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MANAGEMENT OF RHIZOME ROT DISEASE OF GINGER

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ABSTRACT

Experiment was conducted during the year 2016-17 and 2017-18 at High Altitude Research Station, Orissa University of Agriculture and Technology, Pottangi under Pathology trial to assess the efficacy of different organic and inorganic fungicides viz., *Trichoderma viride, Pseudomonas fluorescens* and Metalaxyl Mancozeb Streptocyclin against rhizome rot of ginger caused mostly by *Phythium sps.* and *Fusarium sps. in-vivo* conditions. Among all the tested fungicides minimum disease intensity and maximum per cent disease control was recorded after third spraying with 0.2 per cent Metalaxyl mancozeb + 0.015 per cent streptocyclin (5.67 and 79.09 respectively) followed by *Trichoderma viride* 6.9 and 74.55 respectively. The higher yield of ginger was obtained with 0.2 per cent Metalaxyl Mancozeb + 0.015 per cent streptocyclin followed by *T.viride* recording 17.55 and 15.94 t ha^{-1} respectively. Highest Benefit : Cost ratio (3.16:1) was recorded by Metalaxyl Mancozeb + Streptocyclin against rhizome rot of ginger.

Being both systemic and contact in nature fungicides like Metalaxyl Mancozeb when applied at regular interval got excellent inhibition capacity on germination and growth of the fungus like *Pythium sps.* and *Fusarium sps.* , the most important cause of rhizome rot of ginger and should be used as curative measures. Whereas use of organic fungicides should be encouraged as preventive measures which has shown its long term effect due to establishment of rhizospheric competent strains and mycoparasitism.

(Key words : Rhizome rot, ginger, disease intensity, yield)

INTRODUCTION

Being considered as 'The land of spices' India enjoys a spectacular position in the production and export of ginger from time immemorial. India is the second largest producer of ginger in the world accounting for about one-fourth of the total world output (Anonymous, 2012). In India, major ginger growing states are Kerala, Sikkim, Meghalaya, West Bengal, Odisha, Tamilnanu, Karnataka, Andhra Pradesh, Maharastra and Himachal Pradesh. In India, area under ginger cultivation is 165,000 ha producing about 1081000 MT (Anonymous, 2017). Area under ginger cultivation in Odisha 14,200 ha with production of 34,200 MT and average productivity of 2.41 MT ha^{-1} (Anonymous, 2017).

Ginger (*Zingiber officinale* Roscoe) belongs to the family zingiberaceae. Despite its antimicrobial properties, ginger is still a host of different plant pathogens, including virus, bacteria, oomycota and fungi. Rhizome rot is one of the most destructive disease of ginger world wide (Dohroo, 2005) and an important production constraint causing yield loss up to 50-80%. Pathogens associated with rhizome rot are mostly *Pythium sp*. and *Fusarium sp* (Savita *et al.,* 2009). Keeping all these importance of Rhizome rot disease of ginger, a trial has been conducted at HARS (OUAT), Pottangi during *kharif* 2016-17 and 2017-18 to frame out a management practice for rhizome rot of ginger.

MATERIALS AND METHODS

Attempts were made to evaluate the effect of different organic and inorganic fungicides on the intensity of rhizome rot disease of ginger. The experiment was conducted in Randomised Block Design, with three replications and seven treatments including control. Variety suprava was used for the study.

The tested fungicides were Metalaxyl MZ 72% WP 0.2%, Streptocyclin 0.015%., *Trichoderma viride* 1%, *Pseudomonas fluorescence* 1%.

There were seven treatments. In first three treatments, only seed treatment was done at the time of sowing with Metalaxyl Mancozeb 72% WP 0.2% + Streptocyclin 0.015%, *Trichoderma viride* @ 10 gms l^{-1} of water and *P. fluorescens* @ 10 g l^{-1}. Next three treatments comprised of soil drenching with the above said chemicals at 45 and 90 days after sowing alongwith seed treatments.

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Seventh treatment was untreated control. Observations on disease intensity was recorded at 30, 60 and 90 days after sowing from five plants of each three replications of all treatments.

The per cent disease intensity was calculated by following formula.

$$\% \text{ Disease Intensity} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \text{x } 100$$

The per cent disease control (PDC) was further calculated for each treatment by using following formula.

$$\text{PDC} = \frac{\text{\% disease intensity in control-\% disease intensity in treatment}}{\text{\% disease intensity in control}} \text{x } 100$$

Observations of ginger rhizome yield t ha^{-1} were recorded. Increased yield over control and Benefit: Cost ratio was calculated.

