

Original Research Article

Management of *Fusarium wilt* of lentil through seed treatment with fungicide, botanicals and bio-agents alone or in cocktail

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ABSTRACT

Fusarium wilt is one of the major diseases in lentil crop which causes a significant yield loss. The present study aimed to manage the *Fusarium wilt* of lentil through seed treatment with fungicide, botanicals and bio-agents alone or in combination which is carried out at Student Instructional Farm of ANDUAT, Kumarganj, Ayodhya. It was observed that Minimum disease incidence was found in T₈ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) + *T. viride* (14.13 %) with per cent disease control (82.76) followed by T₃ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma viride* (15.85 %) having PDC (80.67), T₂ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma harzianum* (22.37%) having PDC (72.71), T₇ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) (28.84%) having PDC (64.82).

Keywords

bio-agents,
botanicals,
Fusarium,
management, wilt

Introduction

Lentil (*Lens culinaris* Medik) commonly known as Masur was among the first crop domesticates and has become an important pulse crop in the farming and food system of many countries globally (Sarker and Erskine, 2006). Lentil also known as 'Poor man's meat' as it is rich in nutrients, include 60-67% carbohydrates, 20-36% protein, <4% lipid, and 2-3% ash on dry weight basis (Bhatty, 1988). Major lentil growing states in India are Madhya Pradesh (42.50%), Uttar Pradesh (31.25%), West Bengal (9.38%) and

Bihar (8.75%). In India, lentil was grown in 1.49 mha with production of 1.61 mt with an average production of 1006 kg/ha (Anonymous, 2018).

Among biotic factors disease are major constraint in lentil production. Among the fungal diseases, *Fusarium wilt* of lentil caused by *Fusarium oxysporum* f.sp. *lentil* is a major threat in lentil production worldwide (Bhalla *et al.*, 1992). In India, this disease causes significant yield losses in various states of India where lentil is grown. The fungus is soil and seed borne and also

survives on plant debris in offseason and may active when next crop season started. The fungus is seed borne in nature and transmits from one place to another through seed material. Seed treatment is very effective method to control or manage the disease. Various workers applied fungicides, botanicals and bio-agents as a seed treatment and effective manage the disease (Kamdi *et al.*, 2012, Chandra *et al.*, 2018 and Chandra *et al.*, 2020). The aim of the study is to manage the *Fusarium wilt* of lentil through seed treatment with fungicides, botanicals and bio-agents alone or in combination.

Materials and Methods

Field Experiment

A field experiment was conducted to check the efficacy of seed treatment with fungicide, botanicals and bio-agents alone or in combination against *Fusarium wilt* of lentil var. L 9-12 was carried out during *Rabi* season 2019-2020 to manage the disease at Students Instructional Farm of A.N.D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). The experiment had 9 treatments with three replications in Randomized Block Design (RBD) with each plot measuring 4m x 3m. The crop was grown in the field to follow all agronomical packages of practices. The seeds germination was counted 25 Days after Sowing along with infected plants with the wilt disease. The disease incidence was calculated using following formula.

Treatments Detail

T₁ : Seed treatment with Metalaxyl 8% + Mencozeb 64% @ 2.5g/kg seed.

T₂ : Seed treatments with neem leaf extract @10%.

T₃ : Seed treatment with *Trichoderma viride* @ 4g/kg seed.

T₄ : Seed treatment with *Trichoderma harzianum* @ 4g/kg seed.

T₅ : Seed treatment with Metalaxyl 8% + Mencozeb 64% @ 2.5g/kg seed + Seed treatment with neem leaf extract @ 10%.

T₆ : Seed treatment with Metalaxyl 8% + Mencozeb 64% @ 2.5g/kg seed + Seed treatment with *Trichoderma viride* @ 4g/kg seed.

T₇ : Seed treatment with Metalaxyl 8% + Mencozeb 64% @ 2.5g/kg seed + Seed treatment with *Trichoderma harzianum* @ 4g/kg seed.

T₈ : Seed treatment with Metalaxyl 8% + Mencozeb 64% @ 2.5g/kg seed + Seed treatment with neem leaf extract @ 5% + Seed treatment with *Trichoderma harzianum* @ 4g/kg seed.

T₉ : Control

First appearance of disease, disease incidence and per cent disease control were recorded at 30, 45 and 60 days after sowing. Per cent disease incidence and per cent disease control was calculated by using following formula.

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Per cent disease control

$$C - T \\ = \frac{\quad}{C} \times 100$$

Where,

C = Per cent disease incidence of control plots

T = Per cent disease incidence in treated plots

Results and Discussion

Effect of seed treatment with fungicide, botanicals and bio-agents alone or in combination against *F. oxysporum* f. sp. *lentis*

