EFFECT OF TRICHO-COMPOST AND TRICHO-LEACHATE AS IPM COMPONENTS FOR DISEASE MANAGEMENT OF POINTED GOURD

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Abstract

The experiments were conducted with pointed gourd (BARI Patol 1) at farmers' field in Jessore and Bogra during 2014 and 2015 to control soil borne and foliar diseases. Two treatments such as (i) cow dung at 2.5 t/ha + full dose of chemical fertilizers+ pesticide spray (control) and (ii) soil application of Tricho-compost @ 2.5 ton per hectare + 80% of chemical fertilizer + foliar application of Tricho-leachate @ 20 ml per liter of water at 15 days interval were used. Bordeaux paste and poison baits trap were used to control gummy stem blight disease and fruit fly, respectively. Tricho-compost and-leachate along with other IPM components reduced pest and diseases of pointed gourd. Only 2.96 -5.00% fruit was infested in Tricho-compost and-leachate applied field, while it was 7.62-10.36% in control field (without Tricho-products) in Jessore. Similarly, fruits infestation was recorded 2.43-2.45% in Tricho-products applied field and 5.03-7.62% in control field at Bogra. Root-knot nematode infestation reduced remarkable due to soil incorporation of Tricho-compost. Disease reduction was 37.49-42.42% in 2014 and 25.36-33.73% in 2015 due application of Tricho-products. While yield increased was 51.78-55.65% in 2014 and 50.73-51.24% in 2015. Benefit Cost Ratio was increased 31.31 -32.16% in 2014 and 19.73-27.73% in 2015 in Tricho-compost and-leachate applied field.

***Key words*:** Tricho-compost, Tricho-leachate, Disease control, Pointed gourd

Introduction

Pointed gourd (*Trichosanthes dioica* Roxb.) is a tropical vegetable crop rich in vitamin (Singh 1989). The plant is a perennial, dioecious, and grown underneath fence. In tropics, pointed gourd produces maximum yields for 3-4 years, after which yield potentiality gradually declines (Samalo and Parida 1983). The pointed gourd thrives well under hot or moderately warm and humid climate. Sandy loam soil is ideally

suitable for its. Both pre-rooted and fresh vine cuttings are used for propagation. The yield of pointed gourd is lower due to several reasons. Among them pest and diseases, especially root knot nematode, *Meloidogyne* sp. causes root damage that helps to enter the vascular pathogen- *Fusarium* spp. and produce nematode-fungal disease complex. About 70 to 80% damage occurred due to root knot nematode and *Fusarium* wilt disease complex (Jones *et al*. 2000, Saha *et al*. 2004). Gummy stem blight disease caused by *Didymella siceraria* is another major disease attacking different cucurbitaceous vegetables including pointed gourd (Afroz *et al*. 2012). During rainy season, vine and fruit rot disease caused by *Phytophthora* spp. causes huge yield loss of pointed gourd (Kumar and Singh 2012). Fruit fly and mealy bug are also damaging crop in pointed gourd fields.

These diseases and pest are regarded as yield limiting factors in the cultivation of pointed gourd. Application of *Trichoderma*-based compost might be helped to minimize the disease incidence and increase the yield. *Trichoderma* spp., is well documented as effective biological control agents of plant diseases caused by soil borne fungi (Sivan and Chet 1994, Basim *et al*. 1999). A number of species within the genus *Trichoderma* are well known for their biological control capabilities against a wide range of commercially important plant pathogens (Whipps and Lumsden 2001, McLean *et al*. 2004). They are known to produce a number of antibiotics, such as trichodermin, trichodermol A and harzianolide (Elad *et al*. 1980, Claydon *et al*. 1991). Parr *et al*. (2002) stated that Liquid bio-products commonly referred to as bio-fertilizers contain living micro-organisms that influence the soil ecosystems and produce supplementary substances for plant growth. Presently, different types of bio-products are available and their quality differs mainly due to the kinds of raw materials used, forms of utilization, and the sources of microorganisms (Higa and Parr 1994). Also, Naidu *et al*. (2010) reported that compost extracts considered as bio-fertilizers have been found to enhance plant growth and to suppress pathogens.

Tricho-compost, a *Trichoderma* based compost fertilizer; was developed by mixing a definite concentration of spore suspension of a *Trichoderma harzianum* strain with measured amounts of processed raw materials, such as cow dung poultry refuse, water hyacinth, vegetable wastes, sawdust, maize bran, and molasses. Tricho-leachate; a liquid by-product of the Tricho-compost; was obtained during decomposition of Tricho-compost materials. The two bio-products are found to effective to control fungal and nematode

diseases in different crops (Nahar *et al*. 2012, Faruk and Rahman 2016). To keep all above, the experiment was undertaken to control diseases and increase the yield of pointed gourd by using Tricho-compost and-leachate along with other pest management tools.

