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Management of Stem Rot disease of groundnut under field condition

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Field experiment was made on the management of Stem Rot of groundnut with three organic amendments *viz.* groundnut cake, mustard cake and neemcake, two biocontrol agents *viz. Trichoderma viride* and *Psedomonas fluorescens* and one systemic fungicide carbendazim during *kharif* season of 2011-12 and 2012-13. It was found that all the treatments were effective to reduce the incidence of the disease. Among the treatments seed treatment with *Trichoderma viride* and soil application of *T. viride* was found most effective in both the years and was followed by seed treatment with carbendazim and soil drenching with carbendazim. Per cent disease control in two years pooled mean revealed that the maximum disease control was noticed in the plants treated with *Trichoderma viride*. A maximum increase of yield was achieved with the same treatment.

Key words: Groundnut, Stem Rot, fungicide, bioagents, amendments

INTRODUCTION

Groundnut (*Arachis hypogea* L.) is the leading oilseed crop of Odisha which occupies 30.5% of total oilseed area and 64.4% of the total oil seed production. It is a valuable cash crop cultivated by many of small farmers, because of its economic and nutritional value. Stem rot caused by *Sclerotium rolfsii* is one among the most devastating diseases which poses a problem for successful cultivation of the crop (Punja, 1985). The fungus attacks all parts of the plant, but stem infection is the most common and destructive. Stem rot causes pod yield losses of 10-25%, but under severe diseased conditions yield losses range up to 80% (Rodriguezkabana *et al.*, 1975). The pathogen produces sclerotia which remain in the soil as a primary inoculum and are capable of initiating infection in the field. Several antagonistic organisms have been successfully used as biocontrol agents for controlling soil borne pathogens (Deacon, 1991). Additions of organic amendments were also found to increase antagonistic population in soil and thereby decrease the inoculum of soil borne pathogens (Linderman, 1989). The best reduction in pre and post emergence death of seedlings infected by *Sclerotium rolfsii* was given by amendments of different oil cakes, which also increased the activity of antagonistic microorganisms (Kulkarni *et al.*, 1995). Different isolates of *P. fluorescens* and *Trichoderma* spp. were identified as biocontrol

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agents of groundnut stem rot and other soil-borne diseases (Ganesan and Gnanamanickam, 1987). The present experiment was conducted to know the efficacy of organic amendments, biocontrol agents and fungicide against the disease under field conditions.

MATERIALS AND METHODS

Field experiments were conducted during kharif 2011-12 and 2012-13 at research farm of Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha. The station is situated at 20°21'N latitude and 80°55'E longitude in Dhankauda block of Sambalpur district at an altitude of 178.8 m above mean sea level. The experiment was laid out in a plot size 2 m X 2.5 m following randomized block design (RBD) with three replications. Six treatments with a suitable control constituted seven different treatments of the experiment. The treatments were: T_1=control; T_2=soil application of groundnut cake @ 30 q/ha; T_3=soil application of mustard cake @ 25 q/ha; T_4 =seed treatment with *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha; T_5=seed treatment with *Pseudomonas fluorescens* @ 10 g/ kg seed + soil application of *P. fluorescens* @ 2.5 kg/ha; T_6=soil application of neemcake @ 30 q/ ha; T_7=seed treatment with carbendazim (2 g/kg seed) + soil drenching with carbendazim @ 0.2%. The variety Smruti was sown with 30 cm X 10 cm spacing during the month of July in both the years. A recommended fertilizer dose was applied in all the plots and standard agronomic practices were followed as and when necessary to raise the crop. All the organic amendments neemcake @ 30 q/ ha, mustard cake @ 25 q/ha and groundnut cake @ 30q/ha were applied at the time of sowing. Seeds were treated with *Trichoderma viride* @ 10g/kg seed before sowing and followed by soil application with same bioagent @ 2.5 kg/ha at the time of sowing. Seeds were treated with *Pseudomonas fluorescens* @ 10 g/ kg seed followed by soil application @ 2.5 kg/ha. *Trichoderma viride* was mixed with FYM and kept for 15-20 days maintaining proper moisture for growth then it was applied in the field. Three soil drenching with carbendazim were done at 15 days interval starting from 30 days after sowing of the crop. The inoculum *Sclerotium rolfsii* was multiplied in sand maize medium and then applied in the field at the time of sowing @ 10 g/m^2 area. Observations of stem rot of groundnut disease incidence were recorded 15 days before harvest. The per cent disease incidence was calculated by counting numbers of healthy and infected plants in each treatment. The pod yield of each plot was recorded at the time of harvest and converted to q/ha. The data obtained were subjected to statistical analysis and were tested at five per cent level of significance to interpret the treatment differences following Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The results showed that all the treatments reduced the stem rot disease incidence and subsequently increased the yield in comparison to untreated control.

The disease incidence percentage of the two different years were analysed and the pattern of disease incidence of the different treatments of the two years was similar and pooled mean of two years data were presented and conclusion were drawn on the basis of the pooled mean.

