Evaluation of organic soil amendments against *Macrophomina Phaseolina* (Tassi)

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ABSTRACT

In pot culture experiment, among the different organic soil amendments tested, FYM @ 12.5 t/ha and neem cake @ 250 kg/ha were found to be effective in reducing the inoculum levels of *Macrophomina phaseolina* and significantly reduced the incidence of charcoal rot to 13.3 and 15.0 percent respectively from 63.3 % in the control. The rhizosphere population of bacteria and fungi were increased in the amended soils compared to non-amended soils. Soil application of organic amendments also increased the seed germination, seedling growth and seedling vigour index of sunflower.

Keywords: Sunflower, charcoal rot, organic soil amendments

INTRODUCTION

Sunflower is mainly grown in Rabi season as a rainfed crop mostly by marginal farmers. Many diseases affect it and among them, charcoal rot caused *by Macrophomina phaseolina* (Tassi) Goid is a major one and has assumed economically damaging proportions. Control of charcoal rot of sunflower by drenching the soil with fungicides involves high cost and farmers are reluctant to invest money on fungicides. The use of organic amendments is one of the successful control methods of soil-borne diseases. Organic amendment in soil is a general recognized practice in Indian Agriculture for better plant growth and yield. The addition of organic matter to soil reduced the inoculum density of the soil-borne plant pathogens through changes in the general microbial balance by different mechanisms (Lukade, 1992). The present study was undertaken with an object to assess the ability of different organic soil amendments for suppressing the activity of *Macrophomina phaseolina* with special reference to charcoal rot of sunflower.

Table 1. Effect of organic amendment on sunflower plant growth and charcoal rot incidence

Treatments	Germination (%)	Root length (cm)	Shoot length (cm) mg/plant	Dry matter content (mg/plant)	Seedling vigour index	Disease incidence (%) DAS		
						45	60	75
FYM (12.5 t/ha)	96.7 (81.39)	16.4	29.3	870	4420	1.7	6.7	13.3
Coir waste (12.5 t/ha)	86.7 (68.66)	12.7	24.5	732	3224	13.3	21.7	26.7
Neem cake (250 kg/ha)	95.0 (77.08)	15.9	28.8	838	4247	3.3	8.3	15.0
Mahua cake (250 kg/ha)	81.7 (64.69)	10.9	22.3	630	2714	11.7	21.7	31.7
Sheep manure (12.5 t/ha)	91.7 (73.41)	13.5	27.8	773	3785	6.7	11.7	21.7
Paddy husk (3 t/ha)	93.3 (75.24)	13.8	26.2	741	3737	5.0	13.3	16.7
Press mud (12.5 t/ha)	90.0 (71.57)	13.0	26.1	756	3516	8.3	15.0	23.3
Poultry manure (12.5 t/ha)	78.3 (62.29)	10.4	22.1	547	2526	16.7	28.3	36.7
Peat soil (12.5 t/ha)	81.7 (64.69)	9.5	20.3	562	2434	23.3	36.7	46.7
Groundnut cake (250 kg/ha)	81.7 (64.69)	10.7	22.9	650	2744	15.0	21.7	33.3
Sawdust (3 t/ha)	81.7 (64.69)	9.4	21.4	550	2515	16.7	27.7	43.3
Control (*M.phaseolina)*	76.7 (61.14)	8.2	19.1	504	2100	23.3	38.3	63.3
CD (P=0.05)	5.32	1.6	1.9	34	377			3.12

Figures in parantheses are sinc- transformed values; DAS - Days After Sowing

MATERIALS AND METHODS

A pot culture experiment was conducted in unsterilized soil incorporating the different organic amendments to assess their efficacy against sunflower charcoal rot incidence. The organic amendments at the calculated quantities and the sand maize inoculum of the pathogen @ 50 g kg'[1] were mixed with the pot culture soil a week before sowing. The surface sterilized sunflower seeds were sown at the rate of five per pot. Three replications were kept with four pots in each. The pots were maintained inside the glass home with judicious, uniform and regular watering. The observations on the seed em-germination, root length, shoot length and the biomass content were recorded on 15 days after sowing (DAS). The seedling vigour index was also calculated as per ISTA (1985). The charcoal rot disease incidence was recorded on 45, 60 and 75 DAS and expressed as per cent disease incidence. The rhizosphere population of *M. phaseolina*, total fungi and bacteria were assessed on 15, 45 and 75 DAS by following dilution plate technique using Martin's rose Bengal agar and soil extract agar media respectively.

