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Integrated Management of Sesame (*Sesamum indicum* L.) Diseases

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Abstract: *Field experiment was conducted on integrated disease management practices to combat major diseases and to increase the seed yield of sesame during late kharif season at Regional Agricultural Resarch Station, Jagtial, Telangana revealed that all the IDM modules were superior over farmer's practices, however the module M_3, involving seed treatment with Trichoderma viride (0.4%) and soil application of T.viride @ 2.5 kg/ha followed by spray of Carbendazim plus Mancozeb (Saff) 0.2%) along with Imidachlorprid 17.8SL(0.25ml/lit),was found to be significantly effective IDM practice by recording minimum disease incidence of alternarial leaf spot, powdery mildews and macrophomina stem rot, coupled with maximum seed yield with higher cost benefit C:B (1:4.5) ratio. Among the other modules M2 was found to be the next best practice involving soil application of neem cake @ 250 kg/ha plus seed treatment with Carbendazim 50 WP (0.2%) and spray of Carbendazim plus Mancozeb (Saff 0.2%) along with Imidachlorprid 17.8SL(0.25ml/lit) with good seed yield, significant disease reduction and economically viable C: B (1:3.9) ratio.*

Keywords: *IDM module, neem cake, sesame, Trichoderma viride.*

INTRODUCTION

Sesame (*Sesamum indicum* L.) also known as sesamum, til, gingelly, simsin, gergelim etc and it is the most ancient oilseed crop in the world, regarded as 'Queen of Oilseeds', the quality of its oil being of high nutritional and therapeutic value. High stability of its oil with distinct sweet flavor and oil meal with rich protein make it an ideal for domestic and confectionary uses respectively.

The antioxidants 'sesamin' and 'sesmolin' enhance the keeping quality of oil by making it resistant to rancidity. The oil cake containing 35-50% protein makes a rich feed for poultry and livestock. In the Indian traditional medicine, Ayurveda, sesame is the major ingredient in many of the health rejuvenating formulations and massage oils contain sesame oil as the major ingredient. India is the largest sesame growing country in the world, with an area of 1.76 m.ha and production of 0.75 m.t. But productivity wise it is among the lowest with 384 kg/ha. One of the important biotic reasons for poor yield is diseases. In telangana region the sesame crop is mainly affected by *Alternaria* leaf blight, powdery mildew and dry root rot and phyllody diseases during both karif and rabi. Due to existing health risk and pollution hazards by use of chemical fungicides in plant disease management, it is the need of the hour to minimize pesticide use.

Since sesame seed and oil are in high demand for export due to their high unsaturated fat and methionine content, focus has been shifted on safer alternatives to chemical fungicides in recent years. Biological control had attained importance in modern agriculture to curtail the hazards of intensive use of chemicals for disease control. Since the efficacy of bio control agents in disease management has been inconsistent due to their inability to maintain a critical threshold population necessary for sustained bio control activity, bio control with antagonistic microorganisms alone could not be a complete replacement for management

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strategies currently employed. The biological activities and population of introduced antagonist generally decline with time after their application and thus making the beneficial response of short duration. So to enhance and extend the desired responses, the environment needs to be altered to selectively favor the activities of the introduced biocontrol agent and this can be solved by the addition of specific substrates which are utilized selectively by the introduced microbe employed as biocontrol agent (Paulitz, 2000). Therefore Integrated Disease Management (IDM) strategy could reduce the amount of fungicide used per season in addition to combat diseases in an economically viable and ecologically safe manner. Soil amendments are known to improve the nutrient status and tilth of the soil in addition they also increase the microbial activity so that suppresses pathogens.

Biocontrol agents can grow, prolierate, colonize and protect the newly formed plant parts to which they are not applied. Phytopesticide materials range from whole fresh plants to bioactive phytochemicals or their formulations are known to inhibit pathogens and hence they are considered as attractive supplements to the conventional methods for plant disease management. Hence, all possible attempts were made to assess the effect of IDM modules with chemicals, botanicals, organic amendments and biocontrol agents on disease incidence and yield of sesame in comparison with farmer's practices under field conditions at All India Coordinated Research Project, Regional Agricultural Research Station, Jagtial, Telangana State.

