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EFFECT OF FAECAL SLUDGE ON CABBAGE PRODUCTION

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Abstract

2.7 billion people worldwide rely on onsite sanitation and it is a big problem in developing countries. Faecal sludge is a good source of micro/macronutrients of plant besides its richness in organic matter. Two consecutive field experiments was conducted in BRAC Agricultural Research and Development Centre, Gazipur during Rabi 2015-16 and rabi 2016-17 aimed to determine the effect of faecal sludge on crop production and how much dosage need for maximum yield. Cabbage was the test crop. It was observed that harvesting time was significantly shortened and 25.51% curd weight and 26.55% yield was increase with addition of faecal and chemical fertilizer. No significant differences were found on the dosage of faecal on head formation and head diameter. In the addition of full dosage of faecal with chemical fertilizer, 41.04% and 8.61% curd weight increase than only faecal and chemical fertilizer. Application of full dosage of faecal with full dosages of chemical increases yield 7.28%, 10.66%, 6.88% and 38.75 % than application of half faecal, three-fourth faecal, only chemical fertilizer and only faecal. So addition of full dosage of faecal with chemical fertilizer gives the highest yield on crop. In Bangladesh, faecal might be recycled into agricultural soils as a supplement to commercial fertilizer and thereby enrich the general fertility of the soils and increase crop production.

Keywords: Faecal Sludge, Cabbage, Yield

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Introduction

Faecal sludge is one of the biggest problems in developing countries. The urban environment ends up awash in untreated human waste; with sever public health and environmental consequences, not only for those with inadequate sanitation, but for everyone else too. There are about 2.7 billion people worldwide rely on onsite sanitation and has not been transported through a sewer. It is raw of partially digested, a slurry or semisolid and results from the collection, storage or treatment of combinations of excreta and black water, with or without grey water (Moya Diaz-Aguado *et al.,* 2017; Özyazıcı, 2013).

Faecal sludge that is collected from septic tanks poses management challenges in urban areas of developing countries. Currently, faecal sludge is dumped into the urban and peri-urban environment, posing great risks to the soil, surface water and groundwater quality (Singha *et al.,* 2017).

The management of faecal sludge (septic tank and pit latrine) is very limited and untreated waste ends up entering the urban environment with significant health and environmental implications (Rohini *et al.,* 2017).

Sewage sludge improved soil structure, increases infiltration rate, aggregate stability and soil water holding capacity (Sort and Alcaniz, 1999). As sewage sludge, faecal sludge is a valuable soil conditioner because it contains organic matter, nitrogen and phosphorus.

Human excreta/faecal is a good source of micro/macronutrients of plant besides its richness in organic matter. Human excreta/faecal constitutes a large fertilizer resource, the metals (Ca, Mg, Zn, Cu, Ni, Cd, Pb, Hg) are mainly excreted via the faeces and the remaining elements (N, P, K, S, B) are mainly excreted via the urine (Schouw *et al.,* 2002).

Its irrationalized and unscientific application severely affects plant growth, animal nutrition and human health; moreover, crops responses to sludge application vary by source, application rate, plant species, soil type, weathering conditions and application management (Rabie *et al.*, 1997).

Barriquelo *et al.* (2003) showed a high yield after sludge application, because its content of macro/micronutrients. According to Berti and Jacobs (1996), faecal sludge may be used in agriculture for increasing product yield.

At the present time, several developing countries are facing the challenge of developing scientifically based, but feasible and useful standards within their social and economical context to manage sludge (Jimenez *et al.,* 2006). As faecal sludge studies very limited in Bangladesh, we find it is necessary and useful to study the effect of human faecal on crop productivity.

Materials and Methods

Crop Cultivation

Cabbage was selected as test crop in the experiments. The crop was cultivated in cool moist season in sandy loam soil having PH 6. The seeding was done in 16 October 2015 and 30 days old seedling was transplanted in 15 November 2015. Hardening of seedlings is done by withholding irrigation 4-6 days prior to planting. The spacing was maintained 60 x 45 x 45 cm in a paired row system. Irrigation will be done as and when necessary. For pest and insect control both biological and chemicals techniques were used.

Experimental design

There were two experiments sets in two consecutive seasons i.e. Rabi 2015-16 and Rabi 2016-17 in BRAC Agricultural Research and Development Center (BARDC), Gazipur.

