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Evaluation of Bovine Digesta as Organic Fertilizer in Maize Using Pot Experiments

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A B S T R A C T

In the present study Bovine digesta, a major slaughter house waste has been recycled as organic fertilizer. Bovine digesta collected was sun dried for 3 days, powdered and was subjected to physicochemical analysis - BOD, COD, pH and TDS. Bovine digesta has 1.35% Nitrogen, 0.72% Phosphorous and 0.515% Potassium. Hence, it has been evaluated as organic fertilizer in Maize at various percentages like 75%, 100%, 125% and 150% equated with nitrogen content of urea. Urea and farmyard manure has been used as inorganic and organic fertilizer control for Bovine digesta. The plant growth parameters - height, number of leaves, leaf breadth, stem breadth and number of cobs have been studied at 45th and 90th day. Also the pattern of nutrient release (Nitrogen, Phosphorous, Potassium and Carbon) from bovine digesta to soil has been studied by analyzing the soil samples at regular intervals (7, 14, 21, 28, 45 and 90th day). The nutrient content (Nitrogen, Phosphorous and Potassium) in tissues - leaves, stem, root and cobs have also been analyzed. In the present study soil NPK release, Productivity (number of Cobs) and NPK content in cobs was comparable with urea and farmyard control when bovine digesta was added as organic fertilizer.

Introduction

Fertilizers enhance the growth of plants by supplying one or more essential nutrients to plants. Fertilizers provide macronutrients - Nitrogen, Phosphorous, Potassium, secondary macronutrients - Calcium, Magnesium, Sulphur and micronutrients - Copper, Iron, Zinc and Manganese. The macronutrients, consumed in large quantities by plants are present in plant tissues from 0.15% - 6% on dry matter basis. Nitrogen present in proteins, DNA and other components like chlorophyll are not available to plants as they are not in fixed form. This makes Nitrogen the most important fertilizer. Fertilizers can be

classified as organic and inorganic fertilizers. Inorganic fertilizers are synthetic and rapid in action. Commonly used inorganic fertilizers are ammonium nitrate, ammonium sulfate, potash, triple superphosphate and magnesium sulfate. Although inorganic fertilizers provide nutrients to plants in ready form they are subjected to leaching. Higher dosage of inorganic fertilizer not only burns the plants but also may build up toxic soil concentrations that may lead to chemical imbalances. Organic fertilizers though slow in action, provides a healthy growing environment. They contain only plant or animal-based materials that are either a byproduct or end product of naturally occurring substances thus can be easily recycled. The most commonly used organic fertilizers are peat, animal wastes (often from slaughter houses), plant wastes from agriculture, and treated sewage sludge and others like blood meal, bone meal, fish meal. The slaughter house wastes are very difficult to be treated by the industries and hence they should be recycled in an economical way to maintain a good hygiene and proper sanitation. Blood meal, bone meal and fish meal are the products of slaughtered animals which are used as organic fertilizer. Farmyard manure a commonly used organic fertilizer contains 0.5% nitrogen, 0.2% phosphorous and 0.5% potassium in its well decomposed stage. Bovine digesta when analysed for its NPK content showed a higher value when compared to farmyard manure so, in this study bovine digesta a major slaughter house waste has been evaluated as organic fertilizer in Maize plant, a method of low cost recycling.

Materials and Methods

Preparation of Bovine digesta as organic fertilizer

Bovine digesta was collected from Perambur slaughter house, Chennai. Bovine digesta was sun dried for about 3 days and powdered. The prepared organic fertilizer was analysed for NPK content (Ji *et al.,* 2017 and Kalbani *et al.,* 2016). Nitrogen was estimated by using the method proposed by Kirk (1950), Phosphorus by Bray and Kurtz (1945) and Potassium content by Martin et al (1994) and Creed et al (1994). The physicochemical properties - BOD (IS 1993), COD (Rice *et al.*, 2012), pH (Rice *et al.,* 2012) and Total dissolved solids (TDS) (Rice *et al.,* 2012) were analysed.

