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INTEGRATED MANAGEMENT OF ROOT ROT OF SOYBEAN

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ABTSRACT

Effectiveness of organic ammendments, beneficial microbes and chemical fungicides tested under natural filed conditions against root rot of soybean incited by *Rhizoctonia bataticola*. Results revealed that seed treatment with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carboxin + Thiram (0.1%) at disease inception and Pre- soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed) stood best by recording lowest (6.17 and 8.15%) root rot with 74.48 and 66.28% reduction in disease respectively.

KEYWORDS: Integrated Disease Management, Root Rot and Soybean

INTRODUCTION

Root rot of soybean caused by *Rhizoctonia bataticola* (pycnidial stage *Macrophomina phaseolina*) is severe disease in Maharashtra and other states of India resulting in huge losses on account of pre and post emergence damping off and root rot in well grown plants which cause substantial loss to yield (Chavan and Gupta, 2005). Disease symptoms usually appear under high temperature and low soil moisture or when unfavourable environmental conditions cause stress to the plant. It can cause up to 35% yield loss under congenial conditions (Anonymous, 2014). Yield reductions results from post emergence death of seedling and weakening, root rot as well as premature death of infected plants. Control of the disease is more efficient when integrated measures are adopted involving cultural practices, treatment of seeds with bio-agent, good sanitary and chemical control with recommended fungicides. Being soil borne and poly-phagous pathogen it is difficult to manage in field. Use of fungicides is not sole to solve to this problem. Under such circumstances organic amendments and beneficial microbes helps to manage qualitative changes in myco-flora of soil. Hence, present investigation was undertaken for management of root rot of soybean with fungicides, organic amendments and biological control agents.

MATERIAL AND METHODS

The experiment was laid out in randomized block design with three replications at the farm of Regional Research Center, Amravati, *Kharif*- 2014 under natural field condition. The variety JS-335 was used for the experiment. The plot size of 06 lines of 3 meter length was used with spacing of 45 X 5 cm. The experiment planned with integration of different seed and soil application either chemical or biological agents or amendments like neem cake as sole or in combinations tested. Simultaneously, three replications without the imposition of any treatment maintained as control. Nine different treatments applied are as below-

T1-ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carboxin + Thiram (0.1%) at 50 DAS

T2-ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carbendazim + Mancozeb (0.25%) at 50 DAS

T3-Pre-sowing (15 days before sowing) soil application of neem cake 500 kg/ha + ST with Carboxin + Thiram (2 g/kg seed)

T4-Pre-sowing (15 days before sowing) soil application of *Trichoderma harzianum* 2.5 kg/ha + ST with *T.harzianum* (4g/kg seed)

T5-Pre-sowing (15 days before sowing) soil application of *Pseudomonas fluorescens* @ 5 kg / ha + ST with *P.fluorescens* (10g/kg seed)

T6-Pre-sowing (15 days before sowing) soil application of FYM enriched with *T. harzianum* 2.5 kg/ton FYM + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed)

T7-Pre-sowing soil (15 days before sowing) application of FYM enriched with *Pseudomonas fluorescens* 5 kg/ton FYM + Neem cake 500 kg/ha + ST with *P. fluorescens* (10g/kg seed)

T8-Pre- sowing (15 days before sowing) soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed)

T9- Control

With respect to soil application, treatments of neem cake alone and FYM enriched with bio-control agents in combinations imposed 15 days earlier to sowing. Soil drench with chemicals fungicides taken after 50 DAS. The observation germination, per cent root rot and yield was recorded. The per cent disease incidence was recorded as per the uniform method of AICRP on soybean (Anonymous 2013).

RESULTS AND DISCUSSIONS

The data revealed that (Table 1) there was significant difference in the treatment effects of chemical, bio-agents, organic amendments and their combinations tested on the germination of soybean. Treatment T3- Pre-sowing Soil application of neem cake 500 kg /ha + ST with Carboxin + Thiram (2 g/kg seed) recorded maximum seed germination (91.67%) with highest (28.02 %) increase germination over control. Next best treatment was T1- ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carboxin + Thiram (0.1%) at 50 DAS recorded 90.0% germination with 26.67% increase germination over control followed by treatment T2- ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carbendazim + Mancozeb (0.25%) at 50 DAS registered 89.67% germination with 26.39% hike in germination over control. Least germination recorded in control treatment i.e. 66.0%.

CONCLUSIONS

Least root rot per cent (9.64%) with 68.14% root rot reduction recorded in treatment T1- ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carboxin + Thiram (0.1%) at 50 DAS over a control and other treatments. Second superlative treatment was T8-Pre- soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed) registered minimum (10.37%) root rot with reduction 65.75%. Subsequently treatment T2-ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carbendazim + Mancozeb (0.25%) at 50 DAS also recorded low per cent root rot (10.80%) with 64.32 % reduction in root rot. Higher per cent of root rot (30.27) observed in control treatment. (Table 2).

