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Management of Rhizome Rot of Ginger

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Abstract In order to study the relative efficacy of different bio-agents, fungicides and bactericide in preventing the initial infection and further spread of rhizome rot disease of ginger (*Zingiber officinale* Rose), a field experiment was conducted for two years during 2016-17 and 2017-18. Rhizome treatment (30 minutes) with Metalaxyl @ 0.2% + Streptocycline @ 0.0115% followed by soil drenching with Metalaxyl MZ 72% WP 0.2% + Streptocycline 0.015% twice, first at the appearance of the disease and then 20 days later was found to be the best treatment with least disease incidence, highest rhizome yield (17.5 t/ha) and B : C ratio of 2.48. Among the bio-agents, rhizome treatment with *Pseudomonas fluoroscens* @ 10g /l and soil drenching with the same at the appearance of the disease twice, first at the appearance of the disease and then 20 days later could effectively manage the disease with a rhizome yield of 14.9 t/ha and B : C ratio of 2.09.

Keywords Ginger, Rhizome rot, Bio-agents, Metalaxyl ,Streptocycline.

Introduction

Ginger, *Zingiber officinale* Rose (Family Zingiberaceae) is one of the most important spices crops of our country, which is used as a condiment and flavoring agent in preparation of non-alcoholic beverages and also has numerous medicinal properties (Sharma et al 2010) . India is the largest producer of ginger accounting for about 1/3rd of total world output (Kumar et al.2014). In Odisha, apart from Koraput and other hilly tracts of the eastern ghat high land zone, it is extensively cultivated in several other places including Kandhamal district. Farmers growing ginger crop usually encounter the attack of several diseases inclusive of bacterial wilt caused by *Ralstonia solanacearum,* rhizome rot caused by *Pythium* spp., *Fusarium* spp. and *Pseudomonas* spp. (Sharma et al. 2010 and Kavyashree 2009). There are more than dozens of diseases affecting ginger but rhizome rot is one of the most destructive diseases of ginger worldwide (Dohroo 2005). The term rhizome rot is generally accepted for soft rot and yellow disease complex (Mathur 2000). This disease alone can cause a loss up to 50-90% and in severe cases there may be a total failure of the crop (Fageria et al. 2006

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and Poudyal 2012).

Demand of ginger is increasing each year throughout the world due to its diverse products and medicinal value (FAO 2009). But the area under ginger is exhibiting a declining trend owing to lack of effective management technology of the disease. Till date chemical approach remains to be the main stay of management of this disease. However the fact is overuse and abuse of chemical fungicides and bactericides have developed an array of deleterious effects. As such, chemical control of this pathogen is not economical because of high cost of chemicals, breakdown of resistance, environmental pollution, toxicological problems, deleterious effect to non target beneficial soil micro-organism and ultimately the choice of the consumers for the organic product. The problems associated with the use of hazardous chemicals for plant disease control has received increasing attention worldwide because it causes health hazards, environmental pollution, pathogens become resistant to chemical pesticides and ecological imbalances may occur (Fry 2009). Kandhamal district of Odisha is projected as organic district of future times. It was thus thought proper to compare both chemical and non-chemical approaches for the disease management so as to arrive at a non-chemical way which if not at par, may manage the disease as good as chemical control.

Among the several production constraints of ginger posed by disease incidence, rhizome rot is considered to be the most important one.

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Materials and Methods

The trial was carried out in the Regional Research and Technology Transfer Station, G. Udayagiri of the Orissa University of Agriculture and Technology in North Eastern Ghat Zone of Odisha; consecutively for two years in the same site during *kharif* 2016 and 2017. The experiments were laid out in randomized block design with seven treatments. Disease free rhizomes of ginger variety Suprava, weighing about 20g were planted in 3m ×1m sub-plots with spacing of 20cm × 20cm for two consecutive years during second fortnight of May. Recommended agronomic package of practices were followed, only excepting the plant protection measures. Observations were recorded as percent disease incidence at 30 DAS, 60 DAS and 90 DAS. Yield of individual plot was recorded separately and converted per hectare yield in each treatment. Benefit : Cost ratio was also calculated as per prevailing market price on cost of cultivation and gross return. Data thus obtained were subjected to statistical analysis (Gomez and Gomez 1984).

Treatmet details

T_1 – Rhizome treatment with Metalaxyl MZ 72% WP @ 0.2% + Streptocycline @ 0.015%, T_2– Rhizome treatment for 30 minutes with *T. viride* @ 5 g/l, T_3 – Rhizome treatment for 30 minutes with *Pseudomonas fluoroscens* @ 10g/l, T_4– T_1 + Soil drenching twice*, with Metalaxyl MZ 72%WP @ 0.2% + Streptocycline @ 0.015%, T_5 – T_2 + Soil drenching twice* , with *T. viride* @ 5g/l, T_6 – T_3 + Soil drenching twice*, with *Pseudomonas fluoroscens* @ 10g/l, T_7 – Untreated control, (*Twice – First on apprearance of the disease and then 20 days later).

