

T_{20} - Seeds + Castor Oil pretreatment - Boiling with water - Maceration - Filtering thro' muslin cloth - Final dry wt.

$$\% \text{ of dye} = \frac{\text{Final wt of cloth} - \text{Initial wt}}{10g} \times 100$$

T_{21} - Microorganisms Aided Extraction

T_{22} - Enzyme Aided Extraction

T_{23} - Water soaking for 24 hrs

The results of the study revealed that (Table 1) the highest dye yield of 13.25% was recorded in the treatment of T_{20} (castor oil method) followed by T_{13} (Boiling in hot water for 10 min. - 13.09%) in Salem type, whereas the lowest (3.25%) was obtained in the treatment T_{23} (water soaking - 24 hrs) in Hyderabad type.

Among the two genotypes tried, the dye yield was more in Salem type irrespective of various methods tried. When various solvents were compared, hot water boiling aided the easy separation of dye from the seed ad resulted in higher dye yield.

The use of natural colorants is nothing new; extract of annatto has been used in food since generations (Aparanathi and Borkhatriya, 1999). In the present investigation the highest dye yield (13.25%) was obtained in the treatment of T_{20} (castor oil method) followed by T_{13} (Boiling in hot water for 10 min.). A better colour was also obtained in this treatment. This finding in is corroboration with the results of Farooqi (1999). This is the widely adopted method in India. The reason might be due to hot water boiling, which aided an easy separation of dye from the seed by softening the outer seed coat. The dye is present in outer seed coat.

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(Received: December 2002; Revised: May 2004)

Madras Agric. J. 91 (7-12) : 526-529 July-December 2004

Research Notes

Antifungal effects of organic amendments against Fusarium wilt pathogen in banana

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Fusarium wilt caused by *Fusarium oxysporum* f.sp. *cubense* in banana is a serious and most destructive disease in many cultivars (Ploetz *et al.*, 1990). *F. oxysporum* f.sp. *cubense* is highly variable pathogen in soil. Earlier, the management of soil borne pathogen by the addition of organic amendments was investigated in several diseases (Srivastava, 1961; Mahmood, 1964; Singh and Singh, 1970). Reuveni *et al.* (2002) found that

Sweet basil was protected from Fusarium wilt disease when grown in compost, made by mixing the coarse fraction of cattle manure, chicken manure and wheat straw. The organic amendments are locally available in farm, low cost in nature when compared to inorganic fertilizers. Hence, studies were conducted to find out the antifungal effects of organic amendments against Fusarium wilt pathogen in banana.

Fusarium wilt (Race 1) affected banana plants (cv. Rasthali) were collected from the Horticultural Farm, Agricultural College and Research Institute, Madurai, India and used for isolation of *F. oxysporum* f.sp. *cubense* from suckers showing brown discolouration. The experiment was carried during 2000-2001 at Department of Plant Pathology, Agricultural College and Research Institute, Madurai, India. The fungus was purified by single spore isolation technique transferring a single spore into Potato Dextrose Agar Slant (PDAS) and incubated at 28°C for 5 days. Then the fungus was multiplied in sandmaize medium for further study.

The organic amendment *viz.* farmyard manure (FYM), gingelly cake, groundnut cake, mahua cake and neem cake were used in the study. Extracts of the organic amendments were prepared by mixing known quantity in sterile water and filtered through whatman No: 1 filter paper and Seitz filter.

The efficacy of extracts against *F. oxysporum* f.sp. *cubense* was studied by using poisoned food technique (Schmitz, 1930). The extracts were mixed with PDA medium at required concentration and twenty ml of this mixture was poured into sterilized Petri dishes. A nine mm disc of the pathogen was cut and placed at the centre of the medium. The plates were incubated at room temperature for 7 days. The radial growth of the mycelium was measured and the results were expressed as diameter of the growth of the pathogen.

The efficacy of the organic amendments was tested in cultivar Rasthali. Three months old plants were used in the study. The pathogen multiplied in sandmaize medium was incorporated at the rate of 300 g per 10 kg of pot soil. The organic amendments were added at 15 g per pot. The pot was kept in greenhouse for three months. At the end of the three months, the soil sample was collected from the rhizosphere of the plant and used for assessing the population of the pathogen by using serial dilution technique. The results were expressed as number of colony forming unit per g of soil. After three months, the suckers were uprooted and cut horizontally and observed for the presence of

vascular discolouration. The vascular discolouration was measured by using the scale of 1-6 (Orjeda, 1998). The per cent vascular discolouration index was worked out by using the formula (Mckinney, 1923).

