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COMPARATIVE STUDY OF MECHANICALLY DRIED BIOSLURRY AND COMMERCIAL FERTILIZERS

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ABSTRACT

A comparative study was made at field conditions during 2011-2012 to evaluate the fertilization effect of mechanically dried bioslurry and commercial fertilizers on crop growth, productivity and soil enrichment in terms of NPK and OM. The selected area was at University of Agriculture Faisalabad, and Golden Acre cabbage was used in experiment with four treatments. Each treatment was replicated four times by setting out in randomized complete block design. The bioslurry from a biogas plant was obtained from Al-Hamd Exports, Sutyana Road, Faisalabad and was dried by using a mechanical dryer. The cabbage data regarding plant density, plant height, unfolded leaves per plant, root depth and yield was taken during growing period of crop. The results showed 20-30% increase in plants density, plants height and root depth, and 10% reduction in unfold leaves per plant in bioslurry treated plots. It was followed by the treatment in which bioslurry was applied in combination with commercial fertilizers. The treatment with recommended commercial fertilizers showed least significant effect in improving these parameters of the crop. The cabbage productivity showed minimum yield 45 t/ha and maximum 79 t/ha from control and bioslurry treated plots respectively. It was followed by commercial fertilizers treated plots as 68 t/ha. The fertilization effect of bioslurry was evaluated by measuring residual amount of NPK and OM in soil after harvesting of the crop. The bioslurry treated plots showed better results as it reside 15% more amount of OM and NPK in the soil in relation with commercial fertilizers treated plots. The results revealed that bioslurry mobilize the nutrients and also add up organic matter in soil better than that of commercial fertilizers.

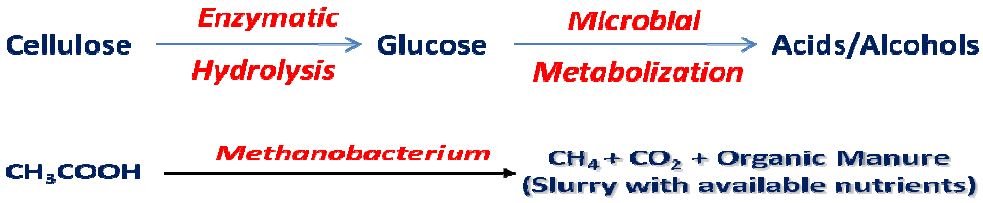
KEYWORDS: Cabbage, Bioslurry, Soil Conditioner, Commercial Fertilizer

INTRODUCTION

Being an agricultural country, soil of Pakistan is of great importance. But now organic matter and other nutrients are going to be low unfortunately in our soil. Intensification in demand of food in the last three decades is met by the immense use of commercial fertilizers. On the other hand it is not a good practice to use commercial fertilizers for long duration due to their adverse effects on environment and soil conditions. Under such situations, there is no alternative besides to add organic fertilizer into the soil to sustain crop productivity and to increase soil fertility. A vast range of organic fertilizers is available in different forms in our surroundings including cow dung, farmyard manure (FYM), farmyard slurry, composted FYM, and digested biogas slurry.

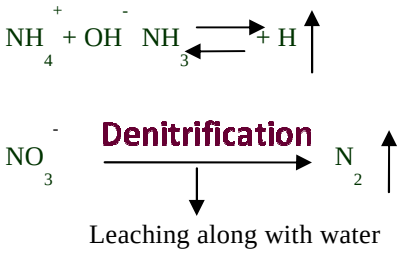
Bioslurry is an anaerobic fermented organic material released as a byproduct from the biogas plant after production of combustible methane gas. It may be considered as an effective source of organic fertilizer as it contains

considerable amount of nutrients and organic matter (Islam, 2006). Bioslurry is rich in micro and macro nutrients compared with both FYM and composted FYM. The fermentation process in a biogas digester is brought anaerobically by *Methanogenic Bacteria*.

