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MANAGEMENT OF VASCULAR WILT OF LENTIL THROUGH BIO CONTROL AGENTS AND ORGANIC AMENDMENTS IN TARAI AREA OF UTTARAKHAND STATE

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ABSTRACT

Lentil is an important component of farming systems in our country. It is one of the important and most nutritious *rabi* pulses. Lentil wilt caused by *Fusarium oxysporum* f.sp. *lentis* is a disease of national importance and it is a limiting factor to lentil cultivation. Field trials were carried out consecutively during *Rabi* 2007-08 and 2008-09 crop seasons in Randomized Block Design (RBD) with three replications, using popular variety Pant L-639. The plot size was $3.0 \times 1.5m^2$ with row spacing of 30cm. It has been observed that seed treatment with *Trichoderma harizanum* + *Pseudomonas fluorescence* gave significant reduction in disease incidence and maximum grain yield. Among organic amendments cow dung manure, FYM, spent compost and vermicompost, minimum disease incidence 3.25% was observed in case of FYM treated plots followed by vermicompost (4.25%) and cow dung manure (4.75%). The highest disease incidence was recorded in spent compost amended plots (5.75%). Similarly highest grain yield in FYM (575 kg/ha) followed by vermicompost (525.5 kg/ha) and cow dung manure (475.5kg/ha).amended plots.

INTRODUCTION

Pulse on account of their vital role in security and soil ameliorating properties have been an integral part of sustainable agriculture since ages. However, production of pulses in Uttarakhand state has drastically came down in the period. India is producing 14.76 million tonnes of pulses of 23.63 million hectare which is one of the largest pulses producing country in the world. However, about 2 to 3 million tonnes of pulses are imported annually to meet the domestic consumption requirement. Thus there is need to increase production and productivity of pulses in the country by more intensive intervention. Pulses hold prime position in Indian agriculture; they are one of the important constituents of the Indian diet and supply major parts of protein. In India, lentil is mostly grown in northern plains, central and eastern parts of India. The major lentil producing states are Madhya Pradesh, Uttar Pradesh, Bihar, Uttarakhand and Bengal.

Lentil (*Lens culinaris* Medik) is a valuable human food. Dehuled lentil seed contain 24-26 per cent protein 3.2 per cent fibre and 57 per cent carbohydrate. It is rich source of minerals containing 68 mg calcium, 300 mg phosphorus and 7 mg iron per 100 g seed. It is also rich in vitamin C and riboflavin (Ali and Mishra, 2000). Globally, lentil shares only 5 per cent of the total area under pulses. Lentil is recognized as one of the most nutritious pulse crop ranking next to chickpea amongst *rabi* pulses. In our country it occupies 1.59m. ha and contributes 0.94 m.t to pulse production (Anonymous, 2011).

Among the biotic factors, diseases are major threat to lentil production in many parts of the world. Lentil suffers from a number of diseases which are caused by fungi, bacteria, viruses, nematodes and plant parasites (Khare *et al*., 1979). Wilt of lentil is one of serious diseases caused by *Fusarium oxysporum* f.sp. *lentis* and plays a major role in reducing lentil yield (Hamdi and Hassanein 1996). The disease appears in either the early stage of crop growth (seedling) or during the reproductive stage (adult stage) (Khare, 1981; Stoilova and Chavdarov, 2006).

Although various fungicides have promising results in controlling the wilt of lentil but there is a problem of phytotoxicity and fungicidal residue leading to the environmental pollution. In recent times, there has been a worldwide swing to the use of eco-friendly methods for protecting the crops from pests and diseases. The use of potential harmful chemical sprays is viewed with dissatisfaction in many countries. As such in the present context, use of biological control agents and organic amendments offers a great promise. Thus the present study was conducted to evaluate the effect of biological agents and organic amendments which are ecofriendly, for the management of wilt of lentil.

