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Research Article

Comparative effect of composts with and without microbial inoculants on the growth of Vigna radiata

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ABSTRACT

This given research evaluates the effect of compost with and without the living forms of biofertilizer on the growth and development of Mung plants (Vigna radiata). Four different types of Trichoderma species were used to compost Wheat bran as a carbon source @ 10 tons per hectare. The result showed that compost with living organisms induced an overall increase in growth and developments of plants. The promotion in length of plant was significant with the application of compost with living Trichoderma species. The carbohydrate content and the protein content were also increased with both forms of applied composts but the promotion was higher in the plants with the compost containing the living microbial inoculants.

Keywords: Mung plants, Biofertilizer, Trichoderma, and Compost.

INTRODUCTION

Good management of soil includes the addition of organic material to the soil and careful use of chemical fertilizers, pesticides, and farm equipment. Fertilizer is one of the most important things for agriculture & crop production that is added to a soil in the form of organic, inorganic and biofertilizers to supply one or more plant nutrients essential to the growth of plants. Organic material is significant for the suitable organization of soil fertility (Guimarães,et al,2013). Organic substances in soil facilitate plants to grow by improving water-holding capacity and drought-resistance. Cultures of microbes like bacteria, fungi, packed in a carrier material are known as biofertilizers. These Microbial inoculants improved Nitrogen (N) fixation or improving the nutrient availability in the soil indirectly to facilitate the plants (Mc Near, 2013). Composting is a biological process through which microorganisms convert organic materials into useful end products **(**Che Jusoh, 2013) which may be used as soil conditioners and/or organic fertilizer (Hanapi, 2013). It is accepted method for the recycling of manures and organic wastes for the manufacture of soil enhancers. Fungi decompose the complex carbon compounds, advance the accumulation of organic material, and hold nutrients in the fungal biomass, dropping escape of nutrients out of the root zone. Fungus contains certain cellulolytic enzymes that decomposes organic substances (Voriskova & Baldrian, 2012) and can be used as a vector in composts. Trichoderma is filamentous fungi present in nearly all soils and other diverse habitats. The beneficial effects on plant growth and development in the company of *Trichoderma* inoculants are reported suitable to the enrichment in mineral uptake, decayed organic material, making of plant hormones, enzymes and antibiotics, etc (Badar & Qureshi,2012). The enhanced growth response induced by Trichoderma spp. have been reported for lots of crops such as beans, cucumber, pepper, carnation , maize , and wheat (Hermosa,2012).

The solid particulate products of composting, which are extracted during the maturation and curing phase are referred to as compost (Litterick and Wood, 2009;

Paulin and O'Malley, 2008). Despite these definitions, the term composting and compost remain fairly ambiguous as compost has also been used to refer to end-products of other biological processes such as fermentation (Lwin & Ranamukhaarachchi, 2006) as well as to products extracted before the maturity and curing phase of the composting process (St. Martin and Braithwaite, 2012).

Composting has turn into a traditional method for the recycling of organic wastes for the manufacture of soil enhancers. It restricts environmental contamination and soil degradation, diminish land filling of wastes and limits greenhouse gas emissions (Pare´ *et al*., 1998). The fungi decay the complex carbon compounds, get better the addition of organic matter which simply do they physically bind soil particles into aggregates, but they are an vital food source for other organisms in the food web. Fungus, as it contains certain cellulolytic enzymes that decomposes organic matter, can be used as a vector in composts. So, it breaks down the carbon source and been reported to have positive effects on plant growth and development.

MATERIALS AND METHOD

Collection and Isolation of fungi Samples for the composting:

Fungi was collected from different areas of Karachi and Malir district and isolated from root samples of plants on potato dextrose agar that in addition contained antibiotics *viz.,* penicillin (100,000unit/liter) and streptomycin (0.2g/liter) to reduce the growth of gram-positive and negative bacteria (Aneja, 1993)). Known test fugal pathogens and test fungus were made separated, isolated on PDA slants for further use. Microbial inoculation was prepared by shaking 50ml of PDA (potato dextrose agar) broth with 1cm^2 of Trichoderma (Abd-Alla & Omer, 2001) separately for each fungal species. The microbial mixture was use for composting of Wheat Bran as Carbon source.

Experimental Procedure:

Experimental treatments were divided into two groups (Table.1). Each treatment had three replicates. First set contained composted material with living Trichoderma species. In 2nd set, the compost was kept in oven at 100^{0}C, so the Trichoderma were dead and used as without living Trichoderma. Compost was added to the soil in a ratio of 10 ton/ha. After a month treated plants were uprooted and final height (root and shoot length) and weights (fresh and dry weight) were calculated. Total carbohydrate and total protein was determined by using method of Yemm and Willis, 1956 and Lowry's 1951 method respectively. Total phosphorous was estimated by Ashraf et al, 1992 method.

ANALYSIS OF DATA

The data was analyzed by using variance and standard deviation tests through SPSS 16 (version 4). The differences were considered significant at $p<0.05$ when treatments' mean compared with control.

