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Original Research Paper

Effect of Different Doses of Sewage Sludge on Soil Health of Black Gram (*Vigna mungo*) Field in Allahabad Region of India

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ABSTRACT

A field experiment was conducted on an alluvial soil to determine sewage sludge efficiency on the soil of Black Gram (*Vigna mungo*) field. Six treatment combinations (3 varieties × 2 sewage sludge doses) were applied to conduct this research. After harvesting of crop, soil samples were taken and brought into the laboratory for analysis of different soil parameters. pH of soil varies from 8.1-8.4. This shows the basic nature of sewage sludge. EC of the soil varies from 0.24-0.27 dSm^{-1}. Organic carbon of the soil varies from 0.49-0.53 % due to increasing carbon content in sewage sludge. Due to improving electrical conductivity nitrogen and phosphorus were also increased. The potassium content of the soil varied from 155.39-166.67 kg/ha. Thus, the study reveals that, soil pH, electrical conductivity, organic carbon, nitrogen, phosphorus and potassium were inclining with increasing doses of sewage sludge.

INTRODUCTION

Sewage sludge is the waste product of domestic, municipal and industrial wastewater. It has high organic matter that may contain approximately 65 % of organic matter, about 3 % of nitrogen, 2 % of phosphorus content and 0.5 % of potassium content. A very wide range of micro and macro content may also be there in sewage sludge which may be useful for growing crop yield and soil health. Many scientists have also worked and explained that sewage sludge may be used in different agricultural crops for fast crop growth and soar the yield.

Some products may be useful as fertilizers in different agricultural as well as forest crops, which can accumulate higher concentration in their biomass. But it has major environmental concern due to dispersal of industrial and urban wastes generated by human activities, i.e. the contamination of soil. The plant macro and micro nutrients as well as organic matter make sludge disposal in soil an attractive option. Nitrogen has received most attention and it is normally the most abundant sludge nutrient. One of the best alternatives to waste disposal is through the soil-plant system as a fertilizer. Based on the properties, different wastes can be co-recycled in order to take simultaneously the best profit and minimize environmental pollution (Ahmed et al. 2010).

MATERIALS AND METHODS

The study comprised of a plot experiment which was conducted at the research farm of the School of Forestry & Environment, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad during February to April, 2014. The plot experiment was laid out with 2 × 2 factorial randomized block design, where the combination of two levels (10 tonne/ha and 20 tonne/ha) and three Black Gram varieties (Pant U-19, Pusa V-19, Vardan-2) were taken as six treatments. All treatments were multiplied as four replications. Treatments were allocated randomly in each plot using a randomized block design. The sewage used in this experiment was brought from Gau Ghat, Allahabad, India. The sewage was weighted and applied according to the treatment combination. Sewage sludge was mixed with soil before three days of sowing. To study about soil health after harvesting Black Gram, soil pH, electrical conductivity, organic carbon, nitrogen, phosphorus and potassium were analysed from the different soil samples.

RESULTS AND DISCUSSION

The soil samples were collected after harvesting the crop and brought out for analysis of soil pH, soil EC, soil organic carbon, soil nitrogen, soil phosphorus and soil potassium. The results of the physicochemical analysis of the soil samples are presented as follows:

Soil pH: Fig. 1 shows the effect of sewage sludge on soil pH of different variety of Back gram. The effect of sewage sludge on soil pH was recorded after harvesting of the crop. The maximum soil pH (8.4) was observed in (T_6) Vardan-2 with 20 tonnes of sewage sludge and minimum soil pH (8.1)