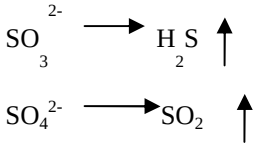


The fibrous material and inorganic solids which cannot digest or convert into methane either settle down in a plant or come out with slurry liquid through an outlet. It is very rich in nutritive elements including nitrogen (N), phosphorous (P), potassium (K) and trace elements as zinc (Zn), nickel (Ni), iron (Fe), cobalt (Co), cadmium (Cd), chromium (Cr), boron (B), calcium (Ca) and sodium (Na) (Gupta, 2007).

It was being in practice from a long period, the use of fresh biogas plant slurry. Latterly, it was also practiced to use this slurry after drying in sun. It was a conventional method of drying, but there were some losses of nutrients from the bioslurry. Leaching down and evaporation of nitrogen and other nutrients from the bioslurry during sun drying process is being observed.



Sculpture available form: SO_3^{2}, SO_4^{2}



Anions

Cl^-, $H_2PO_4^-$, HPO_4^{2-} etc are significantly lost by leaching

Cations

Ca^{++}, Mg^{++}, etc are also lost up to some extent

So, there was a need to introduce some mechanical method to dry the bioslurry in order to save all the nutrients.

In Pakistan, to see the increasing trend in installing biogas plants to meet energy requirements, it was obvious to conduct this type of work for the result oriented techniques in the use of digested biogas slurry. It will be easy now to convince farmers to use dried bioslurry as a fertilizer. If a nearby land is not available or the slurry generated is in

excess, the method of preservation of slurry (drying) can help farmers to use it later and conveniently. It can also provide a basis for the future study of different aspects of bioslurry.

MATERIALS AND METHODS

A mechanical system was being used in our study to dry the bioslurry. That dried bioslurry was being tested for nutritional value and also evaluated its fertilization effect on soil as well as on growth parameters of crop and its productivity at field conditions. It was applied single and also in combination with commercial fertilizers.

Figure 1: Mechanical Dryer for Bioslurry

The Dryer Contained the following Main Parts

- Vibratory sieve bench
- Water collector
- Cylindrical chamber
- Hot air mechanism
- Crusher

Figure 2: Dried, and Crushed Bioslurry

Soil parameters affected by dried bioslurry application were the major objectives of this study. The nutrients residual effect of bioslurry on soil was evaluated by conducting soil tests. Soil samples were taken from depth 0-45 cm to see the nutrients variation and mobility in the field. There were 48 soil samples from which 12 composite soil samples were tested for the values of N, P, K, organic matter and soil texture. The experiment was statistically designed

in randomized complete blocks. The experimental unit was taken 4 m × 5 m and total were 16 units at field. The four treatments were applied namely T_1 (control; without any fertilizer application), T_2 (application of 50% dried bioslurry+50% commercial fertilizers), T_3 (application of dried bioslurry), and T_4 (recommended commercial fertilizers).

The nursery of cabbage variety "Golden Acre" was used in the experiment to see the fertilization efficiency of the bioslurry. The yield from area under each treatment was used to make a comparison by using statistical design. The growth parameters of the cabbage crop were observed including plants density per meter square area, plant height (cm) from bottom to top of the plant, the leaves intensity per plant and root depth (cm) of the cabbage plants.

The commercial fertilizers (Di-Ammonium Phosphate and Urea) were applied in the relevant plots according to recommended dose of NPK as 160, 120 and 60 kg/ha respectively (Malik, 1994). The dried bioslurry was applied @ 10 t/ha (20 kg/20 m^2) in the plots within treatment T_3, and 5 t/ha (10 kg/20 m^2) in the plots within treatment T_2. The crop was irrigated at an interval of about 15 days. The management and intercultural practices as weeding, hoeing, and spray against the insects and pests were made according to requirement.

RESULTS AND DISCUSSIONS

The results of soil nutrients status, cabbage growth parameters and cabbage productivity against respective treatments were as described in graphical form.

