Integrated management of sesame diseases

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ABSTRACT

Field trials conducted on integrated disease management practices to combat major diseases and to increase the seed yield of sesame during summer 2009 and 2010 revealed that soil application of neem cake (250 kg/ha) along with seed treatment and soil application (2.5 kg/ha) of *Trichoderma viride* followed by foliar spray of azadirachtin @ 3 mL/L on 30 and 45 DAS (Module 3) was found to be significantly effective by recording minimum disease incidence coupled with maximum seed yield with higher cost benefit (C:B) ratio. Though module M2 and M1 ranked next to M3 with statistically on par in reducing the diseases, the module M2 consists of seed treatment and soil application (2.5 kg/ha) of *T. viride* followed by foliar spray of mancozeb (0.25%) + endosulfan (0.07%) on 30 and 45 DAS significantly different from M1 by recording seed yield and C: B ratio. All the modules were superior over farmer's practices (without any treatment)

Key words: Azadirachtin, IDM module, neem cake, sesame, *Trichoderma viride.*

INTRODUCTION

Sesame (*Sesamum indicum* L.) cultivated as summer irrigated crop (January – March) in the coastal ecosystem of Union Territory of Puducherry affected by *Alternaria* leaf blight, powdery mildew and dry root rot diseases results in low productivity. At present chemical fungicides are the first choice for the farmers to combat diseases because of their easy adaptability and immediate therapy. Due to health risk and pollution hazards by use of chemical fungicides in plant disease control, it is considered appropriate to minimize their 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 out 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 biocontrol agents in disease abatement has been inconsistent due to their inability to maintain a critical threshold population necessary for sustained biocontrol activity, biocontrol with antagonistic microorganisms alone could not be a complete replacement for management strategies currently employed.

The activities and population of introduced antagonist generally decline with time after their application and thus making the beneficial response of short duration. To enhance and extend the desired responses, the environment needs to be altered to selectively favour the activities of the introduced biocontrol agent and this can be overcome 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) that incorporates the biocontrol agents, botanicals and organic amendments would reduce the amount of fungicide used per season in addition to combat diseases in an economically viable and ecologically safe proportion. Soil amendments are known to improve the nutrient status and tilth of the soil in addition to increase the microbial activity and to suppress pathogens; biocontrol agents can grow, proliferate, 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, an attempt was 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.

MATERIALS AND METHODS

Field trials were conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, U. T. of Puducherry during summer seasons of (January – March) 2009 and 2010 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%) at 30 and 45 DAS; M2: Seed treatment with *Trichoderma viride* (0.4 %) + soil application of *T. viride* @ 2.5 kg/ha + foliar spray of mancozeb (0.25%) + endosulfan (0.07%) at 30 and 45 DAS; 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 on 30 and 45 DAS and M4: Farmer's practices (control) in randomized block design with five replications using the cultivar, TMV 6.

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 a week before sowing. The crop was raised as per the agronomic practices given in the Crop Production Guide 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 at random quadrate selection in each plot and the Percent Incidence (PI) was calculated. The grain yield was recorded and C:B ratio was worked out. Statistical analysis of the experiment was performed using IRRISTAT modules of International Rice Research Institute, Manila and the treatment means were compared using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

It is evident from the Table 1 that all IDM modules were found to be superior over farmer's practice (M4) in reducing the disease incidence and increasing grain yield and C:B ratio during 2009 and 2010. Of which, IDM module M3 including the soil application of neem cake (250 kg/ha) along with seed treatment and soil application (2.5 kg/ha) of *T. viride* followed by foliar spray of azadirachtin @ 3 mL/L on 30 and 45 DAS was found to be significantly effective by recording the minimum incidence of root rot and powdery mildew (2.01%) during 2009 and root rot (2.54%) and *Alternaria* leaf blight (2.48%) during 2010. This was in agreement with the findings of Gayathri Subbiah and Indra (2003), who has 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. Addition of neem cake promotes biological activity in soil by providing nutrients and favorable conditions for the antagonists besides enhancing host growth and vigor was documented by Mallesh *et al.* (2008). The results of the present study also confirm that soil application of *T. viride* and neem cake exhibited maximum disease suppression when applied in combination than alone. Regarding seed treatment, the modules M2 and M3 with *T. viride* seed treatment recorded significantly lesser disease incidence than M1 with chemical seed treatment. From this, it was inferred that seed treatment with biocontrol agents provide longer protection than chemicals which suppress the seed and soil-borne pathogens only in early stage of the crop growth. The present investigation is in line with the report of Rao (2009). Plant

Table 1. Evaluation of IDM Modules for the management of sesame diseases

Module	2009*				2010*			
	Root rot (%)	Powdery mildew (PDI)	Seed yield (kg/ha)	C:B ratio	Root rot (%)	*Alternaria* blight (PDI)	Seed yield (kg/ha)	C:B
M1	8.28 [b]	5.10 [b]	680 [c]	1:1.03	8.80 [b]	5.44 [b]	708 [c]	1:1.18
M2	7.05[b]	4.22 [b]	690 [b]	1:1.13	6.90 [b]	6.16 [b]	720 [b]	1:1.28
M3	3.04[a]	2.01 [a]	760 [a]	1:1.20	2.54 [a] (9.13)	2.48 [a]	766 [a]	1:1.32
M4	17.7 [c]	11.95 [c]	545 [d]	1:1.00	18.60 [c]	19.40 [c]	495 [d]	1:0.98

SA – Soil Application; ST – Seed Treatment; FS – Foliar Spray

* Mean of five replications. Data in parenthesis are arc sine transformed values. In a column, means followed by a common letter are not significantly different at 5% level by DMRT

received the foliar spray with azadirachtin (0.03%) @ 3 mL/L on 30 and 45 DAS recorded lesser incidence of *Alternaria* leaf blight and powdery mildew. A similar observation was made by Rajpurohit (2004) against sesame *Alternaria* blight and Rettinassababady *et al*. (2000) against blackgram powdery mildew. Sanjay Guleria and Ashok Kumar (2006) confirmed that increased biosynthesis of phenols in Sesame plants sprayed with neem leaf extract are responsible for the drastic reduction of *Alternaria* leaf blight. Rettinassababady *et al*. (2000) found that significant reduction in blackgram powdery mildew incidence due to foliar spray of neem oil (3%) might be due to the presence of sulphur containing compounds *viz.,* nimbidin and azadirachtin.

With respect to grain yield, all IDM modules recorded significantly higher seed yield and C:B than farmer's practices. Among them, M3 ranked first by recording the highest seed yield (760 Kg/ha) and C:B (1: 1.20) during 2009 and 766 kg/ha of seed yield and 1:1.32 C:B during 2010 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. The highest grain yield and C: B ratio of M3 may be attributed due to the nutrient content of the neem cake and increased nutrient uptake through enhance root growth by *Trichoderma* and inclusion of only cheap and easily available biopesticides for managing diseases.

From the study, it is concluded that IDM module M3 including soil application of neem cake + seed and soil application of *T. viride* followed by foliar spray of azadirachtin was found to be superior in reducing the diseases and increasing the seed yield coupled with higher cost benefit ratio.

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