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Effect of Organic Amendments on Population Dynamics of *Trichoderma* spp. in different Soil Types

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The three *Trichoderma* spp. *viz., Trichoderma harzianum* (Z5TH8), *T. viride (*Z7TV5) and *T. virens (*Z10TVS10) were isolated from black, red and laterite soils under various pH and temperature ranging from 22-30$_0$C. The soils were inoculated with these organisms and incubated upto 180 days under laboratory condition for six months to study the application of neem and pongamia cakes which enhanced the survivability and population in all soil types. In all types of soils, at 30$_{th}$ day of incubation, the population of Z5TH8, Z7TV5 and Z10TVS10 was higher in both neem and pongamia cakeamended soils. The higher population was recorded in neem cake amended soils compared to pongamia amended black soil and laterite soils compared to red soils.

Key words: *Trichoderma*, Neem, Pongamia.

Microorganisms are ubiquitous and highly proliferating. Soil acts as a reservoir for millions of microorganisms, of which more than 85 per cent are beneficial for plant life. *Trichoderma* spp. are fungi that are present in all soils and other diverse habitats. *Trichoderma* spp. have received considerable attention as potential biological control agents against a wide range of soil -borne plant-pathogenic fungi (Chet, 1987) in the green house (Lewis and Papavizas, 1987) and field (Elad *et al*., 1983). However, the efficacy of *Trichoderma* spp. as biocontrol agents in natural soils may be limited by soil fungistatis (Lai, *et al.,* 1968), competition by other soil microorganisms (Harman, *et al*., 1993), poor root colonization (Ahmad and Baker, 1987), or unfavorable environmental conditions. Identification and quantification of ecological factors affecting the establishment and the population dynamics of introduced *Trichoderma* strains in natural habitats may provide more predictable and effective biocontrol of plant diseases.

For effective biological control of soil borne plant pathogens, pH, soil moisture, temperature, organic amendments and presence of other microorganisms influence the population dynamics and their establishment in soil. Biocontrol agents differ fundamentally from chemical fungicides in that they must grow and proliferate to be effective (Nelson *et al.,* 1994). Therefore, effective antagonists must become established in crop ecosystems and remain active against target pathogens during periods favorable for plant infection. The survival ability of biocontrol agents, including population size, survival period and distribution in or on crops, need to be surveyed and associated with biocontrol effects. Hence, keeping these points in view an investigation was carried out to study the influence of various organic amendments on population density of *Trichoderma* spp.

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Materials and Methods

Studies on the Population dynamics and establishment of *Trichoderma* spp. in soil was undertaken in the Department of Agricultural microbiology, University of Agricultural Sciences, GKVK Campus, Bangalore. Four soil samples from each agro climatic zones of Karnataka was collected and the samples were pooled and used for isolation of *Trichoderma* spp using *Trichoderma* selective medium (TSM) developed by Elad and Chet (1983). The fungal isolates were subjected to morphological tests as listed in 'The Manual of Soil Fungi' (Gilman, 1961) and 'A revision of the genus *Trichoderma*. III', (Bisset, 1991). Different tests were conducted to identify the species of *Trichoderma* like colony morphology, microscopic observations etc.

Totally 47 *Trichoderma* isolates were obtained. Three *Trichoderma* isolates were selected for further study based on their inhibition over control against common soil borne plant pathogens viz., *Rhizoctonia solani, Sclerotium rohlfsii, Fusarium oxysporum*, *Pythium* sp. and *Phytopthora* sp. The antagonistic potential of the *Trichoderma* isolates against soil borne fungal pathogens were tested by dual culture method (Dennis and Webster, 1971b) on potato dextrose agar (PDA) medium.

Effect of organic amendments on population dynamics of *Trichoderma* spp. under incubation studies was conducted by taking two hundred grams of air dried sterilized soils, placed in plastic boxes.

The organic amendments like neem and pongamia were added @ 0.5g/200g of soil (Recommended dose of organic amendments 5-6t/ha for pulses).