MATERIALS AND METHODS

Field experiments were conducted at Regional Agricultural Research Station, Jagtial, Telangana during late kharif seasons (August to November) under All India Coordinated Research Programme on Sesame with four IDM modules: M1: Soil application of neem cake @ 250 kg /ha+ seed treatment with thiram (0.2%) + carbendazim (0.1%) + foliar spray of mancozeb (0.25%) + endosulfan (0.07%); M2: Seedtreatment with *Trichoderma viride* (0.4 %) + soil application of *T. viride* @ 2.5 kg/ha + foliar spray of mancozeb (0.25%) + endosulfan (0.07%); M3: Soil application of neem cake @ 250 kg/ha + seed treatment with *T. viride (*0.4%) + soil application of *T. viride* @ 2.5 kg/ha + foliar spray of azadirachtin (0.03%) @ 3 ml/l ; M4: Soil application of neem cake @ 250 kg/ha + Seed treatment with *Trichoderma viride* (0.4%) + soil application of T. viride @ 2.5 kg/ha + spray of Azadirachtin (0.03%) and M_5: Farmer's practices (control) in randomized block design with five replications using the cultivar, swetha til. All the foliar sprays applied first as blanket spray at 30DAS or at the initial appearance of the disease in the field and second at 15 days after fist spray. The seed treatment with chemicals and *T. viride* were done individually 24 hrs prior to sowing. Neem cake and *T. viride* (TNAU commercial talc formulation) were applied to the soil individually 3days before the sowing.

The crop was raised as per the recommended agronomic practices to get good crop and observations of disease incidence were recorded one week after the last foliar spray. Powdery mildew and leaf blight incidences were scored by following 0–5 scale (Anonymous, 2008) and Percent Disease Index (PDI) was worked out. The incidence of *Macrophomina* root rot was recorded individually by counting the number of affected and healthy plants in each plot and the Percent Incidence (PI) was calculated. The grain yield was recorded and C:B ratio were worked out. The statistical analysis of the experimental data was carried out by adopting the standard method as described by Gomez and Gomez, (1984).

RESULTS AND DISCUSSION

All the tested IDM modules were found to be superior over farmer's practice (M5) in reducing the disease incidence and increasing grain yield and C:B ratio (Table.1). Of which, IDM module M3 including the Seed treatment with *Trichoderma viride* (0.4%) + soil application of *T.viride* @ 2.5 kg/ha + spray of Carbendazim + Mancozeb (Saff) 0.2%) along with Imidachlorprid 17.8SL(0.25ml/lit), first spray at the initial appearance of the disease and second at 15 days after fist spray was found to be significantly effective by recording the minimum incidence of root rot (1.52%), powdery mildew (1.40%) and

Table 1
Testing of IDM Modules for the management of sesame diseases

S. No.	*Name of the treatment*	*Alternaria (PDI%) (PDI%)*	*Powdery mildews*	*Dryroot/ stem rot (%DI)*	*Yield/ kg/ha*	*C:B ratio*
M1	Soil application of neem cake @ 250 kg/ha+ seed treatment with Thiram (0.2%) + Carbendazim 50 WP (0.1%)+ spray of Mancozeb (0.25%) + Endosulfan (0.07%). first spray at the initial appearance of the disease and second at 15 days after first spray.	1.93(7.95)	3.03(9.99)	6.03(14.11)	678	1:3.3
M2	Soil application of neem cake @ 250 kg/ha + seed treatment with Carbendazim 50 WP (0.2%) + spray of Carbendazim + Mancozeb (Saff) 0.2%) and Imidachlorprid 17.8SL (0.25 ml/lit). First spray at the initial appearance of the disease and second at 15 days after first spray.	1.05(5.75)	1.58(7.15)	2.05(8.19)	729	1:3.9
M3	Seed treatment with *Trichoderma viride* (0.4%) + soil application of T.viride @ 2.5 kg/ha + spray of Carbendazim + Mancozeb (Saff) 0.2%) and Imidachlorprid 17.8SL (0.25ml/lit). first spray at the initial appearance of the disease and second at 15 days after fist spray	0.98(5.57)	1.40(6.67)	1.52(7.04)	733	1:4.5
M4	Soil application of neem cake @ 250 kg/ha + Seed treatment with *Trichoderma viride* (0.4%) + soil application of *T. viride* @ 2.5 kg/ha + spray of Azadirachtin 0.03% first spray at the initial appearance of the disease and second at 15 days after first spray.	2.15(8.37)	3.07(10.06)	4.00(11.49)	661	1:1.2
M5	Farmer practice	2.45(8.96)	3.77(11.19)	9.1(17.48)	622	
	S.Em+	0.244(0.582)	0.224(0.474)	0.648(0.792)	11.83	
	C.D at 5%	0.759(1.184)	0.697(1.477)	2.020(2.468)	36.872	

