The Andhra Agric. J 59(4): 609-612, 2012

Prevalence of *Trichoderma* spp in Different Cropping Systems of Guntur District, Andhra Pradesh

M Anasuya, A K Patibanda, M Subba Rao and M Lal Ahmed
Department of Plant Pathology, Agricultural College, Bapatla 522101, Andhra Pradesh

ABSTRACT

Seven different cropping systems of Guntur district, Andhra Pradesh, *viz*., tobacco nurseries, groundnut, vegetables, cotton, chillies, citrus and rice-pulse systems were assessed for the prevalence of *Trichoderma* spp. Direct soil plating method was found better in enumeration of Trichoderma population compared to dilution plate method. Fungal population was more in tobacco and rice – pulse cropping systems, while it is less in chillies and citrus cropping systems.Direct plating of soil on the *Trichoderma* selective medium resulted in appearance of *Trichoderma* colonies only from cotton, chillies, citrus and rice-pulse system and not from tobacco nurseries, groundnut and vegetables.

Key words : Cropping systems, Fungal population, Prevalence, Soil physicochemical properties, *Trichoderma* spp

Trichoderma spp. were extensively studied biocontrol agents in the management of soil borne plant pathogens (Papavizas, 1985; Upadhyay and Mukapadhyay, 1986). In majority of cases, success was achieved mainly *in vitro* but not *in vivo.* Of the several factors that determine the success of biological control, support of the soil and the cropping system practiced play an important role in the establishment of the applied antagonist. Further, prevalence of antagonistic soil microflora in a definite cropping system also indicates health of the soil. Accordingly, the present investigation was undertaken to assess the prevalence of native antagonistic microflora, *viz*., Trichoderma spp. in different cropping systems of Guntur district, Andhra Pradesh, India.

MATERIALS AND METHODS

Collection of soil samples

For the present study soil samples were collected from seven different cropping systems, *i. e.,* tobacco nurseries, groundnut, vegetables, chillies, cotton, citrus and rice-pulse systems in Guntur district, Andhra Pradesh (Table 1). For each cropping system three villages were chosen. In each village one field was selected from which five soil samples were collected and a composite sample was prepared following quartering technique.

Soil testing

Soil testing was done for pH, EC and organic carbon (Jackson, 1973), available nitrogen (Subbaiah and Asija, 1956), available phosphorus (Watanabe and Olsen, 1965), available potassium (Jackson, 1973) and available copper (Lindsay and Norvell, 1978). Standard soil test ratings were followed for nitrogen (Ramamoorthy and Bajaj, 1969), organic carbon, available phosphorus, available potassium, soil reaction and electrical conductivity (Anonymous, 1989).

Population dynamics of *Trichoderma* spp. and fluorescent Pseudomonads:

Soil samples collected from different cropping systems were assessed for the microbial load, *i.e.,* total fungal and total bacterial colony forming units (cfu) on Potato dextrose agar (PDA) and Nutrient agar (NA) media respectively by using dilution plate technique. Isolation of *Trichoderma* spp. from soil samples was done by dilution plate method and also directly spreading 0.25 g of each test soil sample on to the petriplates containing *Trichoderma* selective medium (TSM) under aseptic conditions and incubated at 28 ± 1^{0}C for three days. Identification of species of *Trichoderma* was done based on cultural characteristics such as colony colour, medium pigmentation and microscopic observations of conidial characteristics as described by Gams and Bisset (1998).

RESULTS AND DISCUSSION

Of the twenty one soil samples analyzed in the present study, six were of loamy sand type (tobacco and groundnut systems) and remaining fifteen were of clay loam type (Table 2). In the loamy sand type, pH was found to be acidic (4.2 – 5.8)

Table 1. Details of soil samples collected from different cropping systems in Guntur district, Andhra Pradesh.

S. No	Cropping system surveyed	Sample / location number	Village	Area
1	Tobacco nursery	L_1	Subbareddy Palem	Bapatla
		L_2	Vedullapalli	
		L_3	Kothapalem	
2	Groundnut	L_1	Stuvertpuram	Bapatla
		L_2	Kavurivaripalem	
		L_3	Gavinivaripalem	
3	Vegetables	L_1	Devinuthala	Narakoduru
		L_2	Narakoduru	
		L_3	Budampadu	
4	Chilies	L_1	Chebrolu	Kakumanu
		L_2	Varagani	
		L_3	Nagulapadu	
5	Cotton	L_1	Kommuru	Kakumani
		L_2	Nagulapadu	
		L_3	Pedanandipadu	
6	Citrus orchards	L_1	Kakumanu	Tenali
		L_2	Kolakalur	
		L_3	Revendrapadu	
7	Rice-pulse system	L_1	Chiluvur	Tenali
		L_2	Gudiwada	
		L_3	Kolakalur Halfpet	