Each treatment was replicated thrice and all the treatments were kept under controlled condition under room temperature ranging from 25-28◦C. The soil moisture was maintained at different soil moisture status (Maximum water holding capacity-MWHC) constantly by replacing the moisture lost due to evaporation by weighting the soil and adding sterile water at three days interval. The inoculum density of the three selected isolates viz, Z5TH8, Z7TV5 and Z10TVS10 ($2X10_8$ cells/gm of talc formulation) were added separately to each treatment at the rate of 1g of talc formulation/ treatment. Then population dynamics was determined by recovering the *Trichoderma* spp. at monthly intervals on *Trichoderma* selective medium.

Results and Discussion

The population of *Trichoderma* isolates were determined over a period of 180 days at 30 days interval by taking the soil from incubated boxes and plated on *Trichoderma* selective medium (TSM). The survivability and population dynamics was evaluated for the various organic amendments under incubation in different soil types viz, black, red and laterite soils.

In the present investigation,in black soil, at 30th day of incubation, the Z5TH8 population was 53.33 and 41.33 $x10_4$ cfu/g of soil in neem and pongamia cakes amended soils respectively. Whereas, the population of Z7TV5 was 37.67 and 35 $x10_4$ cfu / g of soil and in Z10TVS10 a population load of 29 and 27.67 $x10_4$ cfu/g of soil were observed in neem and pongamia amended soils respectively (fig 1). Comparison between the cakes revealed that higher population was recorded in neem cake amended soils comparted to pongamia amended black soil.

With respect to red soil, at 30th day of incubation, in both neem and pongamia cake amended soils, the Z5TH8 population was 44 $x10_4$ cfu / g of soil. Whereas, the population of Z7TV5 was 39.66 and 37.33 $x10_4$ cfu / g of soil. The population in Z10TVS10 isolate was 32.33 and 30 $x10_4$ cfu / g of soil respectively (fig 2).

In laterite soil, the population of Z5TH8, Z7TV5 and Z10TVS10 were 54, 39.67 and 30.33 $x10_4$ cfu / g of soil in neem cake soils followed by pongamia amended soil (42, 37 and 31.33 $x10_4$ cfu / g of soil)

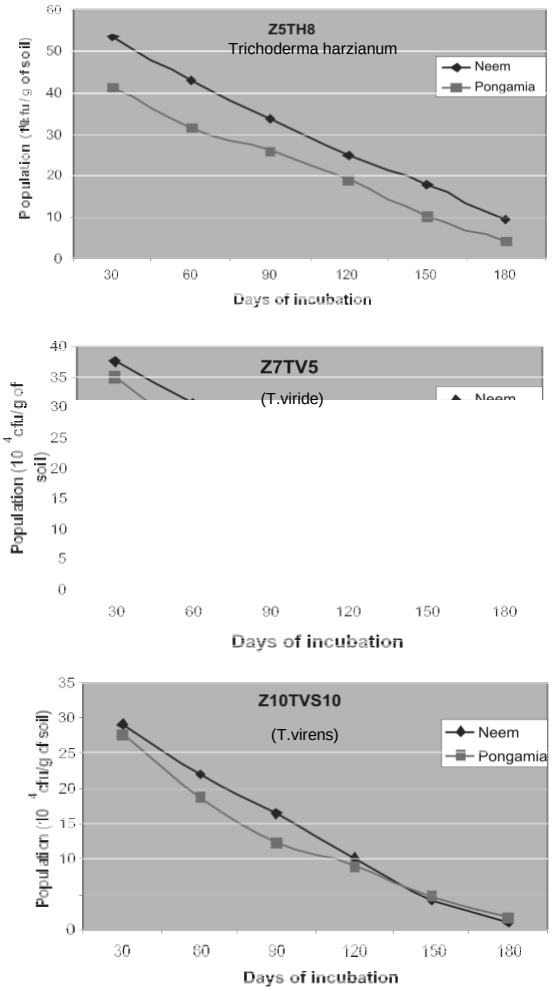

Fig. 1. Effect of neem and pongamia on population dynamics of *Trichoderma* spp. in black soils

