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COMPARATIVE ANALYSIS ON INFLUENCE OF COWDUNG AND NEEM LEAF COMPOST AMENDMENT IN SOIL ON RHIZOSPHERIC MICROORGANISMS OF TOMATO PLANT

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ABSTRACT

Two organic fertilizers were prepared by composting cowdung and neem leaves for four months and after composting the compost were added to soil in the ratio 1:3. Then tomato seeds were germinated and rhizospheric soil samples were collected and analysed for microbial count after 15, 30, 45, 60, 75 and 90 days of plant growth. The results showed that the compost NL and CD both have significant positive influence on rhizospheric bacteria and fungi. However the effect of NL compost was more on bacterial count and CD compost on fungal count. The compost amendment effect was more promising on rhizospheric microbiome at early stages ,i.e. at 15 and 30 days of plant growth.
Keywords : Tomato, compost, rhizospheric microorganisms

Introduction

An important component of commercial tomato production is fertilization, as it influence both plant growth and fruit quality (Mbah, 2006). There are two ways to feed the plant directly or feed the soil and lets nature's soil processes feed the plant. Chemical fertilizers directly feed the plant (Steiner *et al*., 2007) and organic fertilizers feed the soil (Abdel Mouty *et al*., 2001). Among organic fertilizers compost is widely used as it improves soil structure and texture, provide nutrients, improves aeration, retains moisture, increase number of beneficial organisms in soil (Bayoumi, 2005; Awad, 2002; Hafez *et al*., 2004) which in turn improved crop growth and restrained pests and diseases (Zhang *et al*., 2012; Chang *et al*., 2010). The supplementation of fertilizer can cause either direct effect on growth and productivity of agricultural crop or an indirect effect through the impact on microbial population around plant root i.e. rhizospheric microflora (Arafat *et al*., 2017; Mohammadi 2011; Bunemann *et al*. 2006).The microbes associated with root has been referred to as "the second genome of the plant" due to its significant impact on plant growth and productivity (Berendsen *et al*., 2012). With growing demand of organic vegetables and potential benefits of organic fertilizers application it is essential to understand the impact of different organic fertilizer on rhizospheric microflora which inturn affect plant growth and productivity. The aim of present work was to study the comparative influence of cowdung and neem leaf compost on population size of culturable bacteria and fungi associated with tomato rhizosphere so that they can be used to improve crop productivity.

Materials and Methods

The organic fertilizers used for this study were composted cow dung (CD) and green neem leaves (NL). The composting materials were mixed with composted cattle dung in the ratio 4:1 and filled in earthen pots and left for composting for 4 months. In earthen pots labelled as C soil without fertilizer was filled and in other earthen pots labelled as CD and NL soil was mixed with cowdung and neem leaf compost in the ratio 3:1. Certified seeds of *Lycopersicon esculentum* variety Sania were obtained from IARI, Pusa, New Delhi. Surface sterilized seeds equal in size, shape, weight and colour were sown in each earthen pot and allowed to germinate. Tomato seedlings were uprooted along with their roots from all earthen pots after different days of germination (15, 30, 45, 60, 75 and 90) and the rhizospheric soil was collected. The serial dilution-agar plating method was used for isolation of fungi and bacteria from soil (Aneja 2009). The soil sample was serially diluted from 10^{-1} to 10^{-10} dilutions and 0.1 mL diluted sample was plated on Czapeks dox agar (CDA) and nutrient agar medium (NAM) for isolation of fungi and bacteria, respectively. The inoculated petri plates were incubated at 28±2°C for 5 days and 35±2°C for 24hr for fungal and bacterial growth, respectively. The bacterial and fungal colonies developed on NAM and CDA plates after incubation were counted. The number of microorganisms present in soil was then calculated with the help of following formula-

Number of bacterial/fungal cell per g of soil =

$$\frac{Nunber\ of\ cfu/mL\ x\ dilution\ factor}{weight\ of\ soil\ (g)}$$

dilution factor = 1/ dilution number.

All the experiments were carried out in triplicates and results are given as mean values ± S.D.