Materials and Methods

The experiments were conducted at farmers' field in Jessore and Bogra district during cropping session 2014 and 2015. Soil of the experimental fields of Jessore was silty clay loam in texture belonging to Calcareous Brown Flood Plain under AEZ-11. Soils of Bogra district were loamy on the upper part of high floodplain ridges and heavy silt loam on lower land belonging to Tista meander flood plain under AEZ-3. Organic matter content varies from 0.8-1.5 percent. Cultivated top soils are slightly acidic to highly acidic but lower soils are slightly acidic to neutral.

Vine cuttings were made from previous year crop and rooted during November-December and planted January-February in order to obtain a crop in the same year. However, both of the locations plants from previous years root sucker are most popular. From one plant root suckers developed a bunch of seedlings. Farmers selected the strong 2/3 seedlings and the rest were destroyed. A male: female ratio of 1:9 was maintained for ensuring maximum fruit set (Maurya *et al*. 1985).

The experiment was laid out following Pair Plot Technique having five replications with two treatments. The treatments were T_0 = Control (cow dung at 2.5 t/ha + full dose of chemical fertilizers+ pesticide spray) and T_1 = Soil application of Tricho-compost @ 2.5 ton per hectare + 80% of chemical fertilizer + foliar application of Tricho-leachate @ 20 ml per liter of water at 15 days interval. The size of raised bed was 6.0 m x 1.50 m and six plants per bed was planted. Tricho-compost and chemical fertilizer except urea were applied in the field before raising bed. Urea was applied twice as top dresses. The distance between plants was 1.5-2.0 cm x 1.5-2.0 cm (Singh 1989). Tricho-leachate was sprayed on foliage at 15 days interval as preventive measure. Bordeaux paste was used for gummy stem blight disease control. Poison bait traps made by sweet gourd smashes and seven and hand picking of insect were used to control fruit fly use as integrated pest management (IPM) component. Hand cleans with soap water to control Mealy bug infestation.

At harvest, rotted and healthy fruits were separated. Total production of pointed gourd was calculated and analyzed statistically in individual year. Root gall was indexed following 0-10 indexing scale (Zeck 1971). Data were statistically analyzed by "t" test following Steel and Torrie (1960). Yield of component crop was converted into equivalent yield on the basis of the prevailing market price of the crop (Alam *et al*. 2003).

Results and Discussion

Phytopthora fruit rot disease incidence was lower in Tricho-leachate application plots compared to farmers' practices regardless locations and years (Table 1). Only 5.00 and 2.96% fruit rot was recorded in Tricho-compost and -leachate treated plots while it was 10.36 and 7.62% in control plots (without Tricho-products) in 2014 and 2015, respectively at Jessore district. Similarly fruit rot incidence was 2.43 and 2.45% in Tricho-products treated plots and 7.62 and 5.03% in control plots in 2014 and 2015, respectively at Bogra district. Root gall significantly reduced due to soil incorporation of Tricho-compost. Considering locations, root gall indexed value was 2.83 -2.97 in Tricho-compost application plots while it was 5.4 -5.77 in farmer's plots in 2014 and it was 2.5-2.8 Tricho-compost treatments and 4.8-5.48 in control plots in 2015. Root gall reduced 24.3 -29.4% in 2014 and 23-30.7% in 2015 regardless locations (Fig. 1.).

Table 1. Effect of Tricho-compost and-leachate on disease incidence and root-knot nematode of pointed gourd at farmers' fields (n=5).

Treatment	Fruit rot* (%) at harvest				Root gall indexed (0-10 scale)			
	Jessore		Bogra		Jessore		Bogra	
	2014	2015	2014	2015	2014	2015	2014	2015
T_1	5.00	2.96	2.43	2.45	2.83	2.8	2.97	2.5
T_0	10.36	5.67	7.62	5.03	5.77	5.87	5.4	4.8
't' test	-	-	-	-	0.01	0.05	.04	0.08

*Disease caused by *Phytophthora* sp.

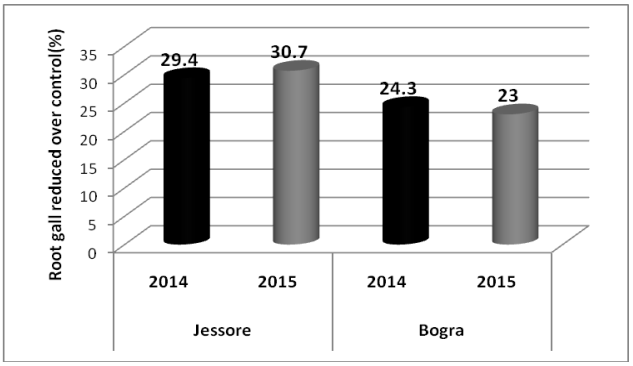

Fig. 1. Percent root gall reduction in Tricho-compost and-leachate applied fields at Jessore and Bogra.