with normal EC (<1.0 dSm^{-1}) and low OC (<0.5%). These soils were found low in N (<280 kg ha^{-1}) and high in P_2O_5 (>50 kg ha^{-1}) and K_2O (>300 kg ha^{-1}) content. Copper content varied from 0.9 to 2.4ppm in different loamy sand type soils collected. Among the fifteen clay loam soils, ten were found to be weakly alkaline (7.5-8.5 pH), normal EC (<1.0 d Sm^{-1}), low OC (<0.5%), low N (<280 kg ha^{-1}), medium to high P_2O_5 (>20 kg ha^{-1}) and K_2O (>150 kg ha^{-1}). In the remaining five samples, four samples were found to be neutral in pH (6.0-7.5) and one sample was in acidic pH (<6.0) (sample L_2 of rice-pulse system).

Of all the samples analysed, highest mean fungal population was recorded in tobacco (1.78 × 10^5 cfu g^{-1}) and rice - pulse system (1.57 × 10^5 cfu g^{-1}) (Table 3). Least mean fungal population was recorded in chillies and citrus systems. It may be noted that though tobacco is a loamy sand type with low OC, acidic pH of the soils could be the reason for high fungal cfu. Brady (1990) stated that molds are abundant in acid surface soils where bacteria and actinomycetes offer mild competition. Low population of fungi in chillies and citrus may be attributed to their neutral (one sample each) to alkaline reaction.

In the present study, though mean fungal cfu varied from 0.43 × 10^5 cfu g^{-1} to 1.78 × 10^5 cfu g^{-1} soil, population of *Trichoderma* was very low, *i.e*., only <2 colonies per g of soil could be recovered when observed on *Trichoderma* selective medium through direct soil plating. These observations were in contradiction to Srinivasa Rao (1999), who recorded 49.26 × 10^4 cfu g^{-1} of *G. virens,* 50.44 × 10^4 cfu g^{-1} of *T. harzianum* and 51.82 × 10^4 cfu g^{-1} of *T. viride* while working with chillies nursery system of Bapatla region in Guntur district of Andhra Pradesh. A decline in the population of *Trichoderma* in the soils analysed was observed in the present studies.

Further in the present experiment, though higher fungal population was observed in tobacco nursery soils, *Trichoderma* prevalence was found nil as no colonies were obtained even when the soil was directly plated on the TSM (Table 4). Similar

Table 2. Physico-chemical properties of soil samples collected from selected cropping systems.

S. No	Cropping system	Sample number	Texture	pH	EC (dSm^{-1})	OC(%)	Kg ha^{-1}			Cu ppm
							N	P_2O_5	K_2O	
1	Tobacco	L_1	Loamy sand	5.8	0.23	0.12	37.6	47.9	499.5	2.4
		L_2	Loamy sand	5.1	0.14	0.33	40.3	100.8	335.9	1.1
		L_3	Loamy sand	4.2	0.10	0.16	31.3	82.2	326.8	1.0
2	Groundnut	L_1	Loamy sand	5.8	0.19	0.17	57.3	146.8	599.2	0.9
		L_2	Loamy sand	6.8	0.27	0.30	43.0	122.3	699.0	1.2
		L_3	Loamy sand	5.4	0.12	0.25	41.2	208.0	726.1	0.9
3	Vegetables	L_1	Clay loam	6.9	0.39	0.39	45.6	16.1	3999.8	1.0
		L_2	Clay loam	7.3	0.26	0.35	42.1	139.5	5356.6	1.0
		L_3	Clay loam	7.7	0.25	0.44	147.8	129.0	6899.1	1.0
4	Chilies	L_1	Clay loam	7.7	0.26	0.33	54.6	70.9	5356.6	1.0
		L_2	Clay loam	7.6	1.14	0.51	46.5	99.9	8625.0	1.1
		L_3	Clay loam	7.8	0.53	0.58	44.8	61.3	4811.9	1.1
5	Cotton	L_1	Clay loam	7.1	2.73	0.50	168.4	128.2	7717.0	1.1
		L_2	Clay loam	7.6	1.10	0.51	60.9	41.1	5446.9	1.2
		L_3	Clay loam	7.5	1.36	0.41	50.2	163.7	6264.6	1.2
6	Citrus orchards	L_1	Clay loam	7.4	0.46	1.05	71.6	175.8	13073.8	1.2
		L_2	Clay loam	7.6	0.31	0.50	50.1	134.2	4696.6	1.5
		L_3	Clay loam	7.5	0.22	0.94	60.0	35.3	8896.6	1.8
7	Rice-pulse	L_1	Clay loam	7.5	0.35	0.23	48.3	155.6	644.6	1.8
		L_2	Clay loam	6.1	0.21	0.77	59.1	249.2	853.4	2.0
		L_3	Clay loam	7.6	0.16	0.23	50.1	100.8	3268.5	1.8

Table 3. Fungal population in soils of selected cropping systems.

