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APPLICATION OF GREEN COMPOST FOR THE IMPROVEMENT OF DRY MATTER YIELD AND CHEMICAL COMPOSITION OF *LOLIUM PERENNE* (GRASS)

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ABSTARCT

A study was conducted to evaluate the effect of greencompost for improvement of dry matter yield and chemical composition of *Lolium perenne* grass. For this purpose, three different types of soils i.e. normal cultivated soil, nutrient deficient sandy soil and soil from industrial area dominant in $CaSO_4$ coded as soil A, B and C were used. Greencompost was applied to all soil types (A, B and C) @ 5 and 10 % of soil volume. Greencompost was analyzed for various chemical properties like pH and C: N ratio before adding to the soil. *Lolium perenne* grass was grown in all the pots those were replicated four times arranged in CRD factorial. After harvesting the grass, plant samples were collected and oven dried at 60 ^{0}C. These plant samples were, then analyzed for organic matter, N, Ca, Mg, K and P contents. All data were analyzed statistically. It was observed that organic matter, N percentage and potassium contents in plant samples increased with the application of greencompost. The resultant improvement in chemical composition of plant samples contributed toward significant enhancement in dry matter yield of *Lolium perenne* grass.

Key words: Greencompost, *Lolium perenne*, soil types, organic matter, nitrogen, phosphorus, potassium, calcium and magnesium.

INTRODUCTION

Organic matter content is very low in Pakistani soils due to which over all fertility status is not higher enough to give the enhanced yield of different crops (Zaka *et al*., 2004). High temperature, low rainfall and removal of almost all the crop residues are some major reasons of low organic matter content. For good crop production, this level of organic matter has to be increased. But after the introduction of chemical fertilizers, the conventional sources of organic matter like farmyard manure (FYM) and green manure have almost been left. Resultantly, the organic matter status of Pakistan soils has already reached the bare minimum. Organic matter is regarded as a very important parameter of soil fertility and productivity. It plays number of roles in soil both in their physical structure, sink for plant nutrients and medium for biological activities. It also provides nutrients to the soil, improves water holding capacity and has greatest contribution to the soil productivity. Organic matter helps the soil to maintain better aeration for seed germination and plant root development (Zia, 1993).

Compost is very good alternative supplement for increasing the organic matter content of soil. But in Pakistan, this very good alternative source has not been benefited so far. Huge amounts of leaves, grass clippings, plant stalks, wines, weeds, twigs and branches and the food wastes like fruit and vegetables scraps, and egg shells are wasted / burnt every day. If this material is piled at the farm level, composted and added into the soil, the fertility status can be improved and crop yields can significantly be increased (Sarwar, 2005). The role of compost in salt-affected soils is very vital because the organic source is ultimate opportunity to improve the physical properties of such soils which have been deteriorated to the extent that water and air passage become extremely difficult in such soils. Resultantly, the water stands on the surface of these soils for weeks long. The plants when grown under these conditions often die due to deficiency of sir root respiration. The compost can be a very good organic amendment in saline agriculture as well as reclamation of salt-affected soils (Zaka *et al.*, 2003). The combined application of both organic and inorganic fertilizers gave significantly higher yield of rice and wheat (Sarwar *et al*., 2008). Soil organic matter encourages granulation, increases cation exchange capacity (CEC) and is responsible for up to 90 % adsorbing power of the soils. Cations such as Ca^{2+}, Mg^{2+} and K^+ are produced during decomposition (Brady and Weil, 2005).

Greencompost is the form of compost prepared from green wastes such as garden and farm wastes and its effects were investigated for the improvement of dry matter yield and chemical composition of *Lolium perenne* grass, as indicator plant. The concentration of various ions in the soil solution is one of the major factors that will be depicted into ionic concentration in plants. Keeping in view the situation of low organic matter status and low fertility of Pakistani soils, the present study was undertaken to evaluate the usefulness of greencompost for enrichment of nutrition in *Lolium perenne* grass.