Evaluation of Bovine digesta as organic fertilizer by pot experiment

Pot experiment for Maize (*Zea mays*)

Soil sample collection

Soil samples were collected from University Research Farm, Madhavaram, Chennai- 51 and analysed for Nitrogen (Subbiah and Asija, 1956), Phosphorous (Olsen *et al.,* 1954), Potassium (Stanford and English, 1949), pH (Jackson and Dutton, 1973) and organic carbon (Walkley and Black, 1934) before the start of the experiment (Akbari *et al.,* 2011 and Islam *et al.,* 2017). Analysis was carried out at Krishi Vigyan *Kendra* (KVK), Veterinary College and research institute, Namakkal.

Seeds

Maize (*Zea mays*) seeds were purchased from Department of millets, Tamil Nadu agricultural university (TNAU), Coimbatore.

Pots

Earthen pots of size 12” (inch) with 10kg soil capacity were purchased from Vadivel Tandoori and Pot supplier, Valluvar kottam, Chennai.

Pot experiment

Based on the Nitrogen content of Bovine digesta (Nitrogen -1.35%) it was taken at

different percentage like 75%, 100%, 125% and 150% by equating with Nitrogen percentage in urea. 10kg of soil was taken as plain control (Adeniyan *et al.,* 2011). 10kg of soil with farm yard manure as organic fertilizer control and with urea as chemical fertilizer control was taken. Bovine digesta at various percentages like 75,100,125 and 150 were added to the soil and mixed thoroughly. Seeds (4 seeds per pot) were sowed at a depth of 1.5cm (Jayasinghe *et al.,* 2016). After three days, the germination of maize will occur completely. After the plant attained two leaves growth stage, the plants were thinned out to two plants per pot. All the studies were done in triplicates.

Calculation for the amount of fertilizer to be added

Farmyard manure was added at 56.8g/10kg of soil. Urea at 1.34g/10kg of soil was added (based on the N content in urea i.e., N=46%)

Urea = (100%* N recommendation for maize *for 10 kg of soil)/ (% N in urea* Kg of soil in one hectare).

Bovine digesta as organic fertilizer for maize was added at 75%, 100%, 125% and 150% to 10kg of soil (percentage indicates nitrogen content equated with urea).

Plant growth studies with Bovine digesta as organic fertilizer

Soil samples were collected at regular intervals (7^{th}, 14^{th}, 21^{st}, 28^{th}, 45^{th} and 90^{th} day) at depth of 0-30cm (Alessandro Rovero *et al.,* 2015) and NPK analysis was carried out. The trial was done till 90^{th} day (Adeniyan *et al.,* 2011) and at 45^{th} and 90^{th} day plant height, number of leaves, leaf breadth, stem breadth and number of cobs were measured (Roy *et al.,* 2013). Tissues at 45^{th} and 90^{th} days (leaves, stem, root and cobs) were taken and analyzed for NPK content (Melissa Herman, 2011). Nitrogen in tissues was estimated using Kjeldhal method (Kirk, 1950), phosphorous by using photometric method (Bray and Kurtz, 1945) and Potassium by using colorimetric method (Abul Fadl, 1949).

Results and Discussion

Bovine digesta converted to organic fertilizer is given in following table.

The physicochemical properties of Bovine digesta is given in Table 1.

NPK content of bovine digesta

Nitrogen - 1.35%
Phosphorous – 0.72%
Potassium- 0.515%
Initial pH, organic carbon and NPK of soil at the 0^{th} day is given in Table 3

Plant growth studies to evaluate Bovine digesta as organic fertilizer

Height of the plant, Number of leaves, Leaf breadth, stem breadth and number of cobs on 45^{th} and 90^{th} day are given in Table 3 and statistical analysis used was Randomized block design.

Randomized block design analysis of evaluation of bovine digesta as organic fertilizer in Maize (Table 3)

Effect of bovine digesta when added as organic fertilizer showed a significant change for height of the plant and number of leaves since the F value for Height of the plant and number of leaves are highly significant between groups (Plain control, Urea control, farm yard manure control, Bovine digesta75%*, 100%*,125%* and 150%*)

Effect of bovine digesta when added as

organic fertilizer showed a significant change for height of the plant, number of leaves and number of cobs since the F value for Height of the plant, number of leaves and number of cobs are highly significant between days (45^{th} and 90^{th} days). There is no significant change in leaf breadth and stem breadth between groups and between days

Height of the plant and number of leaves - Bovine digesta 75%* showed best results when compared with other groups (Plain control, Urea control, farm yard manure control, Bovine digesta 100%*,125%* and 150%*)

No. of cobs- Bovine digesta 100%*,125%* and 150%* showed best results when compared with other groups (Plain control, Urea control, farm yard manure control and Bovine digesta75%*)

NPK and organic carbon release in soil on 7, 14, 21, 28, 45 and 90^{th} days are given in Table 4 and 5 and statistical analysis used was Randomized block design.