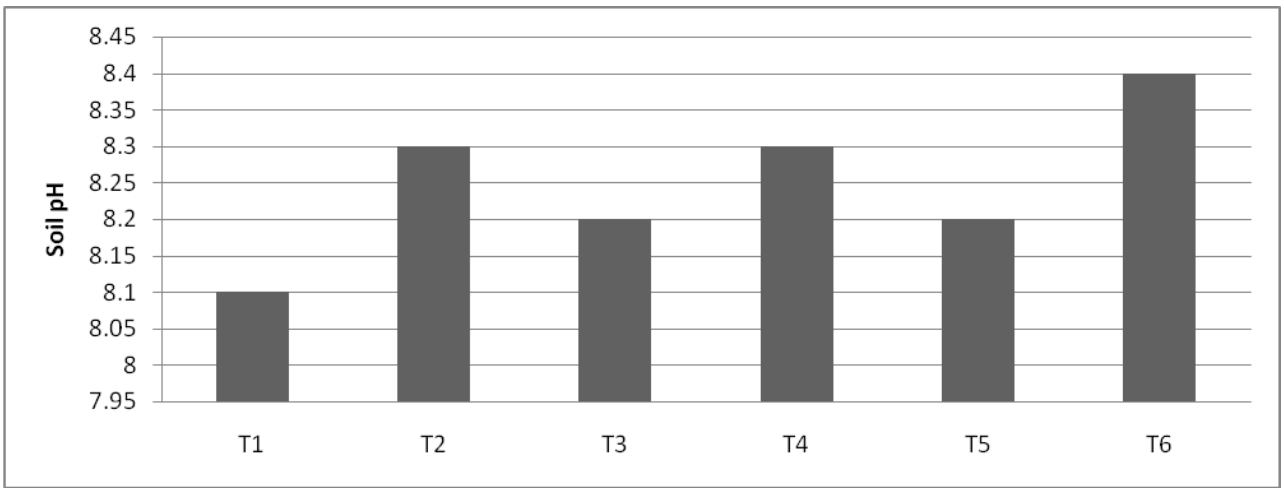

Fig. 1: Effect of sewage sludge on soil pH 1:2 (s/w) at post harvest.

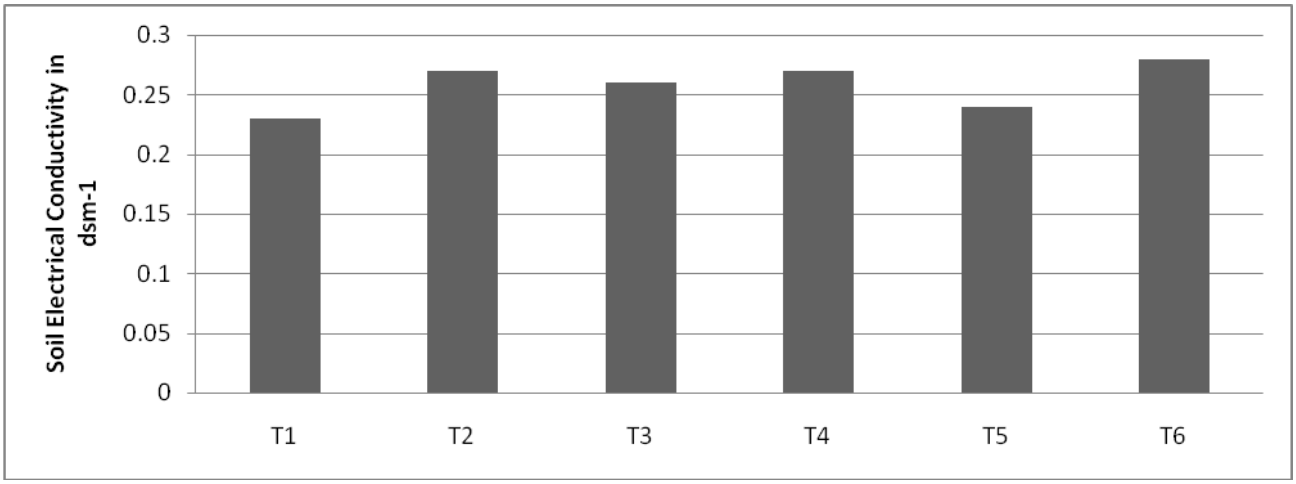

Fig. 2: Effect of sewage sludge on soil EC (dSm^{-1}) at post harvest.

was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. Similar results were also reported by Papadopoulos & Stylianous (1991) and Papadopoulos (1985).

Soil electrical conductivity: Fig. 2 shows the effect of sewage sludge on soil EC of different varieties of Black Gram. The effect of sewage sludge on soil EC was recorded after harvesting of the crop. The maximum soil EC (0.28 dSm^{-1}) after harvesting of crop in (T_4) Vardan-2 with 20 tonnes of sewage sludge and minimum soil EC (0.23 dSm^{-1}) was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. It was high in high doses of sewage sludge because, sewage sludge contains high amount of metallic salt (Biemond & Vos 1992).

Soil organic carbon: Fig. 3 shows the effect of sewage sludge on soil organic carbon of different variety of Black Gram. The maximum soil organic carbon (0.53 %) after crop harvesting was observed in (T_6) Vardan-2 with 20 tonnes of sewage sludge, whereas minimum soil organic carbon (0.49 %) was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. As the sewage has high amount of organic matter, the organic carbon was increasing with increasing doses of sewage sludge.

