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EVALUATION OF INTEGRATED APPROACHES FOR THE MANAGEMENT OF *SCLEROTIUM ROLFSII* CAUSING FOOT ROT DISEASE OF FINGER MILLET

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Abstract

Finger millet is one of the important millet crops widely cultivated across India and more than 60 per cent of its area is concentrated in Karnataka. Although, it is found to be a hardy crop, it is also affected by many diseases, among them foot rot caused by *Sclerotium rolfsii* has been an increasing problem especially in irrigated and heavy rainfall areas. So, several integrated methods were tested against this disease under sick plot conditions. Out of which the treatment containing the soil application of enriched *P. flourescens* + *T. viride* (five hundred gram each of talc formulations mixed in 25 kg FYM incubated for 15 days and applied for one ha) showed least disease incidence (2.08%) both at 45 days after transplanting and at the time of harvest followed by soil application of enriched, *T. viride* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha) with 3.18% disease as against 20.58% in the control plots.

Key words : Finger millet, foot rot, *Sclerotium rolfsii* and management.

Introduction

Finger millet [*Eleusine coracana* (L.) Gaertn.] is one of the important millet crops of India, commonly referred to as Ragi, Bird's foot, Nagli, Mandua in different regions of the country. It belongs to the family Poaceae. It is grown throughout the country extending from Tamil Nadu in the South to Uttarakhand in the North. This crop occupies more than 1.0 m. ha area in Karnataka and Karnataka alone contributes more than 60 per cent of its total production in the country. Finger millet is used as a staple food by many farming communities in south India because of its high nutritive value. Ragi is nutritionally rich with high quality protein; plenty of minerals, dietary fiber, phytochemicals and is having 8-10 times more calcium than rice and wheat and is recommended for diabetic patients. Although, ragi is known to be one of the hardiest crops, relatively free from pests and diseases, it is attacked by many diseases. Among these diseases, foot rot caused by *Sclerotium rolfsii* is one of the important emerging diseases of ragi and is on the increase in the recent past particularly under irrigated and high rainfall situations (Nagaraja and Reddy, 2009). The disease has been reported to cause more than 50 per cent yield loss (Batsa and Tamang, 1983).

Sclerotium rolfsii Sacc. is a well known and most destructive soil borne fungus initially described by Rolfs (1892) on tomato. The *Sclerotium rolfsii* is widely distributed and causes severe damage to more than 500 crops (Aycock, 1966).

Although, there are several other *Sclerotium* producing fungi, the fungus characterized by small tan to dark-brown or black spherical sclerotia with internally differentiated rind, cortex and medulla were placed in the form genus *Sclerotium* (Punja and Rahe, 1992). *Sclerotium rolfsii* Sacc. is predominantly distributed throughout tropical and subtropical regions where, the temperature reaches higher levels during the rainy season. This pathogen causes a variety of symptoms on different hosts like collar rot in chickpea, southern blight of sugar beet, foot rot of finger millet, leaf spot in *Lotus meliloti*, bud rot of *Colocasia variagata* and fruit rot in *Citrullus*

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vulgaris etc. Consequently the diseases caused by this fungus are more serious in tropical and subtropical regions than in temperate regions and this pathogen is of major importance throughout the world.

As *Sclerotium rolfsii* is a soil borne pathogen, use of fungicides may not be economical as it requires a drench to the whole field and development of resistance to the fungicides was a common problem. The cultural practices like crop rotation was also not effective against the *Sclerotium rolfsii* as it has wide host range can infect more than 500 crops. Soil solarisation is one of the effective method to control the soil borne pathogens but it is only suitable for nursery conditions and not advisible for field level. By keeping these things in mind, studies were undertaken to evaluate best integrated management practises for the control of foot rot disease of finger millet caused by *Sclerotium rolfsii*.

Materials and Methods

The experiment was carried out in *Kharif* 2011 in Mandya, Karnataka. Plots of size 3m × 2.25m were made. These plots were made sick by applying pathogen cultures to the soil. Finger millet variety Indaf-5 was sown in nursery as this variety was known to be Susceptible to foot rot disease. After 22 days, these seedlings were transplanted to the sick plots at 30 × 10 cm spacing. The experiment was designed as Randomised complete block design with 3 replications. The experiment was carried out with 7 treatments and a control plot. The treatments containing both chemical and bio control treatments and both soil application and seed treatment methods were formulated in order to know the effectiveness of different methods of application in controlling the disease. The treatment details are as follows

T_1- Seed treatment with *P. flourescens* @ 10g/kg seed.

T_2- Seed treatment with *T. viride* @ 10g/kg seed.

T_3- Seed treatment with *P. flourescens* and *T. viride* each @ 5g/kg seed.

T_4- Seed treatment with Vitavax power @ 2g/kg seed.

T_5- Soil application of enriched *P. flourescens* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha).

T_6- Soil application of enriched *T. viride* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha).