MATERIALS AND METHODS

The field experiments were conducted consecutively during rabi season 2007-08 and 2008-09 at Crop Research Centre (CRC), of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand). A popular lentil variety Sehore 74-3 was used throughout the investigation. The field experiment was concluded in a randomized block design (RBD) with three replication. Recommended dose of nitrogen @ 20 kg/ha, phosphorus 60 kg/ha and potash 50 kg/ha was applied before sowing. Seeds were sown on 22 November during both the crop seasons. Plot size was $3.0 \times 1.5m^2$ with 30cm inter row spacing and sowing depth 3-4cm. All organic amendments were applied in the field one month before sowing @ 2 kg/ plot. Biocontrol agents were used as seed treatment @ 5g/kg seed and plots with untreated seed, was taken as control. Bioagents have shown efficiency on plant pathogens (Mehta *et al.,* 1995; Etebarian 2006). Observations on disease incidence, thousand grain weight and yield kg/ha was recorded.

RESULTS AND DISCUSSION

The effect of bio control agents on wilt incidence, 1000-grain weight and grain yield during 2007-08 and 2008-09 crop seasons is given in Table 1. During 2007-08 crop season, the data recorded, revealed that *Trichoderma harzianum + Pseudomonas fluorescence* showed the lowest disease incidence (1.61%) followed by *Pseudomonas fluorescence* (2.65%) and *Trichoderma harzianum* (2.83%) alone. The highest grain yield (589 kg/ha) was recorded in *Trichoderma harzianum + P. fluorescence* followed by *Pseudomonas fluorescence* (501 kg/ha) and *Trichoderma harzianum* (480 kg/ha). Grain yield increased over check (68.37%) in *Trichoderma harzianum + Pseudomonas fluorescence* treated plot followed by *Pseudomonas fluorescence* (43.34%) and *Trichoderma harzianum* (37.14%).

During 2008-09 crop season again *Trichoderma harzianum + Pseudomonas fluorescence* resulted in minimum disease incidence (2.47%), followed by *Pseudomonas fluorescence* (2.54%) and *Trichoderma harzianum* (3.55%). Highest grain yield (466.6 kg/ha) and 1000-grain weight (14.0 g) was recorded in *Trichoderma harzianum + Pseudomonas fluorescence* treated plots. In *Pseudomonas fluorescence* treated plots disease incidence (2.54%) decline (85.75%), 1000-grain weight (13.57 g) and grain yield (453.3 kg/ha) which increased over check (20.88%). In *Trichoderma harzianum* treated plots disease incidence (3.55%) disease decline (80.09%), 1000-grain weight (13.07 g) and grain yield (428.3 kg/ha) which increased over check (14.21%)

The observation recorded on the effect of bio control agents on wilt incidence and grain yield revealed that *Trichoderma harzianum + Pseudomonas fluorescence* was most effective in reducing the per cent wilt incidence as well as increasing grain yield in both crop seasons followed by *Pseudomonas fluorescence* and *Trichoderma harzianum alone.* Akhtar *et al.,* (2010) reported that mixture of biocontrol agents showed better results, since they may better adapt to environmental changes that occur throughout the growing season and protect against a broader range of pathogens. Ramamoorthy *et al.*

Table 1: Efficacy of biocontrol agents on wilt incidence, grain yield, 1000-grain weight during 2007-08 and 2008-09 crop seasons

Treatment	Dose g/kg	Disease incidence (%) 2007-08	Disease incidence (%) 2008-09	Disease decline (%) 2007-08	Disease decline (%) 2008-09	Grain yield (kg/ha) 2007-08	Grain yield (kg/ha) 2008-09	1000 grain weight 2007-08	1000 grain weight 2008-09	% increase over check 2007-08	% increase over check 2008-09
Pseudomonas fluorescence	5.0	2.65 (9.36)	2.54 (9.22)	84.50	85.75	501.7	453.3	12.90	13.57	43.34	20.88
Trichoderma harzianum	5.0	2.83 (9.67)	3.55 (10.85)	83.45	80.09	480.0	428.3	12.57	13.07	37.14	14.21
Trichoderma harzianum + Pseudomonas fluorescens	5.0	1.61 (7.28)	2.47 (9.17)	90.58	86.15	589.3	466.3	12.95	14.0	68.37	24.43
Check	–	17.10 (27.05)	17.83 (28.23)	-	-	350.0	375.0	10.82	10.54	-	-
S.Em. ±	–	0.10	0.22	-	-	16.0	15.5	0.23	0.37	-	-
CD at 5%	–	0.34	0.73	-	-	52.3	47.3	0.82	1.23	-	-