MATERIALS AND METHODS

This experiment was conducted in the Department of Landscape Ecology and Nature Conservation at University of Kassel, Germany. Three different types of soils were used in this research study: Normal cultivated soil, Nutrient deficient sandy soil and Soil from industrial area dominant in $CaSO_4$. Green compost (Table 1) made through hot method mainly from green wastes such as garden and farm wastes was applied to all three soil types @ 5 and 10 % of the soil volume with control treatment for each soil type. Before addition to the soil, compost was also analyzed for various chemical characteristics. Thus, experiment had 9 treatments with four replications: T1 = Soil A alone, T2 = Soil A + Greencompost @ 5 % of soil volume, T3 = Soil A + Greencompost @ 10 % of soil volume, T4 = Soil B alone, T5 = Soil B + Greencompost @ 5 % of soil volume, T6 = Soil B + Greencompost @ 10 % of soil volume, T7 = Soil C alone, T8 = Soil C + Greencompost @ 5 % of soil volume and T9 = Soil C + Greencompost @ 10 % of soil volume. *Lolium perenne* grass was sown in all the pots. All the pots were irrigated daily with ground water (pH = 7.75 and EC = 0.387 dS m^{-1}). After one month, grass was harvested from all the pots, oven dried, weighed for dry matter yield and analyzed for various chemical characteristics. For this purpose, plant samples were ignited and then desiccated. Ignition was done at 550 ^{0}C to ensure the destruction of all organic matter by the oxidation of CO_2 and water (Saywer, 1994).

Table 1: Composition of Greencompost

Characteristic	Unit	Value
pH	-	7.3
EC	µS cm^{-1}	3120.0
Organic matter	%	40.9
Total Carbon	%	21.6
Total Nitrogen	%	2.1
C/N ratio	-	10.19
Calcium	g. kg^{-1} compost	21.73
Magnesium	g. kg^{-1} compost	4.51
Potassium	g. kg^{-1} compost	20.65
Total Phosphorus	g. kg^{-1} compost	4.43
Chlorides	g. kg^{-1} compost	2.94

All weights are on oven dry basis.

After the completion of ignition process, all the material along with crucible was cooled down to room temperature in dessicator while keeping the relative humidity near to zero. Then 5 ml 32 % HCl was added to each crucible-containing sample in it. After 24 hours, this material was shifted to 100-ml volumetric flask and was subsequent filtered. This filtrate was used to measure various determinations of mineral nutrients like Ca, Mg, K and Cl percentage. All the data were subjected to statistical analysis using completely randomized design with three factors.

RESULTS AND DISCUSSION

Biomass of Lolium grass: Very wide variation was observed in the original potential of three soils of the experiment (Fig. 1). The recorded biomass was significantly more in normal cultivated soil (A) compared with nutrient deficient sandy soil (B) and $CaSO_4$ dominated soil (C) from the industrial area. However, the later two soils indicated non-significant differences. Effects of applied levels of compost were significant. Compost application significantly enhanced the oven dry biomass of the grass at both the levels in soil A but only the highest level was found to be effective in soil B and C. The application of compost improved the physical conditions of the soil and enhances its nutrient supplying capacity. Similar observations were also recorded in the studies of Smith, (1995). Hence, the biomass of *lolium* grass was increased in all the three soils with the two levels (5 and 10 % by volume) of compost due to the same reasons explained by the Smith (1995).

Impact on chemical composition of Lolium grass biomass: The organic matter percentage of the biomass was not significantly affected in soil A and B (Fig. 2). The differences compared with control were significant at both the compost levels in soil C. However, the response within two levels for this parameter was non-significant. The nitrogen percentage was raised non-significantly in different soils with both the compost levels (Fig. 3). However, the treatment means as well as soil differences were found o be significant. The calcium content was affected variably in the three soils of the study. A significant impact due to compost application was found in soil C only (Fig. 4) where calcium percentage was rather decreased significantly. The differences of compost levels were similar in soil A and B. The magnesium percentage was affected significantly in soil A and C while soil B remained non-significant with soil A (Fig. 4). The interactions of soils and applied levels of compost were found to be significant.