S. No	Cropping system	Mean fungal population (X 10^5 cfu g^{-1} soil)	Species and number of *Trichoderma* isolates obtained
1	Tobacco	1.78[a]	Nil
2	Groundnut	0.48[c]	Nil
3	Vegetable	0.6[a]	Nil
4	Cotton	0.83[b]	*T. harzianum* (3)
5	Chilli	0.43[c]	T. virens (2) T. longibrachiatum (1)
6	Citrus	0.43[c]	T. virens (3)
7	Rice-pulse	1.57[a]	T. virens (2) T. longibrachiatum (1)
	CV (%)	12.8	
	CD (P=0.01)	0.25	

Figures represent mean values of three locations.
Figures with similar alphabets do not differ significantly.
Figures in parenthesis indicate number of Trichoderma isolates obtained.

result with zero population of *Trichoderma* was also obtained with groundnut soil which is also loamy sand type, and also from vegetable (clay loam) system. Low OC and application of fungicides such as copper group (in case of tobacco) and Mancozeb (in case of groundnut as seed treatment and in vegetables as spray) were contributed to nil population of *Trichoderma* in case of tobacco, groundnut and vegetables. Warcup (1950) stated that colony forming units obtained through direct soil plating probably reflect the number of conidia lying dormant in the soil, rather than active mycelial mass. Thus in the present investigation, low population of *Trichoderma* (2 cfu g^{-1}) obtained from different cropping systems indicated that *Trichoderma* is not actively proliferating in these soils, rather it may be in dormant state. This may be due to two reasons, *i. e*., No crop situation and unfavourable soil conditions. As the samples were collected from all the cropping systems when crop is in standing stage, the low prevalence is not due to no crop situation. Instead, it appears that these soils (high pH and low OC) and the cropping practices followed are not favouring proliferation of *Trichoderma*.

Only twelve *Trichoderma* isolates could be recovered in the present study from cotton, chillies, citrus and rice-pulse systems (Table 4). All the three isolates recovered from cotton system were identified as *T. harzianum* and all the three isolates recovered from citrus system were identified as *T. virens.* From chillies and rice-pulse systems two isolates each of *T. virens* and one isolate each of *T. longibrachiatum* were recovered.

LITERATURE CITED

Anonymous 1989 Soil survey report of soil correlation. Department of Agriculture, Andhra Pradesh. Government Press, Hyderabad.

Brady N C 1990 The nature and properties of soils. Collier Mac Millan Publisher, London pp 257-265.

Gams W and Bissett J 1998 Morphology and identification of *Trichoderma.* In: *Trichoderma and Gliocladium* Vol 1 Basic biology, toxanomy and genetics. Eds Kubicek C P and Harman G E Taylor and Francis Ltd, London, pp 1-30.

Jackson M L 1973 Soil chemical analysis. Prentice Hall of India Pvt. Ltd. New Delhi. 498p.

Lindsay W L and Norvell A 1978 Development of diethylene triamine penta acetic acid test for zinc, iron, manganese and copper. *Soil Science Society of America Journal,* 42: 421-428.

Papavizas G C 1985 *Trichoderma* and *Gliocladium*: Biology, ecology and potential for biocontrol. *Annual Review of Phytopathology,* 23: 23-54.

Rama Moorthy B and Bajaj J C 1969 Available nitrogen, phosphorous and potassium status of Indian soils. *Fertilizer News,* 14: 25-36.

Sreenivasa Rao 1999 Effect of rhizosphere fungi on damping off disease of chilles M.S. Thesis, ANGRAU, Hyderabad.

Subbaiah B V and Asija G L 1956 A rapid procedure for the determination of available nitrogen in soils. *Current Science,* 25: 259-260.

Upadhyay J P and Mukhapadhyay A N 1986 Biological control of *Sclerotium rolfsii* by *Trichoderma harzianum* in sugarbeet. *Tropical Pest Management,* 32: 215-220.

Warcup J H 1950 The soil plate method for isolation of fungi from soil. Nature 166: 117-118.

Watanabe F S and Olsen S R 1965 Test of ascorbic acid method for determining phosphorous in water and sodium bicarbonate extract of soil. *Soil Science Society of America Proceedings,* 29: 677-679.

(Received on 22.09.2011 and revised on 16.01.2012)