RESULTS AND DISCUSSION

Pooled data of the year 2016-17 and 2017-18 presented in table 1 revealed that after third spray (90 days after sowing) the best treatment in reducing the rhizome rot disease was seed treatment with Metalaxy Mancozeb 72% WP 0.2% + Streptocyclin 0.015% at the time of sowing then soil drenching at 45 and 90 days after sowing followed by seed treatment with *T.viride* @ 10 g t^{-1} both seed treatment and soil drenching with 5.67 and 6.65 per cent disease intensity respectively. Maximum disease intensity was observed in control 27.12 per cent.

All the fungicidal treatments reduced the disease as compared to control. Seed treatment with Metalaxyl MZ + Streptocyclin at the time of sowing along with soil drenching at 45 and 90 DAS recorded maximum 79.09 per cent disease control followed by *T.viride* both seed treatment and soil drenching which was 74.55 per cent.

Minimum disease control 23.30 per cent was noticed in Metalaxyl mancozeb 72% WP 0.2% + Streptocyclin 0.015% when it applied only as seed treatment at the time of sowing.

Considering Benefit: Cost (B:C) ratio, the most economical treatment which recorded highest B:C ratio 3.16:1 was Metalaxyl MZ 0.02% + Streptocyclin 0.015% both seed treatment and soil drenching with the same at 45 and 90 DAS followed by seed treatment with *T.viride* along with soil drenching at 45 and 90 DAS recorded B:C ratio of 2.82:1.

In the first three treatments seeds were applied with fungicides during the time of sowing and observations were taken at 30, 60 and 90 DAS. Data revealed that per cent disease intentensity was less in case of inorganic fungicide (Metalaxyl MZ + Streptocyclin) at 30 DAS than organic (*T.viride* and *P. fluorescens*) but at 60 and 90 DAS per cent disease intensity was more in case of inorganic than organic, which might be due to the degradation pattern of Metalaxyl Mancozeb (Hanumantharaju and Awasthi ,2004) for which the effectiveness of the chemical ingredients reduced as the time proceed from 30 days to 60 and 90 days.

Where as in case of organic fungicides the biogents like *T.viride* and *P.fluorescens*, developed rhizospheric competent strains which established in the root zones (Sharma *et al.,* 2012) and mycoparasitism (Doley and Jite, 2012), it provides a long term and effective management of soil borne diseases (Harman 2000). The reason is that chemical fungicides reduced their effects at regular interval after application. But organic fungicides still shown its long term effect. The treatments which includes both seed treatment followed by soil drenching showed superiority of inorganic fungicides over organic when we applied at 45 and 90 DAS due to continuous application at regular intervals.

So, from the above discussion it is inferred that application of inorganic fungicides in a regular intervals give immediate results but the use of organic fungicides also encouraged yield by reducing disease intensity which is economical, environment friendly and can be used as an alternative to the systemic fungicides.

Similar results were reported by various researchers such as Jayasekhar *et al*.(2000), who found seed treatment and soil application of Metalaxyl MZ @ 0.1% at 45 and 90 DAP showed lowest disease incidence i.e. 4.23 per cent. Dohroo (2005) observed decrease in percentage of disease intensity and registered highest yield in turmeric with the application of Metalaxyl Mancozeb @ 3% as seed treatment. Ajit Kumar Singh (2011) while studying management practices to control rhizome rot found that seed treatment with Metalaxyl MZ 72% WP showed 81.6 per cent plant survival and maximum yield of 10.2 t ha^{-1}. Singh *et al.* (2004) reported highest seed germination (96.5%) and yield (25 t ha^{-1}) and lowest disease incidence (5%) in rhizome rot of ginger with the application of Metalaxyl MZ under field conditions. Doley and Jite (2012) observed that due to development of rhizospheric competent strains which established in root zones and mycoparasitism *T.viride* and *P.fluorescens* provide long term and effective management of soil borne diseases.

Being both systemic and contact in nature fungicides like Metalaxyl Mancozeb when applied at regular interval got excellent inhibition capacity on germination and growth of the fungus like *Pythium sps.* and *Fusarium sps.* , the most important cause of rhizome rot of ginger and should be used as curative measures. Whereas use of organic fungicides should be encouraged as preventive measures which has shown its long term effect due to establishment of rhizospheric competent strains and mycoparasitism.