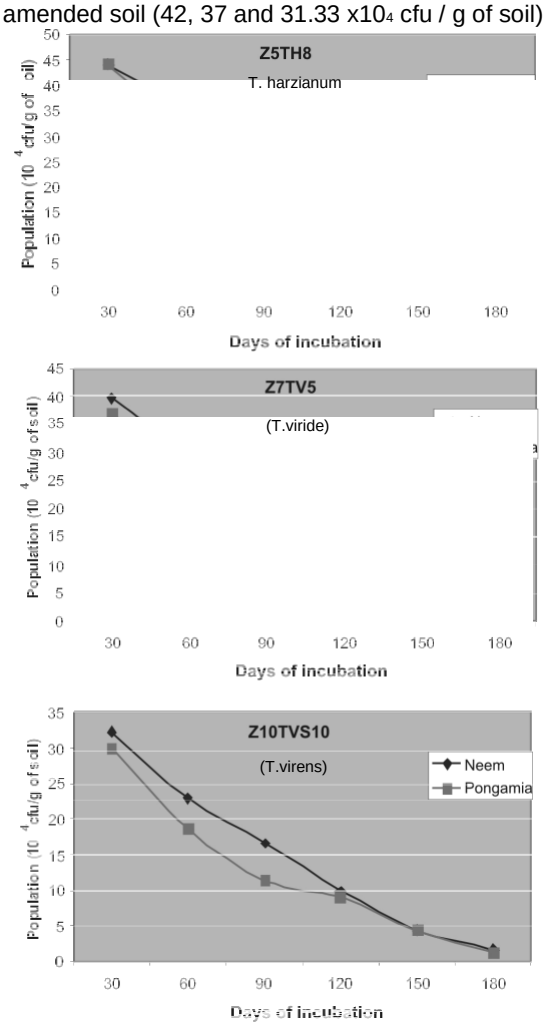

Fig. 2. Effect of neem and pongamia on population dynamics of *Trichoderma* spp. in red soils

after 30th day of incubation (fig 3). Comparison of different soils indicated that red and laterite soil were not found to differ significantly in supporting *Trichoderma* survival.

At 180th day maximum population of Z5TH8 in neem and pongamia applied black soil was 9.33 x10_4 and 4.33 cfu / g of soil respectively. The highest

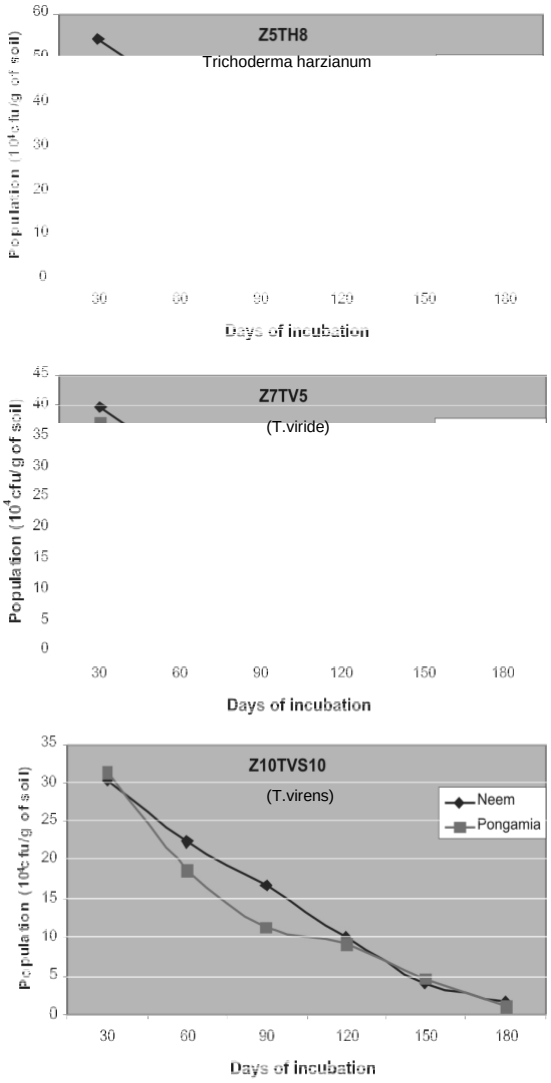

Fig. 3. Effect of neem and pongamia on population dynamics of *Trichoderma* spp. in laterite soils