The two years pooled analysis data on the incidence of stem rot under different treatments and their yield are presented in Table 1. The pooled mean revealed that per cent disease incidence of all the treatments were significantly reduced in comparison to untreated control. The disease incidence percentage in untreated check in 2012-13 was higher than in 2011-12. The minimum disease incidence was observed in seed treatment with *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha in both the years. The pooled mean also showed the lowest disease incidence of 22.47% in the same treatment whereas the maximum disease incidence was recorded in the control plot (55.43%). Seed treatment with carbendazim + soil drenching with carbendazim recorded next best treatment which was statistically at par with best treatment i.e seed treatment with *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha. *Trichoderma viride* as both seed treatment and soil application along with soil application of neem cake recorded the least stem rot incidence of 10.30 per cent as against 26.37 per cent in control plots. (Thiruvudainambi *et al.*, 2010)

The rest four treatments ie, soil application of groundnut cake @ 30 q/ha, soil application of mustard cake @ 25 q/ha, soil application of neemcake

Table 1 : Effect of different treatments on the incidence of stem rot disease and yield of groundnut

Treatments	Percentage disease incidence			% Reduction of disease incidence over control	Pod yield (q/ha)			Per cent increase yield over control
	2011-12	2012-13	Pooled		2011-12	2012-13	Pooled	
Control (T_1)	49.99 (44.99)*	60.87 (51.32)	55.43 (48.13)	-	13.0	11.7	12.35	-
Soil application of groundnut cake @ 30q/ha (T_2)	35.18 (36.37)	43.58 (41.29)	39.38 (38.87)	29.0	17.0	16.4	16.70	35.2
Soil application of mustard cake @ 25q/ha (T_3)	39.78 (39.10)	45.76 (42.56)	42.77 (40.84)	22.8	16.0	15.3	15.65	26.7
Seed treatment with *Trichoderma viride* @10g/kg seed + soil application of *T.viride* @2.5kg/ha (T_4)	24.15 (29.42)	20.78 (27.00)	22.47 (28.24)	59.5	24.0	25.9	24.95	102.0
Seed treatment with *Psedomonas fluorescens* (@10g/kg seed + soil application of *P. fluorescens* @2.5kg/ha (T_5)	32.48 (34.74)	40.61 (39.57)	36.55 (37.19)	34.1	19.0	17.6	18.30	48.2
Soil application of neem cake @ 30q/ha (T_6)	30.39 (33.44)	36.35 (37.05)	33.37 (35.28)	39.8	20.0	19.5	19.75	59.9
Seed treatment with Carbendazim @ 2g/kg seed + soil drenching with Carbendazim @0.2% (T_7)	27.58 (31.66)	24.82 (29.83)	26.20 (30.78)	52.7	22.0	24.10	23.05	86.6
SE(m)±	0.89	2.05	1.09		2.0	0.79	1.06	
CD(0.05)	2.73	6.31	3.36		6.18	2.43	3.27	
CV%	4.30	9.25	5.09		18.56	7.33	9.84	

*Figure in the parenthesis is angular transformed value

@ 30 q/ha and seed treatment with *P. fluorescens* (10 g/kg seed) + soil application of *P. fluorescens* (2.5 kg/ha) were significantly superior over control in reducing the disease incidence but they themselves did not differ significantly from each other and had shown intermediate effectiveness against the disease.

The percent reduction of disease incidence over control were also calculated and it was found that the maximum disease control i.e 59.5% was achieved with seed treatment with *T. viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha. The next best percent disease reduction of 52.7% was found with seed treatment with carbendazim + soil drenching with carbendazim. Disease reductions of 29%, 22.8%, 34.1% and 39.8% were achieved by the treatments T_2, T_3, T_5 and T_6 respectively.

The pod yield data of the two years were also increased due to different treatments as compared to untreated control. The pooled data on pod yield indicated that highest yield of 24.95 q/ha was obtained with seed treatment with *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha which was closely followed by seed treatment with carbendazim + soil drenching with carbendazim (23.05 q/ha). The yield of the rest of the treatments also differed significantly from the control plot. When percent yield increase was considered, it was found that an increase of yield by 102% was achieved with seed treatment with *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha whereas it was 86.6% in case of seed treatment with carbendazim + soil drenching with carbendazim.

Stem rot of groundnut incidence was reported to be reduced in seed and soil treatment with *T. viride* (Rao and Sitaramaiah, 2000). Islam and Bhuiyan (2006) reported that soil drenching of *Trichoderma* with carboxin and thiram was found to be most effective against foot and tube rot of tuberose caused by *Sclerotium rolfsii*. *Trichoderma* spp. are effective in control of soil/seed borne fungal diseases in several crop plants (Sharma, 1994), including groundnut (Podile and Kishore, 2002). Major mechanisms involved in the biocontrol activity of *Trichoderma* spp. were competition for space and nutrients, production of diffusible and/or volatile antibiotics, and hydrolytic enzymes like chitinase and α-1, 3-glucanase. These hydrolytic enzymes partially degrade the pathogen cell wall and leads to its parasitization (Kubicek *et al.*, 2001).

So, it can be concluded from the present experimental results that stem rot disease of groundnut caused by *Sclerotium rolfsii* can be managed with seed treatment of *Trichoderma viride* @ 10 g/kg seed + soil application of *T. viride* @ 2.5 kg/ha and can give maximum pod yield under field condition.

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