Result and Discussion

Fig 1. illustrates the effect of CD and NL compost application on rhizospheric bacterial count at different stage of plant growth. The data indicates that both compost show favourable influence on rhizosheric bacterial count at all stages of plant growth. The rhizospheric bacterial number was 319%, 281%, 227%, 118%, 113% and 113%, of control in NL compost treated plant and 268%, 229%, 178%, 110%, 107%, 106%, of control in CD compost treated plant at 15, 30, 45, 60, 75 and 90 days of plant growth, respectively.

The impact of different compost amendment on rhizospheric fungal count is represented in Fig 2. At 15, 30, 45, 60 and 75 days of plant growth the rhizospheric fungal count was 186%, 228% , 310%, 197%, 147%, of control, in CD treated plant 154%, 211%, 208%, 168%, 120%, of control, in NL treated plant, respectively. The increase in rhizospheric fungal number at 90 days of plant growth is comparable to increase at 75 days, in both treatments. The results show that the compost NL have greater positive influence on rhizospheric bacteria and compost CD on rhizospheric fungi. The findings indicate that the impact of organic fertilizer amendment is found more promising on rhizospheric bacterial population compared to fungal population.

As the rhizosphere bacterial community is recruited from the main reservoir of microorganisms present in soil (*De Ridder-Duine et al.,* 2005; Berg and Smalla, 2009), the fertilizer amendment directly affect the rhizospheric microorganism by influencing soil biological index and indirectly by modifying the root exudates (Zancarini *et al.,* 2012; Lin *et al*., 2019). The compost amendments in soil has significant positive impact on bacterial and fungal population in soil. The cowdung compost increase bacterial count by 4-fold and fungal count by 3.5 –fold, and the neem leaf compost increase bacterial and fungal number by 5-fold and 3-fold in soil, respectively (Tyagi and Kumar, 2015).

The increase in rhizospheric microbial count of tomato was significant at 45 and 60-days of growth. This is the period of vegetative growth and the plant is physiologically most active at this stage of growth. This indicates that the fertilizer supplementation in soil modify the root exudates through changes of physiological and metabolic conditions of plant which in turn influence the rhizospheric microbial population (Das and Dkhar, 2011). Das *et al.,* 2010 indicated that the application of organic amendment favourably influence the microbial population of rhizosphere compared to soil where no organic amendments were applied.

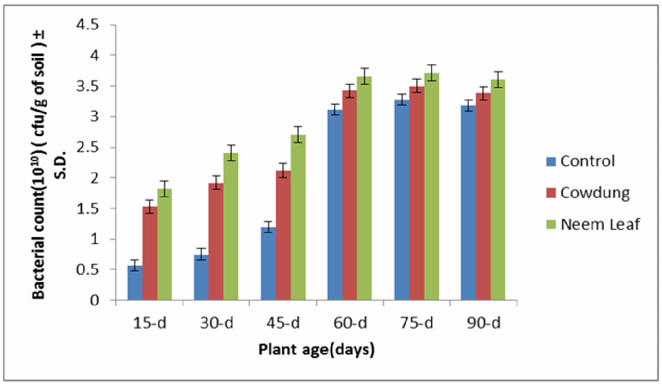

Fig. 1 : Effect of cowdung and neemleaf compost amendment in soil on rhizospheric bacterial count of tomato (*lycopersicon esculentum*) at different plant age.

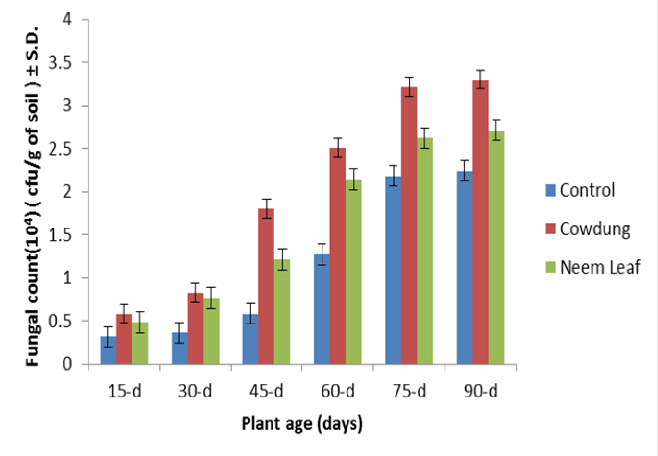

Fig. 2. Effect of cowdung and neemleaf compost amendment in soil on rhizospheric bacterial count of tomato (*lycopersicon esculentum*) at different plant age.

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