In Rabi 2015-16, Randomized Complete Block Design (RCBD) was adopted with three replications. The experiment contained three treatments with the following combinations:

1. Recommended fertilizer dosage
2. Recommended fertilizer dosage with cow dung addition
3. Recommended fertilizer dosage with faecal sludge addition

In Rabi 2016-17, there were five treatments with three replication in Randomized Complete Block Design (RCBD) and the treatments were:

1. Recommended faecal sludge
2. Recommended fertilizer dosage
3. Three-forth (3/4) of recommended chemical fertilizer with recommended faecal sludge
4. Half (1/2) of recommended chemical fertilizer with recommended faecal sludge
5. Recommended chemical fertilizer with recommended faecal sludge

Results and Discussion

Effect of faecal compared with chemical fertilizer and cow dung

There were no significant differences were recorded in time of head formation and number leaves per plant by application of recommended dosages of chemical fertilizer, chemical fertilizer with cowdung and chemical fertilizer with faecal. The shortest time was required for chemical with faecal (72 days) where as the longest time required in chemical fertilizers (77.67 days) and chemical with cow dung required 75 days. Highest head weight was recorded in chemical fertilizer with faecal (3493.33g) and it was significantly differ from chemical with cowdung (3104.33 g) and only chemical fertilizer (2783.00 g). Width of cabbage head was also significantly differ with application of faecal with chemical fertilizer (24.4 cm) on the other hand no significant differences were found in chemical fertilizer with cow dung (21.6 cm) and chemical fertilizer (21.2 cm) only. Significant differences were found in varied treatment on cabbage head yield. Highest yield was recorded in faecal with chemical fertilizer (20.16 t ac^{-1}) whereas chemical (15.93 t ac^{-1}) and chemical fertilizer with cow dung (17.42 t ac^{-1}). Berton *et al*. (1989) and Barriquelo *et al*. (2003) found the maize productivity was increased with application of sewage sludge in filed. The reasons for such type of results may be that the combined application supplies the nutrients continuously and rapidly. The duration of the crop was also shortened by using chemical fertilizer with faecal (126.67 days) and longest time required for final harvest in only chemical fertilizers (133 days). Szymańska *et al.* (2013) reported plant productivity as fresh and dry matter yield of total maize plants was higher than on treatments with mineral fertilization.

Table 1. Effect of faecal sludge compared with chemical fertilizer and cow dung.

Treatment	Days to Head formation	Leaves $plant^{-1}$	Width of head (cm)	Days to 1st harvesting	Weight of head (g)	Crop duration (days)	Yield Ac^{-1} (MT)
T1: Chemical fertilizer	49	19.67	21.2 b	77.67 a	2783.67 b	133 a	15.93 b
T2: Chemical Fertilizer with Cow dung	47.67	18.33	21.6 b	75 b	3104.33 b	128.67 b	17.42 ab
T3: Chemical Fertilizer With Faecal sludge	46.67	18	24.4 a	72 c	3493.33 a	126.67 b	20.16 a
CV%	3.49	6.19	1.03	0.8902	5.34	1.03	6.83
LSD	-	-	0.52	1.51	378.25	3.02	2.76

Within column values followed by different letter(s) are significantly different by DMRT (p>0.05).

Effect of dosage of faecal on crop yield

After findings of the effect of faecal on cabbage head yield and yield components, next Rabi-2016-17 examine how much faecal need to better yield and whether applying faecal, chemical fertilizer and/or organic fertilizer is necessary or not.

There were no significant differences recorded in day to head formation and head width with application of different dosages of chemical fertilizers with faecal. Szymańska *et al*. (2013) found that growth and development of maize fertilized with municipal sewage sludge was normal and did not differ from mineral-fertilized

plants. On the other hand, significant differences were observed in number of leaves per plant with application of faecal with chemical fertilizers where highest (20.60) number of leaves was recorded in recommended dosages of chemical fertilizers with recommended dosages of faecal and lowest (14.9) were recorded while applied only faecal. Significant differences were observed in head weight with application of different dosage of fertilizers with faecal. Highest head weight (2277 g) was recorded in applying full dosages of chemical fertilizers with full dosages of faecal and lowest (1614.33 g) were recorded while applied only faecal.

Table 2. Effect of dosage of faecal on crop yield.