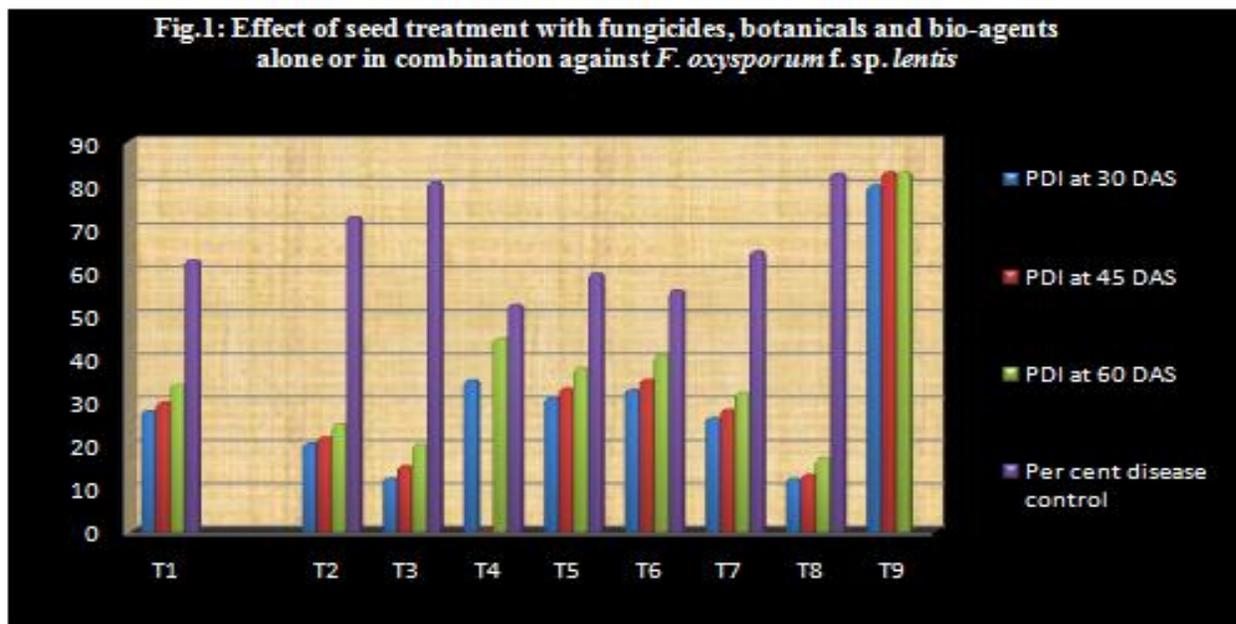
Minimum disease incidence was found in T₈ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) + *T. viride* (14.13 %) followed by T₃ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma viride* (15.85 %), T₂ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma harzianum* (22.37%), T₇ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%)

(28.84%), T₁ Metalaxyl 8% + Mancozeb 64% (30.59 %), T₅ *Trichoderma viride* (33.88%), T₆ *T. harzianum* (36.26%) and T₄ Neem leaf extract 10% (39.04 %) as compared to control (82.00%) per cent disease incidence was recorded. There was no significant difference in incidence between T₃ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma viride* and T₈ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) + *T. viride*, T₁ Metalaxyl 8% + Mancozeb 64% and T₇ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) and T₄ Neem leaf extract 10%, T₅ *Trichoderma viride* and T₆ *T. harzianum* were at par to each other.

Table.1 Effect of seed treatment with fungicides, botanicals and bio-agents alone or in combination against *F. oxysporum* f. sp. *Lentis*

Treatment	Dose g/kg	Per cent disease incidence			Mean	Per cent disease control
		At 30 DAS	At 45 DAS	At 60 DAS		
T ₁ Metalaxyl 8 % + Mancozeb 64 %	2.5	27.90 (31.87)	29.85 (33.11)	34.03 (35.68)	30.59	62.69
T ₂ Metalaxyl 8 % + Mancozeb 64 % + <i>Trichoderma harzianum</i>	2.5	20.40 (26.85)	21.83 (27.83)	24.88 (29.92)	22.37	72.71
T ₃ Metalaxyl 8 % + Mancozeb 64 % + <i>Trichoderma harzianum</i>	2.5	12.30 (20.53)	15.17 (22.91)	20.10 (28.15)	15.85	80.67
T ₄ Neem leaf extracts	10 %	35.00 (36.25)	37.45 (37.73)	44.69 (40.79)	39.04	52.39
T ₅ <i>Trichoderma viride</i>	4	30.90 (33.75)	33.06 (35.10)	37.69 (37.84)	33.88	59.68
T ₆ <i>Trichoderma harzianum</i>	4	32.80 (34.93)	35.10 (36.33)	40.90 (39.23)	36.26	55.78
T ₇ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%)	2.5	26.30 (30.85)	28.14 (32.03)	32.08 (34.49)	28.84	64.82
T ₈ Metalaxyl 8% + Mancozeb 64% (2.5g/kgseed) + Neem leaf extract (10%) + <i>T. viride</i> (4/kgseed)	2.5	12.25 (20.45)	13.16 (22.27)	16.99 (22.79)	14.13	82.76
T ₉ Control		80.00 (63.56)	83.00 (71.57)	83.00 (72.25)	82.00	-
SEm±		1.13	0.67	1.69		
CD at 5%		3.39	2.03	3.11		

Fig.1 Effect of seed treatment with fungicides, botanicals and bio-agents alone or in combination against *F. oxysporum* f. sp. *lentis*



Maximum per cent disease control was obtained in T₈ Metalaxyl 8% + Mancozeb 64% + Neem leaf extracts (5%) + *Trichoderma viride* (82.76 %) followed by T₃ Metalaxyl 8 % + Mancozeb 64 % + *Trichoderma viride* (80.67 %), T₂ Metalaxyl 8% + Mancozeb 64% + *T. harzianum* (72.71 %), T₇ Metalaxyl 8% + Mancozeb 64% + Neem leaf extract (10%) (64.82 %), T₁ Metalaxyl 8 % + Mancozeb 64 % (62.69 %), T₅ *Trichoderma viride* (59.68 %), T₆ *Trichoderma harzianum* (55.78 %) and T₄ Neem leaf extract 10% (52.39 %) as compared to T₉ control (0.0) per cent disease control was recorded.

Our findings is analogous with the findings of Garkoti *et al.*, 2013 reported that the combination of bioagents as seed treatment was found effective to manage the disease (Chandra *et al.*, 2018 and Chandra *et al.*, 2020). Seed treatment with fungicides + bioagents were also found effective against the disease (Kamdi *et al.*, 2012).

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