Soil nitrogen: Fig. 4 shows the effect of sewage sludge on soil nitrogen. It is found that the maximum soil nitrogen (237 kg/ha) after crop harvesting was observed in (T6) Vardan-2 with 20 tonnes of sewage sludge, whereas minimum soil ni-

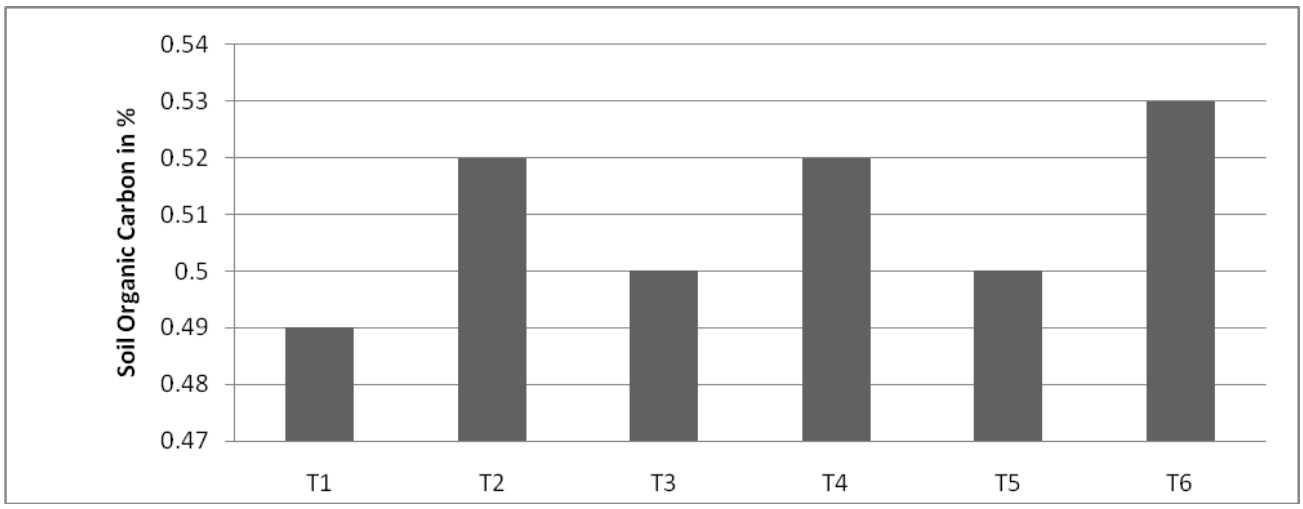

Fig. 3: Effect of sewage sludge on organic carbon (%) at post harvest.

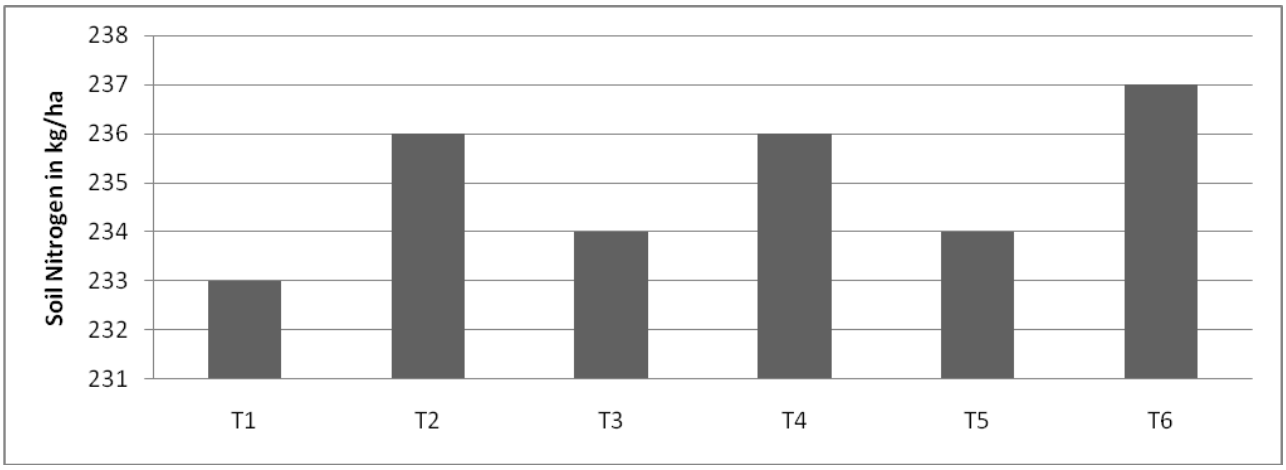

Fig. 4: Effect of sewage sludge on nitrogen (kg/ha) at post harvest.

trogen (233 kg/ha) was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. Soil nitrogen is essential for crops. This may be due to high amount of sewage sludge been applied. Similar findings were also reported by the Achari et al. (1999).

Soil phosphorus: Fig. 5 shows the effect of sewage sludge on soil phosphorus where the maximum soil phosphorus (32.01 kg/ha) after crop harvesting was observed in (T_6) Vardan-2 with 20 tonnes of sewage sludge and minimum soil phosphorus (29.53 kg/ha) was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. As the sewage sludge contains about 2 % of phosphorus content, it was increased with high sewage sludge treatments. Similar results were also reported by Pathak et al. (1998), Reddy et al. (1998).