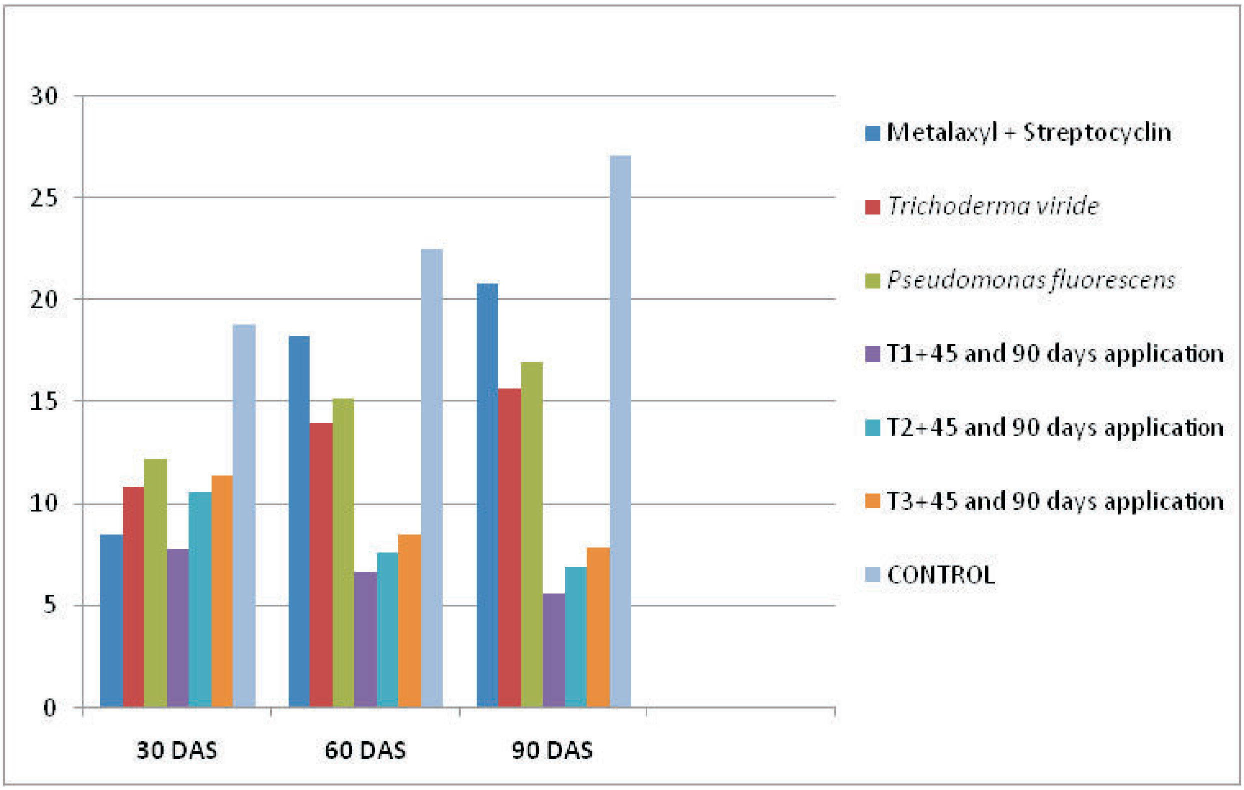

Fig.1.Per cent disease intensity

Fig.2.Ginger plot affected with Rhizome rot

Table 1. Effect of different fungicides on rhizome rot and yield of ginger (Pooled data 2016-17 and 2017-18)

Sl. No.	Treatment Details	Disease Intensity (%) Pooled Data 30 DAS	60 DAS	90 DAS	PDC (in 90 DAS)	Yield t ha^{-1} Pooled Data	Increased yield over Control	B:C Ratio Pooled Data
1	Seed treatment with Metalaxyl MZ 72% WP 0.2% + streptocycline 0.015%	8.05 (16.47)*	18.25 (25.18) *	20.8 (27.12) *	23.30	11.37	1.13	1.77:1
2	Seed treatment with *T.viride* @ 10g/lt.	10.85 (19.22) *	14.01 (21.97) *	15.67 (23.31) *	42.21	14.27	4.03	2.46:1
3	Seed treatment with *P.fluorescens* @ 10g/lt	12.2 (20.43) *	15.19 (22.94) *	17.0 (24.33) *	37.31	13.63	3.39	2.30:1
4	T1+Metalaxyl MZ 72% WP 0.2% + Streptocyclin 0.015 % soil drenching at 45 and 90 DAS	7.8 (16.20) *	6.65 (14.93) *	5.67 (13.77) *	79.09	17.55	7.31	3.16:1
5	T2+*T.viride*@ 10g/lt soil drenching at 45 and 90 DAS	10.62 (19.01) *	7.62 (16.01) *	6.9 (15.22) *	74.55	15.94	5.7	2.82:1
6	T3+*P.fluorescens* @ 10g/lt soil drenching at 45 and 90 DAS	11.39 (19.72) *	8.54 (16.99) *	7.9 (16.31) *	70.87	14.88	4.64	2.56:1
7	CONTROL	18.84 (25.72) *	22.5 (28.30) *	27.12 (31.38) *	-	10.24	-	1.52:1
8	SEm	0.07	0.11	0.07		0.06		
	CD at (5 %)	0.23	0.34	0.21		0.18		
	CV	0.68	0.92	0.55		0.73		

* (Figures in paranthesis are arc sin values)

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