T_7- Soil application of enriched *P. flourescens* + *T. viride* (five hundred gram each of talc formulations mixed in 25 kg FYM incubated for 15 days and applied for one ha).

T_8- Control.

The results were statistically analysed as per the procedures given by Panse and Sukhatme (1985). Actual data in percentage were converted to angular values before analysis.

Results and Discussion

Among the different integrated methods tested, application of bio agents was effective in controlling the foot rot disease than the chemicals. In the bio agents, combined application of bacterial and fungal bio-agents was found to be better compared to lone application. When, we applied these bio agents individually fungal bio agents was more effective, but the lone application of bacterial bio agent showed more incidence of foot rot disease than the chemicals. The results also showed that the soil application of bio agents is more helpful than seed treatment. In seed treatment plots the disease ranged from 4.06 to 6.38% whereas in soil application plots disease incidence ranged from 2.08 to 4.52% at the time of harvest. In seed treatment plots disease incidence increased after 45 days after transplanting, whereas in soil application plots disease incidence is almost constant both at 45days after transplanting and at harvest. Among the different treatments the plots receiving soil application of enriched *P. flourescens* + *T. viride* (five hundred gram each of talc formulations mixed in 25 kg FYM incubated for 15 days and applied for one ha) showed least disease incidence (2.08%) both at 45 days after transplanting and at the time of harvest (table 1) followed by soil application of enriched *T. viride* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha) with 3.18% disease as against 20.58% in the control plots that were on par with each other and the treatment containing seed treatment of *P. flourescens* showed more disease incidence among the treatments other than the control.

The reduced disease incidence has been attributed by several factors including soil temperature, moisture, as these affect both pathogen and bioagent. During the early stage of the crop, the crop by avoiding the infection by the pathogen, but at later stages bioagent doesn't have any effect on pathogen so the disease incidence is increased in seed treated plots. In case of soil application, after the establishment of the crop, the applied bioagent in the soil might build up their population and helps the growing plant to avoid pathogenic infection.

Manjunatha and Kiran Babu (2012) reviewed several

Table 1 : Effect of different management practices on foot rot of finger millet.

Treatments	Treatment details	Foot rot (%)		Yield (kg/ha)
		At 45 days	At harvest	
T_1	Seed Treatment with *P. flourescens* @10g/kg seed	5.04 (13.00)*	6.38 (14.60)	3250
T_2	Seed Treatment with *T. viride* @ 10g/kg seed	3.21(10.32)	4.54 (12.30)	3395
T_3	Seed Treatment with *P. flourescens* + *T. viride* each@5g/kg seed	4.21(11.84)	4.06 (11.62)	3343
T_4	Seed Treatment with Carboxin 37.5% and Thiram 37.5% @ 2g/kg seed	4.17(11.80)	3.96 (11.50)	3366
T_5	Soil application of enriched *P. flourescens* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha)	4.52(12.27)	4.52 (12.27)	3321
T_6	Soil application of enriched *T. viride* (One kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha)	3.17(10.25)	3.18 (10.27)	3452
T_7	Soil application of enriched *P. flourescens* + *T. viride* (500 g each of talc formulations mixed in 25 kg FYM incubated for 15 days and applied for one ha)	2.07(8.30)	2.08 (8.30)	3795
T_8	Control	9.94(18.37)	20.58(26.97)	3044
	S.Em.±	**1.05**	**1.17**	**117**
	CD at 5%	**2.90**	**3.55**	**356**

*Figures in parenthesis are arc sine transformed values.

research literatures pertaining to *Sclerotium rolfsii* from groundnut and highlighted that, the application of bioagent alone or in combination with chemicals protect the crop without any deleterious effect by *Sclerotium rolfsii*. Similar results were observed by several other workers (Kulkarni and Kulkarni, 1994; Virupaksha Prabhu *et al*., 1997; Sheela *et al*., 1998; Biswas *et al*., 2000 and Patibanda *et al*., 2002) on different crops.

With regard to the yield, it was found that, as the disease increased yields decreased. The highest yield of 3795 kg/ha was recorded in treatment containing soil application of enriched *P. flourescens* + *T. viride* (five hundred gram each of talc formulations mixed in 25 kg FYM incubated for 15 days) followed by 3452 kg/ha in soil application of enriched *T. viride* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days) as against 3044 kg/ha in control. However, the treatment containing the seed treatment with chemical (vitavax power @ 2 g/kg seed) produced 3366 kg/ha yield and it was on par with the other treatments containing bio agents (table 1).

Conclusion

Soil application of bio agents was found to be effective compared to see treatments. The treatment containing the soil application of enriched *P. flourescens* + *T. viride* (500 g each of talc formulations mixed in 25 kg FYM incubated for 15 days and applied for one ha) sowed least disease incidence followed by soil application of enriched *T. viride* (one kg talc formulation mixed in 25 kg FYM, incubated for 15 days and applied for one ha). With respect to the yield also these treatments was effective compared to other treatments tested.

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