The statistical analysis of data for OM in soil showed highly significant results at 5% probability level. The effect of each treatment is given in Figure 3. The treatment with dried bioslurry showed the maximum value as 1.525%. It was increased 0.66% over control, which was 0.865%. Treatment with combination of bioslurry and commercial fertilizers gave second high percentage of organic matter as 1.2675 that was followed by treatment with recommended commercial fertilizers as 1.065%. It is evident from results that commercial fertilizers could not increase the organic matter in soil significantly in relation with bioslurry. These results were in line with those obtained by Juliana (1991) who stated that slurry obtained from bio fermentation process contains high concentration of plant nutrients and organic matter.

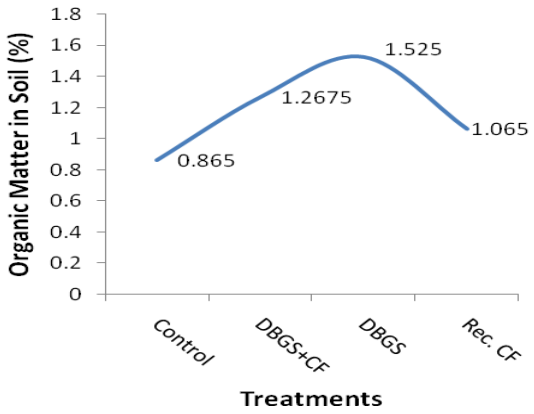


Figure 3: Mean Values of Treatments for OM in Soil

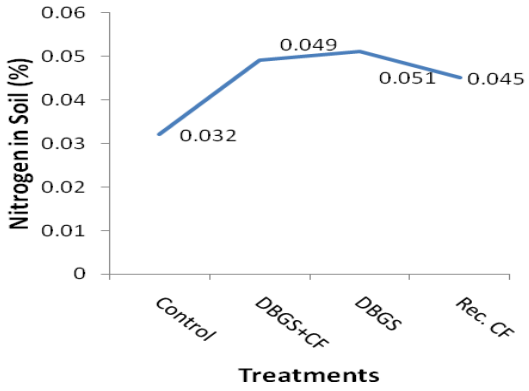


Figure 4: Mean Values of Treatments for Nitrogen in Soil

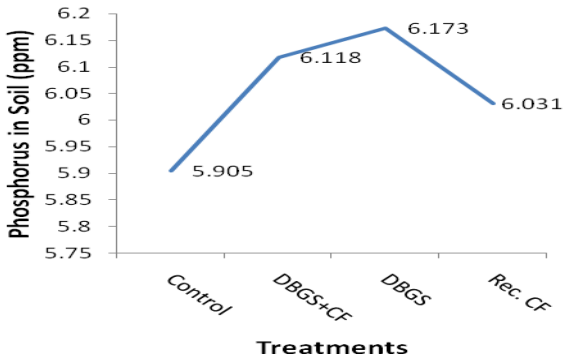


Figure 5: Mean Values of Treatments for Phosphorus in Soil

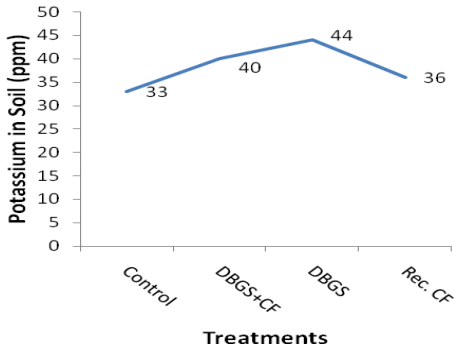


Figure 6: Mean Values of Treatments for Potassium in Soil

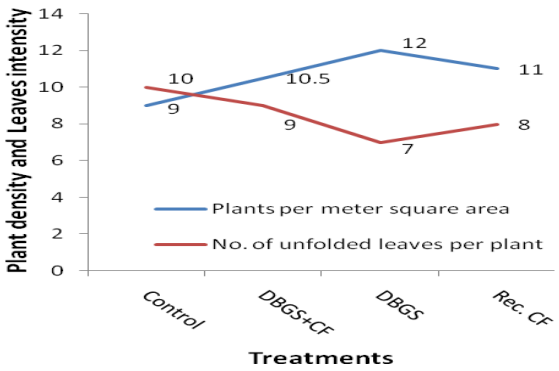


Figure 7: Mean Values of Treatments for Plant Density and Leaves Intensity of Cabbage