population of Z7TV5 and Z10TVS10 was 5.33x10_4 and 1.67 x10_4 cfu / g of soil in neem amended soil. Similar trend was observed till 180th day of incubation in soil types with *Trichoderma* isolates studied.

In the present investigation, the *Trichoderma* isolates survived in different soil types. As the days of incubation increased, the population *Trichoderma* isolates decreased in all the soil types. In the present study increase in *Trichoderma* population indicated that neem and pongamia acts as food for establishment and proliferation of *Trichoderma* isolates in different soil types. Shamarao *et al.,* (1998) found that for mass multiplication or production, pongamia was the best medium followed by neem cake and groundnut. The *Trichoderma* spp. responded for the addition of neem and pongamia cakes to the soil. The addition of a food base along with the propagules may allow spores to germinate. Among neem and pongamia, neem amended soils showed maximum population of *Trichoderma* isolates compared to pongamia amended soils up to 180th day of incubation. Lewis and Papavizas (1984) also showed that *Trichoderma, Gliocladium* and other potential biocontrol fungi proliferate abundantly in various soils when added as young mycelia in intimate contact with a food base.

References

Ahmad, J.S. and Baker, R. 1987. Rhizosphere competence of *Trichoderma harzianum*. *Phytopathol.,* **77**:182-189.

Chet, I. 1987. Innovative approaches to plant disease control, John Wiley and sons, New York, N.Y., p 137-160.

Chet, I. 1987. *Trichoderma* – application, mode of action and potential as a biocontrol agent of soil borne plant parthogenic fungi. In: Innovative approaches to plant disease control (Ed., I. Chet), pp. 137-160, John Wiley and Sons, New York.

Elad, Y. and Chet, I. 1983. Improved selective media for isolation of *Trichoderma* and *Fusarium* spp. *Phytoparasitica*, **11**: 55-58.

Elad, Y., Barak, R. and Chet, I. 1983. Ultrastructural studies of the interaction between *Trichoderma spp*. and plant pathogenic fungi. *Phytopathol.,* **107**: 168-175.

Harman, G.E., Hayes, C.K., Lorito, M., Broadway, R.M., Dipietro, A., Peterbauer, C. and Tronsma, A. 1993. Chitinolytic enzymes of *Trichoderma harzianum*: Purification of chitobiosidase and endochitinase. *Phytopathol*., **83**: 313-318.

Lai, M.T., Weinhold, A.R. and Hancock, J.G.1968. permeability changesin *Phaseolus aureus* associated with infection by *Rhizoctonia solani*. *Phytopathol*., **58**: 240-245.

Lewis, J.A. and Papavizas, G.C., 1984. Chlamydospore formation by *Trichoderma* spp.in natural substrates. *Can. J. Microbiol.*, **30**: 1-7.

Lewis, J.A. and Papavizas, G.C. 1987. Application of *Trichoderma* and *Gliocladium* in alginate pellets for control of *Rhizoctonia* damping-off. *Plant Pathol.*, **36**: 438-446.

Nelson, E.B., Burpee, L.L. and Lawton, M.B. 1994. Biological control of turfgrass diseases. 409-427 In: Handbook of Integrated Pest Management for Turf and Ornamentals. A. Leslie, (ed.) CRC Press, Boca Raton, FL.

Shamarao Jahagirdar, Siddaramaian, A. L., Narayanswamy, H. and Jahagirdar, S., 1998. Screening of substrates for mass multiplication of *Trichoderma viride*. *Karnataka J. Agric. Sci.*, **11**: 233-236.

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