Results and Discussion

The effect of chemicals and biocontrol agents on dis-

Table 1. Effect of management of ginger rhizome rot using chemicals and biocontrol agents on yield and benefit cost ratio (2016-2017 and 2017-18).

Treatments	Yield (t/ha) 2016-17	2017-18	B : C ratio 2016-17	2017-18
T_1	11.87	13.8	1.69	1.97
T_2	13.40	14.4	1.91	2.05
T_3	14.53	14.3	2.07	2.04
T_4	18.07	16.7	2.58	2.38
T_5	14.30	13.4	2.04	1.91
T_6	14.90	14.6	2.12	2.07
T_7	9.53	09.5	1.36	1.35
SE (m) ±	0.52	2.76		
CD (0.05)	1.55	8.20		
CV (%)	3.81	1.99		

Table 2. Management of ginger rhizome rot using chemicals and bio-agents.

Treat-ments	Disease incidence (%) pooled data 30 DAS	60 DAS	90 DAS	Yield (t/ha) pooled data	B : C ratio pooled data
T_1	15.32 (23.03)	17.25 (24.50)	21.37 (27.49)	12.97	1.83
T_2	16.45 (23.89)	17.87 (24.95)	22.61 (28.31)	13.92	1.98
T_3	15.93 (23.50)	17.68 (24.80)	22.93 (28.59)	14.43	2.05
T_4	14.77 (22.54)	12.42 (20.62)	7.12 (15.45)	17.53	2.48
T_5	15.37 (23.03)	16.70 (24.12)	13.83 (21.81)	13.87	1.97
T_6	15.62 (23.26)	14.13 (22.06)	11.33 (19.64)	14.94	2.09
T_7	18.53 (25.47)	33.52 (35.37)	33.25 (35.18)	9.52	1.35
SE (m) ±	0.65	0.77	1.43	0.41	
CD (0.05)	1.93	2.30	4.25	1.21	
CV (%)	4.07	4.18	7.56	2.95	

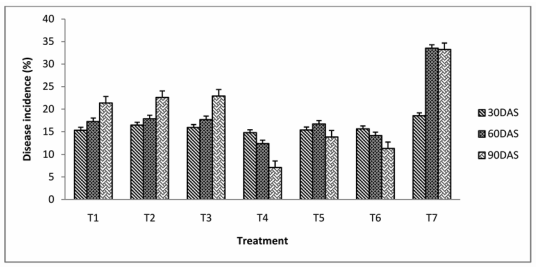

Fig. 1. Effect of chemicals and biocontrol agents on disease incidence.

ease incidence of rhizome rot of ginger is presented in Tables 1 and 2. The results of the experiments revealed that, all the test treatments could effectively manage rhizome rot disease in ginger. However, it was found that rhizome treatment with Metalaxyl MZ 72%WP @ 0.2% + Streptocycline @ 0.015% followed by soil drenching twice, with Metalaxyl MZ 72%WP @ 0.2% + Streptocycline @ 0.015% (T_4), once on appearance of the disease and then 20 days later, was the most significant treatment which could bring down the disease incidence up to 78% as compared to untreated control (Fig.1). This treatment recorded the highest rhizome yield of 17.5 t/ha with the highest B : C ratio of 2.4.

Among the test bio-agents, rhizome treatment with *P. fluoroscens* @ 10g/l followed by soil drenching with the same twice, once on appearance of the disease and then 20 days later (T_6), proved to be the best treatment (Fig. 1). It could bring down the disease incidence by 65%, associated with a rhizome yield of about 15 t/ha and B : C ratio of 2.09. This finding is in agreement with the observations of Bhardwas et al. (1988), who reported that the rhizome treatment with *P. fluoroscens* @ 10g/l followed by soil drenching was most effective treatments to control the rhizome rot disease.

The rhizome treatment with *T. viride* @ 5 g/l followed by soil drenching with the same twice, once on appearance of the disease and then 20 days later (T_5), proved to be the second best treatment among the test bio-agents. In this case there was a reduction of 63% in disease incidence as compared to untreated control; while the rhizome yield was up to 13.9 t/ha with a B: C ratio of 1.9. This is well supported by the findings of Dohroo et al. (1984), who reported that ginger treated with *T. viride* showed more than 80% control of rhizome rot caused by *Pythium, Plerotium* (wet rot) and *Fusarium equiseti* (dry rot). The variation in the extent of contending the disease might be attributed to the difference in virulence of the local strains of the pathogen, prevalent climatic and soil conditions of the sites of testing.

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