All the tested treatments recorded significantly higher yield over control. Among the treatments, T1- ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carboxin + Thiram (0.1%) at 50 DAS was found most effective which recorded highest grain yield (1934 kg/ha) followed by treatment T-8 Pre- soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed) (1811 kg/ha).Second best set of treatment were treatment T2, T6 and T7 recorded 1749, 1663 and 1671 kg/ha yield and which is at par with each other. Lowest yield was obtained in control (1008 kg/ha).

Organic ammendments, beneficial microbes and chemical fungicides evaluated under natural filed conditions against root rot of soybean were found most effective in increasing seed germination, reducing the disease incidence as well as increasing the seed yield over control. Efficacy of neem cake, beneficial microbes like *T. harzianum* and *P. fluorescens* and chemical seed dressing fungicides in controlling root rot of soybean and allied field crops with increase in yield were reported by several workers (Gupta and Sharma, 2009; Pitamber *et al*., 2010 ; Belkar and Gade, 2013 and Dhutraj and Utpal Dey 2014). Seed treatment with fungicides protect the seed from infection with seed and soil borne pathogens, enables the seed to germinate and establish as a healthy seedlings (Anitha *et al.,* 2015). The use of organic amendments and bio-control agents is one of the potential non chemical means to reduce the soil borne plant pathogenic disease. So, that their integration in soil borne disease management is advocated.

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APPENDICES

Table 1: Effect of Different Treatments on Germination of Soybean

Sr. No.	Treatments	% Germination	% Increase Germination Over Control
1	ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with 0.1% Carboxin + Thiram at 50 DAS	90.0 (71.94)#	26.67
2	ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carbendazim + Mancozeb (0.25%) at 50 DAS	89.67 (71.68)	26.39
3	Pre-sowing Soil application of neem cake 500kg/ha + ST with Carboxin+Thiram (2 g/kg seed)	91.67 (73.81)	28.02
4	Pre-sowing soil application of *Trichoderma harzianum* 2.5kg/ha +ST with *T.harzianum* (4g/kg seed)	84.00 (66.65)	21.43
5	Pre-sowing soil application of *Pseudomonas fluorescens*@5kg/ha+ST with *P.f* (10g/kg seed)	85.00 (67.31)	22.35
6	Pre-soil application of FYM enriched with *T. harzianum* 2.5 kg/ton FYM+ neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed)	87.33 (69.40)	24.42
7	Pre-soil application of FYM enriched with *Pseudomonas fluorescens* 5kg/ton FYM + neem cake 500 kg/ha + ST with *P. fluorescens* (10g/kg seed)	88.00 (70.01)	25.00
8	Pre- soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively+ neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed)	88.67 (70.57)	25.57
9	Control	66.00 (54.52)	
	Test	Sig.	
	SE ± (m)	2.81	
	CD (P=0.05)	8.45	

Figures in parenthesis are arc sin transformed value

Table 2: Effect of Different Treatments on Per Cent Root Rot and Yield of Soybean

Sr. No.	Treatments	% Root Rot	% Root Rot Reduction	Yield (Kg/Plot)
1	ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with 0.1% Carboxin + Thiram at 50 DAS	9.64 (3.10)*	68.14	1934
2	ST with Carboxin + Thiram (2.0 g/kg seed) + soil drench with Carbendazim + Mancozeb (0.25%) at 50 DAS	10.80 (3.28)	64.32	1749
3	Pre-sowing Soil application of neem cake 500kg/ha + ST with Carboxin + Thiram (2 g/kg seed)	12.33 (3.50)	59.25	1556
4	Pre-sowing soil application of *Trichoderma harzianum* 2.5kg/ha +ST with *T .harzianum* (4g/kg seed)	18.37 (4.28)	39.30	1502
5	Pre-sowing soil application of *Pseudomonas fluorescens* @ 5kg/ha + ST with *P. fluorescens* (10g/kg seed)	20.95 (4.57)	30.78	1514
6	Pre-soil application of FYM enriched with *T. harzianum* 2.5 kg/ton FYM + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed)	14.03 (3.74)	53.63	1663
7	Pre-soil application of FYM enriched with *Pseudomonas fluorescens* 5kg/ton FYM + neem	15.83 (3.97)	47.69	1671

	cake 500 kg/ha + ST with *P. fluorescens* (10g/kg seed)			
8	Pre-soil application of FYM enriched with *T. harzianum* and *P. fluorescens* 2.5 kg and 5 kg respectively + neem cake 500 kg/ha + ST with *T. harzianum* (4g/kg seed) and *P. fluorescens* (10g/kg seed)	10.37 (3.22)	65.75	1811
9	Control	30.27 (5.50)		1008
	Test	Sig.		Sig.
	SE ± (m)	0.16		57.7
	CD (P=0.05)	0.48		173.1