RESULTS AND DISCUSSIONS

The composted wheat bran without Trichoderma sp. showed enhancement of root length in the range of 15% to 17% over control, but in comparison with living Trichoderma sp. which was up to 27% (Fig.1). Application of composted wheat bran without Trichoderma sp. had the positive effect on the shoot length upto 27% over control. This positive effect was less than the promotion in the shoot length treated with composted wheat bran with Trichoderma sp which was 29% (Fig.2). Along with revelation of diverse antifungal mechanisms of Trichoderma the ability to promote plant growth, to increase plant height, leaf area and dry weight were perceived (Pintarić,*et al.*,2013).

Composted wheat bran with Trichoderma species showed upto 107% increase in fresh biomass over control plants (Table.2).*Trichoderma viride in* combination with organic amendments had been known to produce growth hormones, which eventually boost the plant vigor **(** Shamalie *et al*., 2011). Treatment with both groups of composts had an almost equal promotion on the fresh weight over control (Table.2).The increase in dry weight due to the application of compost without Trichoderma species was up to 233% over control, while treatment with Trichoderma sp. increase the dry weight upto 241% (Table.2).Wheat bran (WB) reported as a medium for the development of *T.harzianum* and carrier for the similar fungus which on utilization begin efficient in declining the *Phythiumsp* causing damping off infection in pea, tomato, cucumber, etc(Sivan *et al.*, 1984).

Table 3 showed that, compost without Trichoderma species had positive effect on carbohydrate content up to 134% over control but was less than the promotion with living Trichoderma species treated plants, which was up to 175%. It was furthermore observed that composting of food wastes (rice husk and wheat bran) with preferred microbial management better their total carbohydrate and total protein contents which could give as superior source of carbon and nitrogen respectively and may facilitate to re-establish or develop the fertility of degraded soil or soil. Studies proved that well processed organic material or compost can give tremendous supply of food and vigor for innate micro flora chiefly rhizosphere proficient one (Bunemann *et al.*, 2006; Fuchs *et al.*, 2008). Similarly, application of compost without Trichoderma species had a promotion on the protein content over control. This is much less than the promotion caused by the compost with living Trichoderma species treatments. T.hamatum and Rhizobium sp individually increased carbohydrate and crude protein contents at 60th day of germination of V.mungo (Badar & Qureshi, 2012). The increase in phosphorous content due to the application of compost without Trichoderma species was up to 200% over control, which was less than the compost with living Trichoderma species application (up to 237%). It is as same as many studies confirmed that treatment with effective microorganisms (EM) increased the mineral content of composted waste materials (Shalaby, 2011). Plant growth promoting activity of T. harzianum was well documented for its phosphate and micronutrient solubilization. Altmare *et al*. (1999) have reported that in-cooperation of *Trichoderma* increase phosphate solubility and the availability of micro nutrients in the soil and it could promote growth of the plants.

Table: 1 Treatments used for the preparation of compost.

S.No	Code	TREATMENTS
1	**Control**	**Untreated**
2	**JUF2L**	**Compost 1 with Trichoderma sp-1**
3	**JUF3L**	**Compost 2 with Trichoderma sp-2**
4	**JUF4L**	**Compost 3 with Trichoderma sp-3**
5	**JUF5L**	**Compost 4 with Trichoderma sp-4**
6	**JUF2D**	**Compost 5 without Trichoderma sp.1**
7	**JUF3D**	**Compost 6 without Trichoderma sp.2**
8	**JUF4D**	**Compost 7 without Trichoderma sp.3**
9	**JUF5D**	**Compost 8 without Trichoderma sp.4**

Table: 2 Effect of compost with Trichoderma species and without Trichoderma species on fresh and dry weight of mung plants

S.NO.	TREATMENTS	FRESH WEIGHT (cm)	DRY WEIGHT (cm)
1	**Control**	0.82^{i} ±0.16 (0)	0.12^{f} ±0.02 (0)
2	**JUF2L**	1.42^{e} ±0.20 (+73.17)	0.22^{e} ±0.05 (+83.33)
3	**JUF3L**	1.25^{g} ±0.02 (+52.43)	0.32^{c} ±0.05 (+166.66)
4	**JUF4L**	1.33^{f} ±0.69 (+62.19)	0.41^{b} ±0.29 (+241.66)
5	**JUF5L**	1.70^{b} ±0.17 (+107.31)	0.34^{c} ±0.06 (+183.33)
6	**JUF2D**	1.24^{g} ±0.11 (+51.21)	0.21^{e} ±0.01 (+75)
7	**JUF3D**	1.70^{b} ±0.29 (+107.31)	0.40^{b} ±0.08 (+233.33)
8	**JUF4D**	1.65^{b} ±0.50 (+101.21)	0.34^{c} ±0.17 (+183.33)
9	**JUF5D**	1.50^{d} ±0.27 (+82.92)	0.34^{c} ±0.12 (+183.33)

Value in parenthesis showed percent increase and decrease (+/-) over control.
Values with + showed standard deviation of mean

Table: 3 Effect of compost with Trichoderma species and without Trichoderma species on biochemical parameters of mung plants.