Soil potassium: Fig. 6 shows the effect of sewage sludge on soil potassium of different varieties of Black Gram. The maximum soil potassium (167.67 kg/ha) after crop harvesting was observed in (T_6) Vardan-2 with 20 tonnes of sewage sludge and minimum soil potassium (155.39 kg/ha) was recorded in (T_1) Pant U-19 with 10 tonnes of sewage sludge. Results were similar to the findings reported by Biemond & Vos (1992), Papadopoulos & Stylianous (1991).

CONCLUSION

On the basis of this study, it can be concluded that sewage sludge is an important organic fertilizer in low concentra-

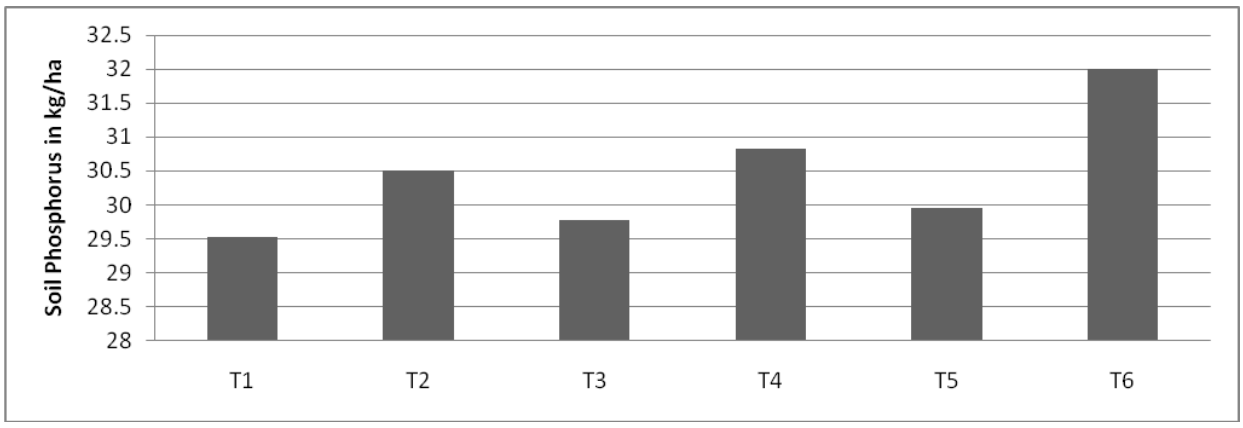

Fig. 5: Effect of sewage sludge on phosphorus (kg/ha) at post harvest.

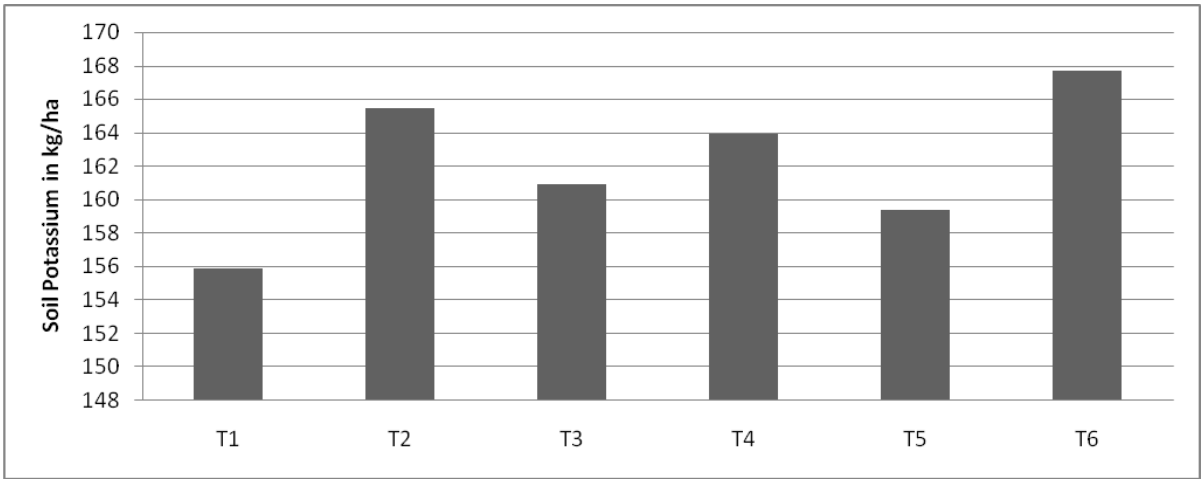

Fig. 6: Effect of sewage sludge on potassium (kg/ha) at post harvest.

tion of doses. It should be used for sustainable agriculture so that the load of chemical fertilizers like urea, phosphate can be overcome. The obtained data also revealed that most of the soil parameters were improved with increased doses of sewage sludge, so that sewage sludge can be applied as a fertilizer for improving the soil health and crop yield.

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