RESULTS AND DISCUSSION

Application of organic amendments significantly improved the seed germination, plant growth and seedling vigour. Among these, FYM @ 12.5 t ha'[1] was the best treatment followed by neem cake @ 250 kg ha-[1] (Table 1). Sethuraman (1991) found that FYM and neem cake significantly increased both the plant growth and the seedling vigour of gingelly. Haque *et al*. (1995) reported increased shoot fresh weight with neem cake and plant height and shoot fresh weight with cotton cake.

Application of FYM and neem cake significantly reduced sunflower charcoal rot incidence (Table 1). Soil application of FYM reduced root rot incidence in safflower (Lukade and Rane, 1994). The reduction of charcoal rot due to soil amendments might be due to the alteration of host physiology so as to bringfroth resistance to *M. phaseolina* (Samiyappan, 1988). Zhang *et al*. (1994) found that compost induced systemic resistance in cucumber to *Pythium* root rot. The increased microbial population due to amendments might play some role in the disease suppression (Osunlaja, 1990).

The population of *M. phaseolina* most significantly reduced in FYM and neem cake amendments in sunflower rhizosphere. The total fungal and bacterial populations also enormously increased (Table 2). Rukmani and Mariappan (1990) reported that organic amendments reduced sclerotial population of *M. phaseolina*. Lumsden *et al*. (1982) stated that soil amendment with the composted sludge led to the stimulation of germination followed by the lysis of the propagules. The stimulated saprophytic microbial activity depleted the nitrogen level

Table 2. Effect of organic amendments on sunflower rhizosphere *M.phaseolina* and other microbial populations

Organic amendments	Microbes											
	M.phaeseolina (cfu 10^{-3} g^{-1} soil)			Mean	Fungi (cfu* 10^{-3} g^{-1} soil)			Mean	Bacteria (cfu 10^{-3} g^{-1} soil)			Mean
	15	45	75		15	45	75		15	45	75	
FYM (12.5 t/ha)	23.3	32.7	45.3	33.8	41.7	61.3	65.0	56.0	72.3	98.3	108.7	93.1
Coir waste (12.5 t/ha)	40.3	54.3	70.7	55.1	37.7	47.7	49.7	45.0	63.7	85.0	95.3	81.
Neem cake (250 kg/ha)	28.3	37.3	46.0	37.2	37.3	58.7	61.7	52.6	69.3	94.7	105.3	89.8
Mahua cake (250 kg/ha)	47.7	60.3	74.3	60.8	25.7	31.3	37.3	31.4	35.3	46.0	56.0	45.8
Sheep manure (12.5 t/ha)	37.3	51.3	66.7	51.8	35.7	48.7	50.0	44.8	63.3	73.0	90.7	75.7
Paddy husk (3 t/ha)	35.3	51.3	69.7	52.1	36.0	56.0	57.7	49.9	57.7	87.7	98.0	81.1
Press mud (12.5 t/ha)	38.0	50.7	67.0	51.9	23.3	44.0	46.0	37.8	55.7	71.0	87.0	71.2
Poultry manure (12.5 t/ha)	50.0	64.0	76.7	63.6	15.7	24.3	27.7	22.6	43.7	52.7	59.7	52.0
Peat soil (12.5 t/ha)	57.7	39.7	81.0	69.4	22.0	34.7	35.0	30.6	77.0	97.7	107.7	91.8
Groundnut cake (250 kg/ha)	50.7	62.0	71.3	61.3	25.7	40.0	43.0	36.2	38.7	51.3	64.0	51.3
Sawdust (3 t/ha)	50.0	67.3	77.7	65.0	20.7	30.7	34.3	28.6	27.3	48.7	56.7	44.2
Control (*M.phaseolina)*	58.7	76.7	92.0	75.8	15.3	27.3	29.3	24.0	22.3	42.7	51.0	38.0
Mean	43.1	56.5	69.9	-	28.1	42.1	44.7	-	51.6	70.7	81.7	-

Initial soil population (zero day) Fungi: 14.4; Bacteria: 20.7

CD (P=0.05)	*M. phaseolina*	Fungi	Bacteria
Treatments	3.1	1.9	3.1
Interval	1.6	1.0	1.5
Interaction	5.4	3.3	5.3

or its form in the soil resulting in imparing the infection process by the pathogen. The decline in the inoculum potential of *M. phaseolina* by incorporation of organic amendments might be due to the release of toxicants (Smith and Ashworth, 1965). Soil amendment with neem cake was reported to favour the multiplication of *Trichoderma* spp (Krishnamoorthy and Bhaskaran, 1991). The addition of organic amendments increased the population of beneficial fungi and bacteria as also reported by several workers (Lukade, 1992 and Hundekar, 1994). Farmyard manure amended soil was enriched with bacteria of which 20 per cent was *Pseudomonas* sp. according to the report by Toyota and Kimara (1991).

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