Treatment	Days to head formation	Days to 50% head formation	Leaves Plant^{-1}	Head Diameter (cm)	Weight of Head (g)	Yield Ac^{-1} (MT)
T1: faecal sludge	40	44.67	14.9 d	59.27	1614.33 c	26.63 c
T2: Fertilizer dosage	40	44.67	20.13 ab	59.47	2096.33 b	34.57 b
T3:3/4th Chemical fertilizer+faecal sludge	39.33	43.67	17.63 c	59.07	2008 b	33.39 b
T4:1/2 Chemical fertilizer+faecal sludge	39	44	19.43 b	59.27	2087.67 b	34.44 b
T5:Full Chemical fertilizer+faecal sludge	39.33	43.33	20.6 a	59.67	2277 a	36.95 a
CV(%)	1.5	1.71	2.89	1.32	2.98	2.83
LSD	-	-	1.01	-	113.31	1.77

Within column values followed by different letter(s) are significantly different by DMRT (p>0.05).

Yield is one of the important characters and it depends on different parameter contributing to yield. Significant differences were found in cabbage head yield. The highest yield (36.95 t ac^{-1}) was recorded in treatment of recommended dosages of chemical fertilizer with recommended dosage of faecal and lowest yield (26.63 t ac^{-1}) recorded where applied only faecal. There were no significant yield differences where applied only recommended chemical fertilizer (34.57 t ac^{-1}), half dosage of recommended chemical fertilizer (33.39 t ac^{-1}) and three-fourth chemical fertilizers (34.44 t ac^{-1}). Szymańska *et al.* (2013) found that the yield of wheat, maize and vetch increased with addition of sewage sludge with mineral fertilizer by 62.6, 95 and 16.4%, respectively vs. control, while only sludge application increase was 89.7, 177.0, and 32.3%, respectively vs. control. Barriquelo *et al.* (2003) showed a high yield after sludge application, because it's content of macro/ micronutrients.

References

Barriquelo, M., Marines, J., Silva, M. and Lenzi, E. 2003. Lead behavior in soil treated with contaminated sewage sludge and cultivated with Maize. *Brazilian J. Arch. Biol. Tech.* 46 (4): 499-505.

Berti, W.R. and Jacobs, L.W. 1996. Chemistry and Phytotoxicity of soil trace elements from repeated sewage sludge applications. *J. Env. Qual.* 25: 1025-1032.

Berton, R.S., Camargo, O.A. and Valadares, J.M.A.S. 1989. Absorcao de nutrients pelo milho em resposta adicao de lodo de esgoto a cinco solos paulistas. *R. Bras. Ci. Solo.* 13: 187-192.

Cofie, O.O., Berisavljevic, D. and Drechsel, P. 2007. The use of human waste for peri-urban agriculture in Northern Ghana. *Renew. Agric. Food Syst.* 20 (2): 73-80.

Jimenez, B., Austin, A., Cloete, E. and Phasha, C. 2006. Using Ecosan sludge for crop production. *Water Sci. Tech.* 54(5): 169–177.

Moya Diaz-Aguado, B.A., Parker, A. and Sakrabani, R. 2017. Maximizing the Value of Fertilizers Derived from Source-Separated Human Waste in Antananarivo, Madagascar. FSM4 Abstract presentation Track-1: Research. pp. 93-94.

Özyazıcı, M.A. 2013. Effects of sewage sludge on the yield of plants in the rotation system of wheat-white head cabbage-tomato. *Eurasian J. Soil Sci.* 2: 35-44.

Rabie, M.H., Negm, A.Y., Eleiwa, M.M. and Abd - El- Sabour, M.F. 1997. Influence of two sewage sludge sources on faba bean and sorghum plants growth and elements uptake. *Egypt. J. Soil Sci.* 37 (4): 425-435.

Rohini, P., Sarani. S. and Susmita. S. 2017. Characteristics of Faecal Sludge generated from onsite systems located in Devanahalli. FSM4 Abstract presentation Track-1: Research. pp. 89-90.

Schouw, N.L., Danteravanich, S., Mosbaek, H. and Tjell, J.C. 2002. Composition of human excreta: a case study from Southern Thailand. *Sci. Total Env.* 286 (1-3): 155-66.

Singha, S., Mohana, R.R., Rathi, S. and Raju, N.J. 2017. Technology options for faecal sludge management in developing countries: Benefits and revenue from reuse. *Env. Tech. Innov.* 7: 203–218.

Sort, X. and Alcaniz, J.M. 1999. Effect of sewage sludge amendment on soil aggregation. *J. Land degrad. Dev.* 10 (1): 3-12.

Szymańska, G., Sulewska, H. and Śmiatacz, K. 2013. Response of maize grown for silage on the application of sewage sludge. *Acta Sci. Pol. Agricultura.* 12(3): 55-67.