Table 2: Effect of organic amendment on wilt incidence, grain yield, 1000-grain weight during 2007-08 and 2008-09 crop season

Treatment	Dose (kg/plot)	Disease incidence (%) 2007-08	Disease incidence (%) 2008-09	Disease decline (%) 2007-08	Disease decline (%) 2008-09	Grain yield (kg/ha) 2007-08	Grain yield (kg/ha) 2008-09	1000 grain weight 2007-08	1000 grain weight 2008-09	% increase over check 2007-08	% increase over check 2008-09
Cow dung manure	2.0	4.75 (12.58)	4.75 (12.58)	72.22	73.36	475.5	525.7	12.95	12.80	35.86	40.19
FYM	2.0	3.25 (10.38)	3.75 (11.16)	80.99	78.97	575.0	610.0	13.88	13.50	64.29	62.67
Spent compost	2.0	5.75 (13.87)	5.25 (13.24)	66.37	70.56	450.7	475.0	12.50	12.60	28.77	26.67
Vermicompost	2.0	4.25 (11.89)	4.20 (11.82)	75.15	76.44	525.5	556.2	13.55	13.0	50.00	48.32
Check	–	17.10 (27.05)	17.83 (28.23)	–	–	350.0	375.0	10.82	10.54	–	–
S.Em. ±	–	0.11	0.17	–	–	6.75	9.09	0.14	0.12	–	–
CD at 5%	–	0.39	0.58	–	–	22.01	29.65	0.47	0.41	–	–

(2002) reported that induction of difference engagers involved in phenylproponiod pathway accumulation of phenolics and PR proteins might have contributed to restricting invasion of pathogen in tomato roots. Gehlot *et al.* (2002) reported that *Pseudomonas fluorescens* reduced the wilt incidence of chilli caused by *Fusarium solani* and it increased the plant biomass and yield of chilli.

The data recorded on soil amendments are presented in Table 2. During 2007-08, disease incidence (3.25%) was recorded in case of FYM, followed by vermicompost (4.25%) and cow dung manure (4.75%). Highest yield was recorded in FYM amended plots (575 kg/ha) followed by cow dung manure (475.5 kg/ha) while in check plot, only 350 kg/ha yield was observed.

During 2008-09 crop season FYM again resulted minimum disease incidence (3.75%) followed by vermicompost (4.20%) and cow dung manure (4.75%) while it was maximum (5.25%) in spent compost. Highest grain yield (610 kg/ha) and 1000-grain weight (13.5g) was recorded in FYM.

During both the crop seasons effect of organic amendments on vascular wilt and grain yield of lentil revealed that the minimum disease incidence was observed in FYM followed by vermicompost and cow dung manure. The highest disease incidence was recorded in spent compost amended plot, while maximum grain yield in FYM followed by vermicompost and cow dung manure. Thousand grain weight was also highest in FYM followed by vermicompost, cow dung manure and spent compost. Manthan and Balabaskar (2002) reported that neem leaf extract (60%), buffalo urine (20%) and poultry litter (40%) were able to inhibit the mycelial growth of *F. moniliforme*. Rajive and Dubey (2003) observed the effect of soil amendments alone or in combination with fertilizers, on lentil wilt (*Fusarium oxysporum* f.sp. *lentis*) at seedling and flowering to pod formation stages. Thus these ecofriendly practices found as an interesting alternative to synthetic fungicides due to their less negative impacts on the environment as well as they are economically feasible.

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