Randomized block design analysis of experiment on evaluation of bovine digesta as organic fertilizer in Maize (Table 4 and 5)

Effect of bovine digesta when added as organic fertilizer showed a significant change for height of the plant and number of leaves since the F value for Nitrogen, Phosphorous and Potassium are highly significant between groups (Plain control, Urea control, farm yard manure control, Bovine digesta 75%*, 100%*, 125%* and 150%*) and days (7,14,21,28,45 and 90).

There is no significant change in carbon between groups and between days since the F value for carbon has no significant change between groups (Plain control, Urea control, farm yard manure control, Bovine digesta75%*, 100%*, 125%* and 150%*) and days (7,14,21,28,45 and 90).

Nitrogen- Bovine digesta 125%* showed best results (276.46 kg/ha) when compared with other Bovine digesta groups (Bovine digests 75%*, 100%* and 125%*) and Urea control showed best results (284kg/ha) when compared with other groups (Plain control, farm yard manure control, Bovine digesta75%*, 100%*,125%* and 150%*)

Phosphorous- Bovine digesta 100%* showed best results when compared with other groups (Plain control, Urea control, farm yard manure control, Bovine digesta75%*,125%* and 150%*)

Potassium- Bovine digesta 125%* showed best results when compared with other groups (Plain control, Urea control, farm yard manure control, Bovine digesta75%*, 100%* and 150%*)

NPK content in root, stem, leaves and cobs on 45^{th} and 90^{th} days are given in Table 6 and statistical analysis used was Randomized block design.

Randomized block design analysis of experiment on evaluation of bovine digesta as organic fertilizer in Maize (Table 6)

Effect of bovine digesta when added as organic fertilizer showed a significant change in Nitrogen, phosphorous and potassium content since the F value for Nitrogen, Phosphorous and Potassium in root, stem, leaves and cobs are highly significant between groups (Plain control, Urea control, farm yard manure control, Bovine digesta75%*, 100%*, 125%* and 150%*) and days (45^{th} and 90^{th} day).

Nitrogen in cobs - Bovine digesta 75%* showed best results (2.47%) when compared with other Bovine digesta groups (100%*, 125%* and 150%*) and Urea control showed best results (2.75%) when compared with other groups (Plain control,

farm yard manure control, Bovine digesta75%*, 100%*,125%* and 150%*)

Phosphorous and potassium in cobs - Bovine digesta 100%* showed best results (1.09% and 1.73%) when compared with other Bovine digesta groups (75%*, 125%* and 150%*) and farm yard manure control showed best results (1.4%) when compared with other groups (Plain control, urea control, Bovine digesta75%*, 100%*,125%* and 150%*).

Table.1 Physicochemical properties of Bovine digesta

Parameters	Results	Methods
pH	6.86	4500 H^+ B (Rice *et al.*, 2012)
Total dissolved solids(mg/l)	1510	IS 3025:P.16:1984:R:2012 (Rice *et al.*, 2012)
COD (mg/l)	29800	IS 3025:P.58:2006:R:2012 (Rice *et al.*, 2012)
BOD at 27ºC for 3days (mg/l)	11640	IS 3025:P.44:1993:R:2009 (BIS, 1993)

Table.2 Initial analysis of soil

Parameters	Results	Methods
pH	5.87	Potentiometry (Jackson and Dutton, 1973)
Organic carbon (%)	0.3	Rapid titration method (Walkey and Black 1934)
Nitrogen (Kg/ha)	267	Alkaline permanganate Oxidation method (Subbiah and Asija, 1956)
Phosphorous (Kg/ha)	43.2	Extraction with 0.5M $NaHCO_3$ (Olsen *et al.*, 1954)
Potassium (Kg/ha)	175	Extraction with Neutral normal NH_4OAc and Flame photometry (Stanford and English, 1949)