Data in parenthesis are arc sine transformed values.

Alternaria leaf blight (0.98%). This was in agreement with the findings of Gayathri Subbiah and Indra (2003), who has also reported that soil application of neem cake along with seed treatment and soil application of *T. viride* reduces the groundnut collar rot significantly than seed and soil application of *T. viride* alone.

Regarding seed treatment, the modules M3 with *T. viride* seed treatment recorded significantly lesser disease incidence than module M1 and M2 with chemical seed treatment. From this, it was inferred that seed treatment with bio control agents provide longer protection than chemicals which suppress the seed and soil-borne pathogens. The present investigation is in line with the report of Rao (2009). A similar observation was made by Rajpurohit (2004) against sesame *Alternaria* blight and Rettinassababady *et al*. (2000) against blackgram powdery mildew. Jeyalakshimi *et al.,* (2013) also reported similar results with IDM modules in sesame disease management. Animisha *et al.* (2012) showed that chickpea wilt incited by *Fusarium oxysporum* can be effectively controlled by integration of *T. viride*, carbendazim and neem cakes. Mahesh *et al.* (2010) observed that combined application of carbendazim, *T. viride* and *P. fluorescens* were superior in management of Pigeon pea wilt disease incited by *Fusarium udum var cajani* Govindappa *et al.* (2011) reported that application of biocontrol agents *viz., T. harzianum, B. subtilis* and *P. fluorescens* reduced the *Fusarium* wilt incidence of safflower both under greenhouse and field conditions.

Different mechanisms have been suggested as being responsible for their combined or single effect on fungal inhibition and yield improvement. *T. harzianum* caused a drastic decrease in the rhizosphere population of *F. oxysporum* f. sp. *ciceris* and increased the number of functional nodules in the chickpea roots (Khan *et al*., 2004). Moreover, the induction of resistance and the attenuation of the hormonal disruption caused by the pathogen were both mechanisms by which *T. harzianum* could control *Fusarium* wilt (Martínez-Medina *et al*., 2010). With respect to grain yield, all IDM modules recorded significantly higher seed yield and C:B ratio than farmer's practices.

Among them, M3 ranked first by recording the highest seed yield (733 Kg/ha) and C:B ratio (1: 4.5) followed by M2. Our results are in confirmatory with those of Harman *et al.* (2004) and Haikal (2008) who also observed similar effects of *T. viride* in different crops. Papavizas and Lumsden (1980) opined that changes in soil reaction due to increased activity of introduced *Trichoderma* species might be one among the reasons for the increased seedling growth beside production of growth regulating substances by the antagonists. From the study, it is concluded that IDM module M3 including the Seed treatment with *Trichoderma viride* (0.4%) + soil application of *T.viride* @ 2.5 kg/ha + spray of Carbendazim + Mancozeb (Saff) 0.2%) along with Imidachlorprid 17.8SL(0.25ml/lit), was found to be superior in reducing the diseases and increasing the seed yield coupled with higher cost benefit ratio indicated the use of suitable microbial antagonist, fungicide,along with insecticide, in an appropriate combination could be the key measures for a rational integrated management of sesame diseases in sustainable cropping systems.

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