Marketable and total fruit yield was significantly higher in compost application plots compared to control plots regardless of locations and years. Totally, 24.80-28.71 ton per hectare yield was obtained from Tricho-compost plots, while it was 8.15-23.93 ton per hectare in control plots regardless of location and year (Table 2). Disease reduction and yield increased over control were 37.49-42.42% and 51.78-55.65%, respectively in 2014 and 25.36-33.73% and 50.73-51.24%, respectively in 2015 considering the locations (Fig. 2.).

Table 2. Effect of Tricho-compost and-leachate on yield of pointed gourd at farmers' field (n=5).

Treat-ment	Total yield (t/ha)				Marketable yield (t/ha)			
	Jessore		Bogra		Jessore		Bogra	
	2014	2015	2014	2015	2014	2015	2014	2015
T_1	24.80±1.69	28.52±2.19	25.49±2.07	28.71±2.21	23.62±1.71	27.68±2.19	24.88±2.03	28.03±2.21
T_0	18.15±0.51	23.93±1.72	18.42±1.22	22.01±1.87	17.18±0.53	22.08±1.74	17.47±1.25	20.96±1.84
't' test	0.0018	0.02	0.002	0.002	0.0012	0.002	0.002	0.002

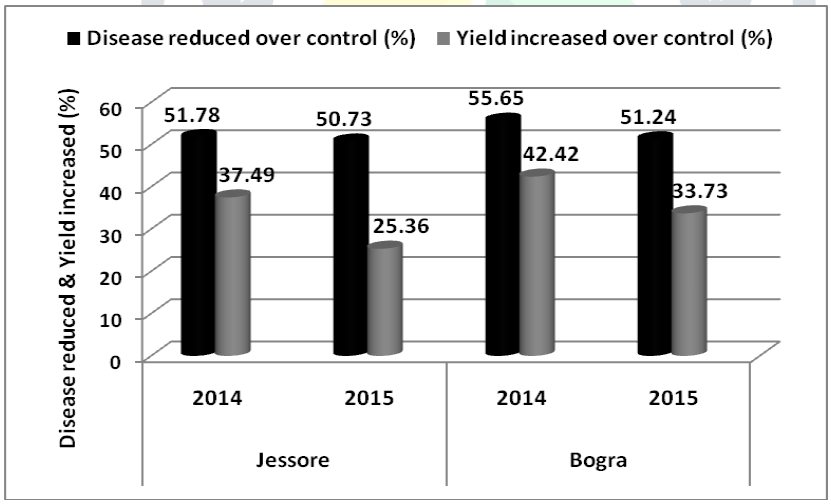

Fig. 2. *Phytophthora* fruit rot reduction and yield increased in Tricho-compost and-leachate applied fields at Jessore and Bogra.

Regardless locations, Benefit Cost Ratio for Tricho-products application treatment were 2.48-3.05 in 2014 and 3.31-3.08 in 2015. While it was 1.89-2.30 in 2014 and 2.41-2.76 in 2015 in control (farmer's practices). Similarly, BCR increased over control by 31.31 -32.16% in 2014 and 19.73-27.73% in 2015 due to Tricho-compost and-leachate application (Table 3).

Table 3. Benefit Cost Ratio (BCR) and BCR increased over control for pointed gourd production using Tricho-compost and-leachate at farmers' fields

Treatment	BCR				BCR increased over control (%)			
	Jessore		Bogra		Jessore		Bogra	
	2014	2015	2014	2015	2014	2015	2014	2015
T_1	2.48	3.31	3.05	3.08	31.31	19.73	32.16	27.73
T_0	1.89	2.76	2.30	2.41	-	-	-	-

Trichoderma harzianum is a soil inhibiting beneficial fungus which is generally used as a biocontrol agent against economically important aerial and soil borne plant pathogens (Papavizas 1985, Harman 2006). Molasses mixing *T. harzianum* was found to be effective to control *Phytophthora cinnamomi* (Kelley 1976). Application of Tricho-compost significantly reduced seedling mortalities, root-knot nematode infestation, and increased yield and quality of vegetable crops (Nahar *et al*. 2012). Faruk *et al*. also reported that Tricho-compost reduced seedling mortality and accelerated plant growth of chickpea with increasing grain yield.

Using Tricho-compost and pheromone traps as integrated disease management components found to be effective to combat soil borne diseases including several of pests such as cucurbit fruit fly and eggplant fruit and shoot borer (Mian *et al*. 2016). Howell and Stipanovic (1983) isolated a new antibiotic, gliovirin from *Trichoderma virens* (GV-P) that was strongly inhibited the growth of *Pythium ultimum* and *Phytophthora* sp. Elad *et al*. (1980) reported *T. harzianum* more effective to control disease incidence and increase yield in greenhouse condition than field condition.

Trichoderma spp. is highly interactive with rhizosphere root and soil environments. It reduced pathogens growth through different mechanisms like competition, antibiosis, mycoparasitism, hyphal interactions, and enzyme secretion. The present study revealed that soil amendment with Tricho-compost and foliar application of Tricho-leachate was most effective for reducing fruit rot and root-galling nematode, and increasing yield of pointed gourd.

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