Table.3 Randomized block design analysis for plant growth studies to evaluate Bovine digesta as organic fertilizer in maize on 45th day

Groups	Plain control		Farmyard manure control		Urea control		Bovine digesta 75%		Bovine digesta 100%		Bovine digesta 125%		Bovine digesta 150%		F value Between groups	F value between days	Significance between groups	Significance between days
	Mean ± SD																	
	45th day	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**				
HP in inches	34 ± 6.24	68 ± 23	37.66 ± 11.23	56.66 ± 5.77	40.66 ± 9.23	76 ± 17.34	47 ± 2	**121 ± 6.55**	38 ± 5.29	67 ± 11.26	40.66 ± 6.02	84.66 ± 6.5	45 ± 1	78.66 ± 13.05	7.959	138.623	0.00	0.00
NL in cm	5.66 ± 2.08	12 ± 0.00	5.66 ± 2.08	8.33 ± 1.15	10.00 ± 1.00	12 ± 2.00	11.00 ± 1.00	**13.33 ± 0.57**	9.66 ± 1.52	12 ± 1.00	9.00 ± 3.46	12 ± 1.00	9.66 ± 1.52	13.00 ± 1.00	7.148	40.33	0.00	0.00
LB in cm	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	5.00 ± 0.00	-	-	-	-
SB in cm	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	-	-	-	-
NC	0.00 ± 0.00	2.00 ± 0.00	0.00 ± 0.00	2.33 ± 0.577	0.00 ± 0.00	2.66 ± 0.57	0.00 ± 0.00	2.00 ± 1.00	0.00 ± 0.00	**3.00 ± 1.00**	0.00 ± 0.00	**3.00 ± 0.00**	0.00 ± 0.00	**3.00 ± 1.00**	1.212	265.091	**0.329**	0.00

Where HP- height of the plant, NL- number of leaves, LB- leaf breadth, SB – stem breadth and NC- number of cobs.
Where* indicates nitrogen equated with urea.

Table.4 Randomized block design analysis for Nitrogen, Phosphorous and Potassium release studies from soil when bovine digesta was added as organic fertilizer in Maize

