatment	Disease incidence	%Disease control	Disease incidence	%Disease control	Disease incidence	%Disease control	Disease incidence	%Disease control	Disease incidence	%Disease control	Disease incidence	%Disease control
	30 days		60 days		90 days		30 days		60 days		90 days	
	2016-2017						2017-2018					
Carbendazim (2g kg^{-1} seed)	4.00	40.29	8.00	40.29	32.33	39.68	4.54	37.80	9.08	37.80	36.33	38.00
	(2.12)	(6.38)	(2.91)	(6.38)	(5.72)	(6.33)	(2.24)	(6.18)	(3.09)	(6.18)	(6.06)	(6.20)
T. harzianum@4g kg^{-1} seed	5.15	17.91	11.00	17.91	44.00	17.91	6.00	17.10	12.00	17.80	48.00	18.08
	(2.37)	(4.29)	(3.39)	(4.29)	(6.66)	(4.28)	(2.55)	(4.19)	(3.53)	(4.27)	(6.95)	(4.31)
T. viride @4g kg^{-1} seed	5.17	22.83	10.35	22.76	41.40	22.76	5.50	24.65	11.10	23.97	44.40	24.23
	(2.38)	(4.82)	(3.29)	(4.82)	(6.46)	(4.82)	(2.45)	(5.01)	(3.40)	(4.94)	(6.69)	(4.91)
T.virens @4 g kg^{-1} seed	5.68	15.22	11.36	15.22	45.44	15.22	5.90	19.17	11.80	19.17	47.35	19.19
	(2.48)	(3.96)	(3.44)	(3.96)	(6.77)	(3.96)	(2.53)	(4.43)	(3.50)	(4.43)	(6.91)	(4.43)
B. subtilis @ 10g kg^{-1} soil	4.50	32.83	9.11	32.01	36.45	31.99	4.90	32.87	9.81	32.80	39.45	32.67
	(2.23)	(5.77)	(9.11)	(5.70)	(6.07)	(5.69)	(2.32)	(5.77)	(3.21)	(5.76)	(6.31)	(5.75)
P. fluorescens @ 10g kg^{-1} seed	4.27	36.56	8.55	36.19	34.21	36.17	4.78	34.52	9.57	34.45	38.30	34.64
	(2.18)	(6.08)	(3.00)	(6.05)	(5.88)	(6.05)	(2.30)	(5.91)	(3.17)	(5.90)	(6.22)	(5.92)
Zinc (Zn) @ 80ppm	6.10	8.95	12.20	8.95	48.80	8.95	6.70	8.21	13.40	8.21	53.70	8.36
	(2.57)	(3.07)	(3.56)	(3.07)	(7.01)	(3.07)	(2.68)	(2.95)	(3.72)	(2.95)	(7.36)	(2.97)
Manganese (Mn) @80ppm	6.25	6.71	12.50	6.71	50.10	6.52	6.80	6.84	13.70	6.16	55.10	5.97
	(2.59)	(2.68)	(3.60)	(2.68)	(7.10)	(2.65)	(2.70)	(2.71)	(3.76)	(2.58)	(7.45)	(2.54)
Control	6.70	0.00	13.40	0.00	53.60	0.00	7.30	0.00	14.60	0.00	58.60	0.00
	(2.58)	(0.71)	(3.72)	(0.71)	(7.35)	(0.71)	(2.79)	(0.71)	(3.88)	(0.71)	(7.68)	(0.71)
Standard error (SE±)	0.075	0.154	0.110	0.144	0.231	0.153	0.079	0.149	0.115	0.153	0.232	0.147
Critical Difference (CD)	0.223	0.457	0.325	0.428	0.686	0.456	0.236	0.442	0.342	0.454	0.688	0.436
Coefficient of Variation (CV)	5.409	6.354	5.688	5.959	6.100	6.368	5.482	6.131	5.740	6.316	5.859	6.056

Note: Data given in parenthesis is root transformed values

seed treatments to evaluate the effect of Fusarium wilt management in lentil would be advantageous.

CONCLUSION

Minimum disease incidence and maximum disease control were recorded by treatments of Carbendazim @ 0.2g kg^{-1} seed followed *by P. fluorescens*, *B. subtilis*, *T. viride*, *T. harzianum*, *T. virens*, Zn, and Mn as compared to control at 90 days after sowing.

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