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***Research Note* :**

ECO-FRIENDLY MANAGEMENT OF RHIZOME ROT (SOFT ROT) DISEASE OF GINGER UNDER PASIGHAT CONDITION OF ARUNACHAL PRADESH

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ABSTRACT : Rhizome rot of ginger, caused by *Pythium aphanidermatum* (Edson) Fitz, is a major constraint for the production of healthy rhizome, sometimes causing total failure of crop. Chemical control of this pathogen is not economical and non-ecofriendly. Thus, the treatment with bio-control agent (*Trichoderma viride*) may offer practical and economical alternative for eco-friendly management of this disease. The lowest disease incidence (18.00 %) was recorded in T_5 - Rhizome treated with *Trichoderma viride* @ 10g/l of water + Three foliar sprays of *Trichoderma viride* @ 4 kg/ha followed by T_4-Rhizome treated with *Trichoderma viride* @ 10g/l of water + Two foliar sprays of *Trichoderma viride* @ 4 kg/ha with disease incidence of 24.33 %. The highest disease incidence (86.33%) was recorded in T_6 (control) which was raised without any rhizome treatment and foliar sprays.

Keywords : *Ginger, management, Pythium aphanidermatum, rhizome rot, Trichoderma spp.*

Ginger (*Zingiber officinale* Rosae L.) is an important spice crop belonging to family *Zingiberaceae*. Rhizome rot of ginger caused by *Pythium aphanidermatum* (Edson) Fitz is a major constraint for the production of healthy rhizome, sometimes causing total failure of crop (Fagaria *et al.,* 2). Chemical control of this pathogen is not economical because of high cost of chemicals; break down of resistance, environmental pollution, deleterious effect to non target beneficial soil micro-organisms and ultimately the choice of the consumer for organic product. In biological control, disease suppression/ control is the consequences of interactions between the plant, pathogen and microbial community (Singh and Sachan, 6). Thus, the treatment with bio-control agent (*Trichoderma viride*) may offer practical and economical alternative for eco-friendly management of this disease.

The present investigation was carried out at Herbal Garden of Department of Botany, J. N. College, Pasighat, Arunachal Pradesh, India during *Kharif*, 2012-13. The rhizomes were planted in field at 25 x 15 cm spacing with three replications in randomized block design. The six treatments were applied in treated plots along with control (water soaked/sprayed).

Isolation, purification and identification of *Trichoderma* spp.

Fifteen soil samples collected from different agricultural fields, forests and deep forest of East Siang District of Arunachal Pradesh were inoculated on to potato dextrose agar (PDA) and rose bengal agar and incubated at 28 ^{0}C for 5 days. After incubation period, colonies determined to be *Trichoderma spp.* (Watts *et al.* 9, and Rifai, 5) were purified for further experiment.

The treatment details were as below :

T_1-Rhizome treatment with *Trichoderma viride* @ 10g/l of water

T_2-Two foliar spray of *Trichoderma viride* @ 4 kg/ha

T_3-Three foliar spray of *Trichoderma viride* @ 4 kg/ha

T_4-Rhizome treatment with *Trichoderma viride* @ 10g/l of water + Two foliar spray of *Trichoderma viride* @ 4 kg/ha

T_5-Rhizome treatment with *Trichoderma viride* @ 10g/l of water + Three foliar spray of *Trichoderma viride* @ 4 kg/ha

T_6-Control (Water spray)

Rhizome treatment–Rhizomes were dipped in the suspension prepared @ 10 g /l of water. They were shade dried for 15 minutes before planting.

Foliar application - Made a paste by adding 10 g in 15 ml water and then the paste was added to 1.5 litre of water and mixed properly before spraying on the plant parts.

In control, rhizomes were soaked in water instead of *Trichoderma viride*. The treated and untreated rhizomes were sown separately in the experimental plots as well in plastic pots filled with sterilized sand being used for seed quality traits assessment. Foliar sprays of *Trichoderma viride* were done at weekly

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interval starting just after apparent symptom appeared in the field for the first time. The symptomatology and disease incidence was recorded by the formula of (Verma and Awasthi, 8).

The results obtained (Table 1) clearly showed that native bio-control agent *Trichoderma viride* (Rhizome treatment and foliar spray) significantly reduced the growth of the fungus.

Table 1: Effect of rhizome treatment and foliar spray with *Trichoderma viride* on rhizome rot (soft rot) disease of ginger.

Treatments	Disease incidence (%)	Disease reduction (%)
T_1-Rhizome treatment with *Trichoderma viride* 10g/l of water	28.33 (32.16)*	67.18 (54.85)
T_2-Two foliar spray of *Trichoderma viride* @ 4 kg/ha	44.67 (41.94)	48.14 (43.93)
T_3-Three foliar spray of *Trichoderma viride* @ 4 kg/ha	40.67 (39.60)	52.96 (46.70)
T_4- (T_1+T_2)	24.33 (29.49)	71.84 (58.00)
T_5-(T_1+T_3)	18.00 (25.04)	79.19 (62.92)
T_6-Control (Water spray)	86.33 (68.44)	0.00 (02.87)
CD (P = 0.05)	4.10	4.20

*Figures in parenthesis are arcsine transformed values.

Minimum disease incidence (18.00 %) was recorded in T_5 - Rhizome treatment with *Trichoderma viride* @ 10g/l of water + Three foliar spray of *Trichoderma viride* @ 4 kg/ha followed by T_4 Rhizome treatment with *Trichoderma viride* @ 10g/l of water + Two foliar spray of *Trichoderma viride* @ 4 kg/ha (24.33 % incidence), T_1-Rhizome treatment with *Trichoderma viride* @ 10g/l of water (28.33 %), T_3-Three foliar spray of *Trichoderma viride* @ 4 kg/ha (40.67 %) and T_2-Two foliar spray of *Trichoderma viride* @ 4 kg/ha (44.67% disease incidence).

Results pertaining to the efficacy of rhizome treatment and foliar sprays with *Trichoderma viride* indicated the superiority of rhizome treatment plus three foliar sprays of *Trichoderma viride* resulting in to minimum disease incidence having rhizome treatment with *Trichoderma viride* @ 10g/l of water + Two foliar spray of *Trichoderma viride* @ 4 kg/ha. The maximum disease incidence (86.33%) was recorded in T_6 (control) which was raised without any rhizome treatment and foliar sprays, served as control.

Application of *Trichoderma viride* as seed treatment as well soil amendment was found most effective. These results are in agreement with Joseph and Prasad (3) and Srivastava *et al*. (7), who isolated native antagonist *T. viride* from healthy ginger plants and evaluated against rhizome rot. Two isolates *viz*., isolate no. 12 and 7 stimulated plant growth and isolate no. 12 gave higher rhizome yield, better biomass production and disease suppression also. Formulations of antagonistic organisms when once introduced into the soil survive for a longer period. There is also circumstantial report that native antagonists are more efficient than introduced antagonists (Kulkarni and Sagar, 4). Soil amendments alter the soil reaction, change the spectrum of soil microflora, and thus affect the proportion of pathogens existing in soil (Dohroo and Pathania, 1). Addition of organic matter favourably improves crop yield mainly by enhancing soil fertility rather than through provision of nutrients to the plants. Considerable improvements in soil structure, water retention capacity and aeration in different types of soils have been observed following the addition of green manures, farm yard manures and other organic matter. Another additional advantage of using organic matter is the activation of many beneficial microbes antagonistic to soil borne pathogens, leading to disease suppression.

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