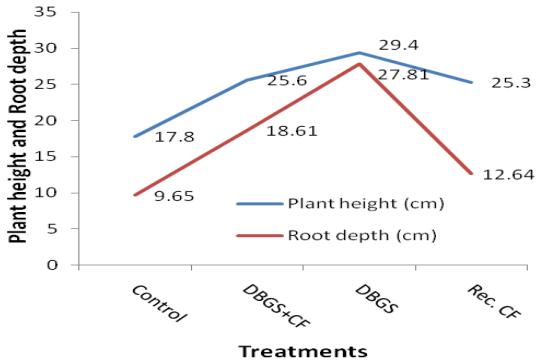


Figure 8: Mean Values of Treatments for Plant Height and Root Depth of Cabbage Plants

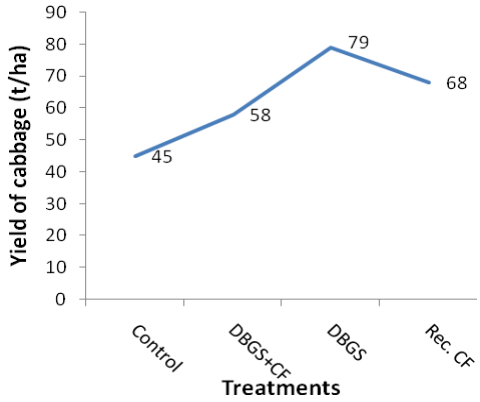


Figure 9: Mean Values of Treatments for Yield of Cabbage

The study revealed a remarkable change in soil macro nutrients availability by applying bioslurry. The overall results of treatment with bioslurry were significant for residual amount of NPK in soil from rest of the treatments. The treatment means for nitrogen, phosphorus and potassium are represented in Figure 4, 5, and 6. It has beens proved from results that bioslurry is very effective to mobilize the nutrients in soil. These results were in agreement with the findings of Nasir *et al*. (2010) who stated that bioslurry improved NPK contents in maiz crop. The results were also evident of statement by Islam (2006). He said that bioslurry is an excellent organic fertilizer and a good source of plant macro and micro nutrients

The results for growth parameters of cabbage plants showed in Figure 7 and 8. The graphs showed maximum number of plants per meter square, a significant increase in plant height and root depth, and reduction in unfold leaves per plant in bioslurry treated plots. It was followed by treatment T_2. While treatment T_4 showed least significant effect in improving these features of the crop. These results were in line with findings by Morsy (2002). He reported increase in plants density in cow dung bioslurry and poultry manure slurry treated plots. The results were also in accordance with the findings by Rahman *et al*. (2008). They stated that plant height increased and number of unfolded leaves per plant of cabbage decreased significantly by the application of cow dung bioslurry.

Figure 9 shows cabbage yield results. There was significant difference between the treatments T_1 and T_3. T_3 showed maximum yield 79 t/ha. It showed 34 t/ha increase in yield over control. It was followed by T_4 and T_2 as 68 and 58 t/ha respectively. These treatments were not significantly different from each other, but showed increase in yield 23 and 13 t/ha respectively over control. The higher yields of vegetables from bioslurry treated plots were reported by Khan *et al*.

(2007). The results obtained were also confirmed the findings by Tripathi (1993) who reported that dried biogas slurry effectively increased the yields of vegetables like tomato, cauliflower, cabbage, potato and brinjal.

CONCLUSIONS

Based on all analysis of the field data following conclusions are drawn.

- The dried bioslurry can be used as an effective fertilizer in development of cabbage significantly.
- The soil OM and NPK increases 15% with the application of DBGS, so it can be use as an effective soil conditioner.
- The biogas slurry application promotes growth parameters 20 to 30% which ultimately enhances production of the crop from 30 to 40%.
- It was found easy to use and transport the dried bioslurry

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