Per cent vascular discoloration index =

$$\frac{\text{sum of grades of all individual}}{\text{Total no. of suckers} \times \text{maximum grades}} \times 100$$

The extracts of organic amendments significantly reduced the mycelial growth of *F.oxysporum* f.sp. *cubense* (Table 1). In the organic amendments, neem cake was found to be the most inhibitory to the mycelial growth of the pathogen, followed by groundnut cake. The lesser growth of the pathogen was recorded in farmyard manure. The germination of micro as well as macro conidia was significantly inhibited by all the extracts. Neem cake recorded the maximum reduction of the germination of micro and macro conidia. FYM had the maximum germination of the conidia. Earlier, the neem cake and groundnut cake effectively controlled the growth of *Fusarium udum* (Singh and Singh, 1970; Singh and Singh, 1985) and *F. solani* (Khalis and Manoharchary, 1985). Gautam and Kolte (1997) attributed that the inhibitory effects of oil cake extracts due to the presence of some antifungal ingredients in them.

In the greenhouse experiments, all the organic amendments exhibited significant reduction in the population of the pathogen in the rhizosphere and vascular discolouration index (Table 2). In the amendments applied, neem cake could be observed as the maximum reduction of population of the pathogen and vascular discolouration index. Earlier, Karthikeyan and Karunanithi (1996) reported that organic substrate effectively inhibited the Fusarial wilt incidence in banana.

The soil borne pathogen *F. solani* was reduced by neem cake (Lakshmi and Jeyarajan, 1987), mustard cake and groundnut cake (Chakrabarti and Sen, 1991). Singh *et al.* (2002) observed that farmyard manure effectively reduced chickpea wilt disease.

Table 1. *In vitro* efficacy of organic amendments against *Fusarium oxysporum* f.sp. *cubense*.

Organic amendments	Diameter of growth of <i>Fusarium oxysporum</i> f.sp. <i>cubense</i> (mm)	Per cent micro conidial germination	Per cent macro conidial germination
Farmyard manure	46.00 ^b	29.50 (32.93) ^e	41.17(39.61) ^a
Gingelly cake	38.33 ^c	31.89 (34.38) ^c	40.78 (39.69) ^c
Ground Nut cake	36.00 ^c	23.08 (28.72) ^d	39.73 (39.08) ^c
Mahua cake	38.00 ^d	32.00 (35.06) ^b	46.86 (43.21) ^b
Neem cake	26.71 ^e	11.75 (20.04) ^f	19.67 (26.33) ^d
Control	89.00 ^a	88.83 (70.49) ^a	83.85 (66.42) ^a

* Mean of three replications

Values in parenthesis are arcsine transformed values

Mean followed by same letter are not significantly different at 5% DMRT level.

Table 2. Efficacy of organic amendments against *Fusarium oxysporum* f.sp. *cubense* under green house conditions

Organic	* Per cent vascular discolouration index	Population of <i>Fusarium oxysporum</i> f.sp. <i>cubense</i> (x 10 ⁻⁴ cfu/g of soil)
Farmyard manure	75.33 (60.22) ^b	25.69 ^b
Gingelly cake	60.67 (51.16) ^c	21.67 ^c
Ground Nut cake	57.00 (49.02) ^{cd}	17.89 ^d
Mahua cake	60.33 (50.96) ^c	147.65 ^c
Neem cake	50.83 (45.48) ^c	2.40 ^f
Control	97.67 (81.20) ^a	32.06 ^a

* Mean of three replications

Values in parenthesis are arcsine transformed values

Mean followed by same letter are not significantly different at 5% DMRT level.

Lazarovits *et al.* (2000) reported that soil amendments with compost decreased Verticillium wilt incidence in Tomato. In our study neem cake acts as superior in reducing Fusarium wilt incidence. The amendments were attributed to inhibit the soil borne disease either by antibiosis or by competition, by increasing the saprophytic soil microbial population (Zakaria and Lockwood, 1980; Zakaria *et al.*, 1980). The decomposition of any organic matter provides the food source in which the antagonistic fungi thrive and multiply rapidly because of continuous supply of nutrients from the substrate (Paulitz and Baker, 1987). So the study

revealed that neem cake effectively inhibited the growth and population of *F. oxysporum* f.sp. *cubense* and vascular discoloration in the banana suckers.

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(Received: March 2003; Revised: August 2004).