The soil and treatment means of potassium percentage of *Lolium* biomass indicated significant differences in both cases (Fig. 4). The K values were the highest in soil A and only the level of 10 % compost slightly decreased this constituent. The responses were clear in soil B where both the levels significantly enhanced K concentration. The plants of soil C were having the least value of this parameter. Both compost levels were found significantly higher than control. In respect of phosphorus percentage in *Lolium* grass, the recorded values for soil A were significantly higher than soil B and C (Fig. 4). The mean consecutive differences due to compost levels were non-significant. However,

both the levels caused significantly more P concentration compared with control.

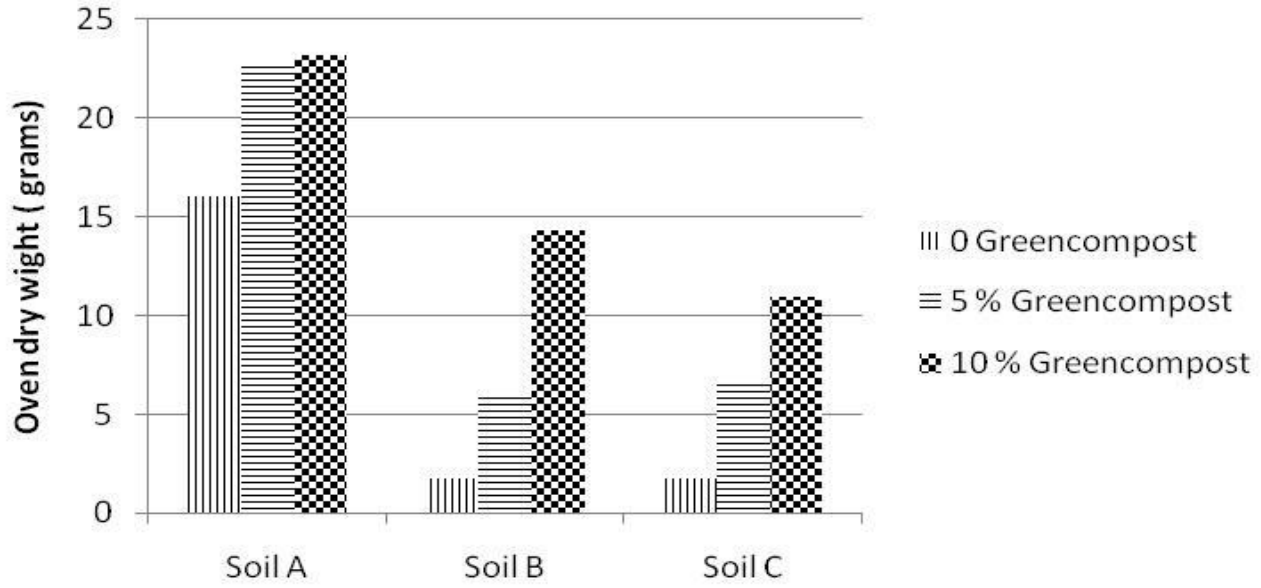

Figure 1: Oven dry biomass of Lolium grass

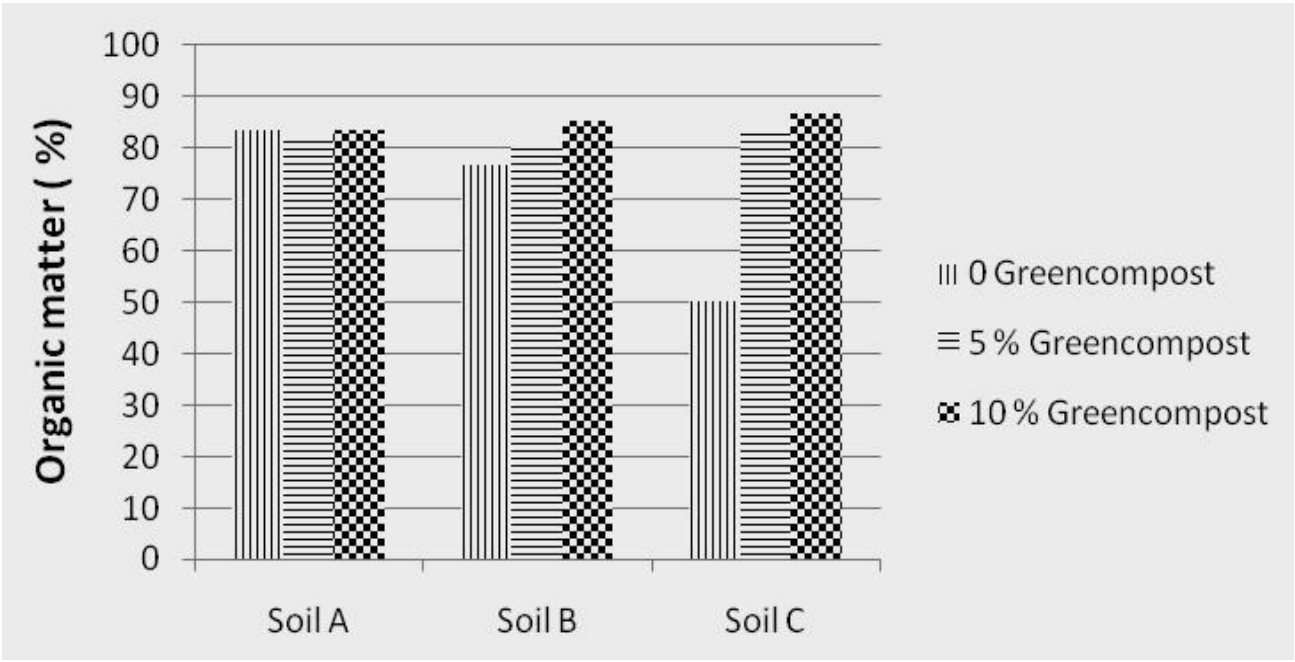

Figure 2: Organic matter percentage in Lolium grass biomass

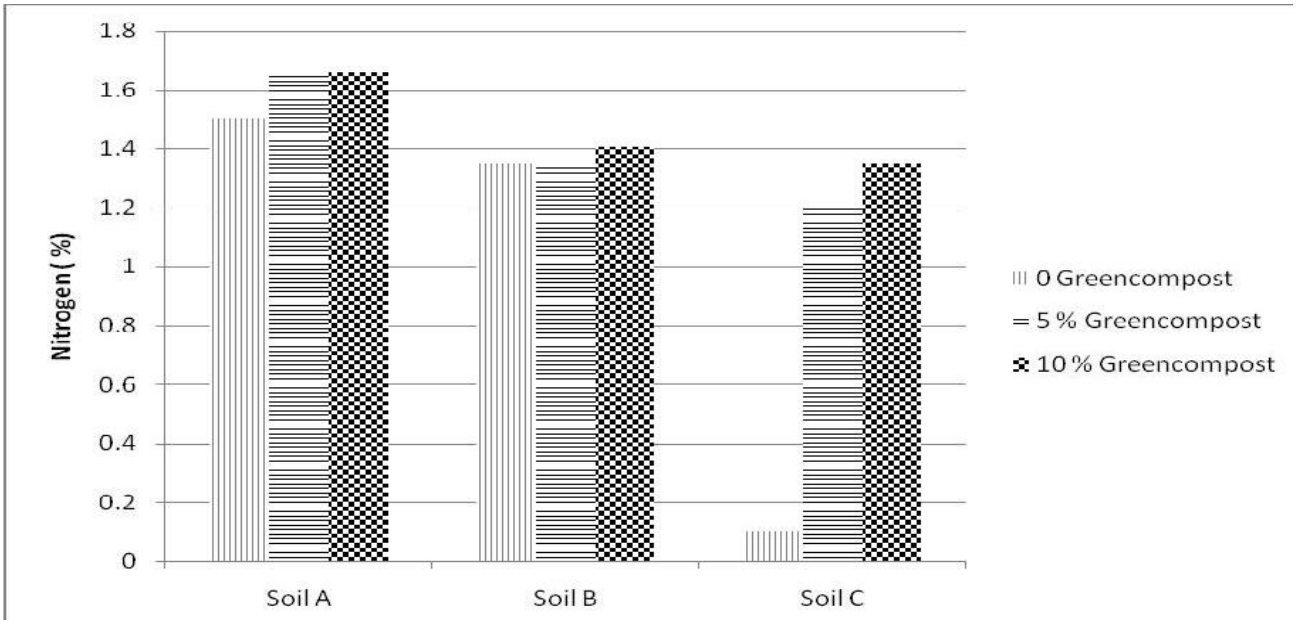

Figure 3: Nitrogen percentage in Lolium grass biomass

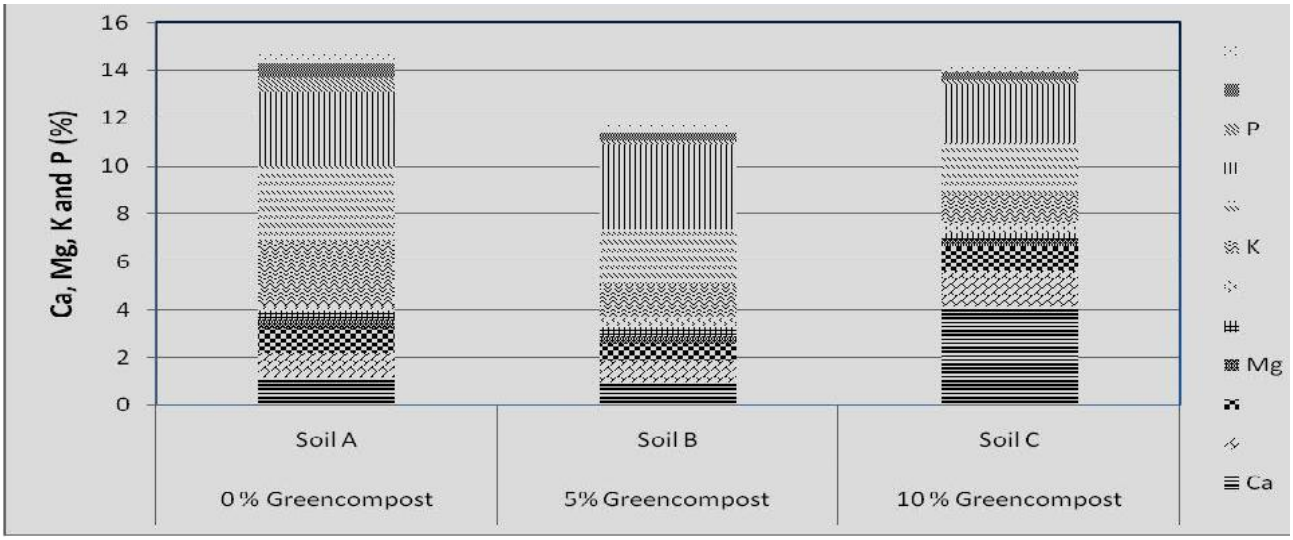

Figure 4: Ca, Mg, K and P concentration (%) in Lolium grass biomass

The overall results of plant analysis revealed that nutrient concentration was the highest in soil A because it was normal cultivated soil. The responses of compost application were positive and high in soil B being depleted nutrients deficient soil. Almost similar behaviour was found for that of soil C that was industrial area $CaSO_4$ dominant soil. The compost application improved the overwhelming effects of Ca. Even the response of lower level of compost indicated significant effect in soil C. In general, the application of compost enhanced the concentration of all the studied nutrients. Sarwar *et al.* (2003) observed that organic matter and N percentages in plant material were increased with the application of biocompost. They also claimed that the contents of mineral nutrients in the soil were increased by the use/addition of biocompost. These resultant improvements in soils, contributed towards significant enhancement in dry matter yield of *Loluim perenne* grass.

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