S.NO.	TREATMENTS	CARBOHYDRATE (µmole/gm)	PROTEIN (µmole/gm)	PHOSPHOROUS (%)
1	**Control**	1.90^{l} ±0.18	1.12^{k} ±0.38	0.08^{f} ±0.05
2	**JUF2L**	2.93^{j} ±1.09 (54.21)	2.02^{e} ±0.69 (80.35)	0.27^{c} ±0.08 (237.5)
3	**JUF3L**	3.11^{h} ±0.53 (63.68)	2.03^{e} ±0.61 (81.25)	0.28^{c} ±0.20 (250)
4	**JUF4L**	3.10^{h} ±1.08 (63.15)	2.70^{b} ±1.06 (141.07)	0.21^{d} ±0.05 (162.5)
5	**JUF5L**	5.24^{a} ±2.54 (175.78)	2.14^{d} ±0.55 (91.07)	0.21^{d} ±0.04 (162.5)
6	**JUF2D**	3.12^{h} ±1.12 (64.21)	1.97^{f} ±0.91 (75.89)	0.20^{d} ±0.12 (150)
7.	**JUF3D**	4.01^{d} ±2.65 (111.05)	2.02^{e} ±1.56 (80.35)	0.14^{e} ±0.01 (75)
8.	**JUF4D**	4.46^{b} ±2.49 (134.73)	1.73^{h} ±1.19 (54.46)	0.24^{c} ±0.12 (200)
9.	**JUF5D**	4.22^{c} ±1.48 (122.10)	1.85^{g} ±0.76 (65.17)	0.24^{c} ±0.13 (200)

Value in parenthesis showed percent increase and decrease (+/-) over control.
Values with ± showed standard deviation of mean

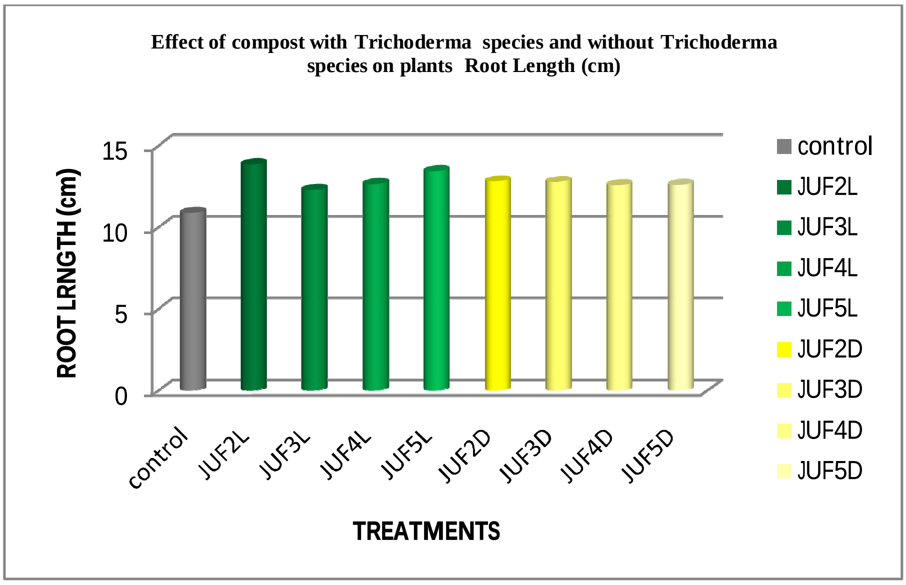

Fig.1

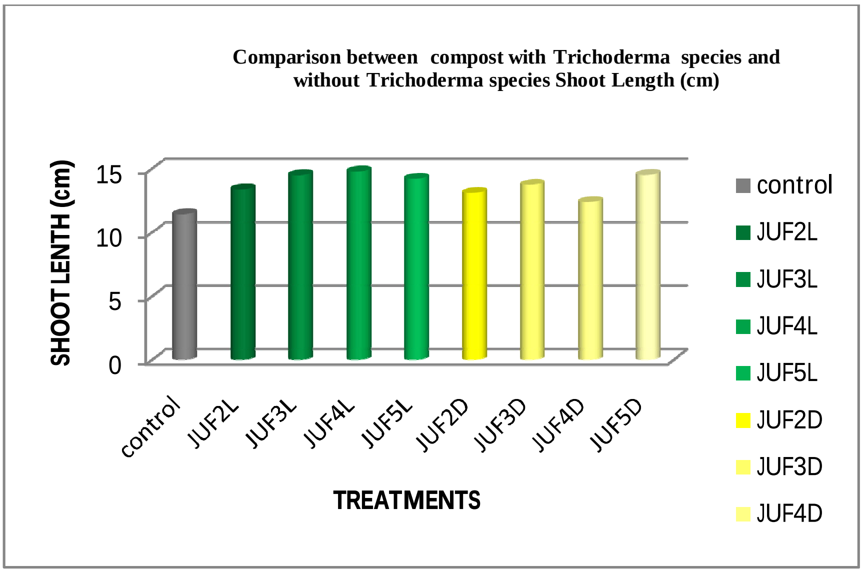

Fig.2

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