Groups	Nitrogen						Phosphorous						Potassium					
	7th day	**14th day**	**21st day**	**28th day**	**45th day**	**90th Day**	**7th day**	**14th day**	**21st day**	**28th day**	**45th day**	**90th Day**	**7th day**	**14th day**	**21st day**	**28th day**	**45th day**	**90th Day**
	Mean±SD																	
Plain control	243 ± 2.00	238.66 ± 1.66	234.56 ± 0.89	230.32 ± 0.68	225 ± 1.67	215.66 ± 2.66	18.2 ± 0.2	17.7 ± 0.38	16.33 ± 0.23	14.4 ± 0.6	13.36 ± 0.03	12.96 ± 0.3	176.16 ± 1.04	167.70 ± 1.33	150.77 ± 1.17	134.43 ± 0.51	121.9 ± 0.87	116.4 ± 1.27
Farm yard manure control	244.21 ± 1.21	245.22 ± 0.78	246.44 ± 1.44	247.67 ± 1.34	248.66 ± 1.55	242 ± 0.67	18.26 ± 0.26	18.6 ± 0.06	19.21 ± 0.35	19.7 ± 0.14	20.3 ± 0.36	19.66 ± 0.34	191.0 ± 1.00	202.4 ± 0.96	210.29 ± 0.86	218.37 ± 1.25	221.44 ± 0.77	219.15 ± 1.23
Urea control	252 ± 0.24	259 ± 1.32	264.3 ± 0.64	271.5 ± 0.5	**284 ± 1.35**	276.76 ± 3.14	20.3 ± 0.48	20.78 ± 0.44	21.2 ± 0.2	21.45 ± 0.45	21.78 ± 0.22	21.33 ± 0.01	197.8 ± 0.74	203.7 ± 1.83	212.52 ± 1.34	221.41 ± 0.61	225.48 ± 2.34	220.96 ± 0.61
Bovine digesta 75%	247.66 ± 0.66	251 ± 0.67	255.66 ± 4.66	263.66 ± 1.33	272.33 ± 1.33	262.66 ± 0.34	19.13 ± 0.15	19.17 ± 0.08	20.12 ± 0.22	20.64 ± 0.28	20.96 ± 0.04	20.63 ± 0.3	195.3 ± 0.61	202.26 ± 1.17	209.7 ± 0.69	220.93 ± 0.24	219.21 ± 1.33	212.99 ± 0.87
Bovine digesta 100%	256.33 ± 1.33	259.66 ± 0.66	263.66 ± 2.34	268.66 ± 2.33	275.33 ± 3.44	267.33 ± 0.67	19.5 ± 0.2	19.96 ± 0.1	20.55 ± 0.02	20.89 ± 0.33	**21.87 ± 0.21**	20.69 ± 0.09	197.07 ± 1.00	202.24 ± 1.09	211.00 ± 1.00	223.7 ± 0.78	228.9 ± 0.78	223.6 ± 1.41
Bovine digesta 125%	253.21 ± 2.93	260.33 ± 2.67	264.38 ± 1.87	270.23 ± 2.59	**276.46 ± 2.91**	269.66 ± 1.13	19.94 ± 0.14	20.15 ± 0.03	20.66 ± 0.11	20.88 ± 0.1	21.37 ± 0.46	20.84 ± 0.11	199.7 ± 2.13	20.4.03 ± 0.83	215.25 ± 1.17	225.22 ± 1.07	**231.33 ± 1.19**	226.9 ± 0.84
Bovine digesta 150%	246.28 ± 2.28	251.66 ± 1.66	257.5 ± 1.18	267.66 ± 0.88	273.56 ± 0.56	266.78 ± 1.22	19.33 ± 0.12	19.66 ± 0.11	20.1 ± 0.1	20.78 ± 0.06	21.37 ± 0.16	20.57 ± 0.1	194.33 ± 1.33	201.56 ± 0.69	210.15 ± 1.03	220.04 ± 1.00	225.78 ± 1.22	221.53 ± 0.77
F value Between Groups	961.88						1039.19						9678.59					
F value Between Days	204.665						34.06						794.29					
SigniFicance Between Groups	0.000						0.000						0.000					
SigniFicance Between Days	0.000						0.000						0.000					

Table.5 Randomized block design analysis for carbon release studies from soil when bovine digesta was added as organic fertilizer in Maize

Groups	C						F value between groups	F value between days	Significance between groups	Significance between days
	7th day	**14th day**	**21st day**	**28th day**	**45th day**	**90th day**				
	Mean± SD									
Plain control	0.28 ± 0.01	0.29 ± 0.00	0.28 ± 0.02	0.28 ± 0.01	0.28 ± 0.02	0.30 ± 0.01	2.162	1.337	0.023	0.02
Farm yard manure control	0.29 ± 0.01	0.28 ± 0.02	0.30 ± 0.01	0.29 ± 0.02	0.28 ± 0.01	0.30 ± 0.01				
Urea control	0.29 ± 0.02	0.31 ± 0.02	0.29 ± 0.02	0.29 ± 0.01	0.29 ± 0.02	0.29 ± 0.01				
Bovine digesta 75%	0.31 ± 0.01	0.28 ± 0.01	0.30 ± 0.01	0.30 ± 0.01	0.29 ± 0.01	0.29 ± 0.02				
Bovine digesta 100%	0.31 ± 0.02	0.28 ± 0.02	0.31 ± 0.01	0.30 ± 0.02	0.29 ± 0.02	0.30 ± 0.02				
Bovine digesta 125%	0.29 ± 0.01	0.30 ± 0.01	0.30 ± 0.01	0.28 ± 0.01	0.29 ± 0.01	0.30 ± 0.02				
Bovine digesta 150%	0.28 ± 0.01	0.28 ± 0.02	0.30 ± 0.02	0.31 ± 0.01	0.30 ± 0.02	0.29 ± 0.01				

Table.6 Randomized block design analysis for Nitrogen, Phosphorous and Potassium uptake studies in root, leaves, stem and cobs when bovine digesta was added as organic fertilizer in Maize

Groups	Plain control		Farmyard manure control		Urea control		Bovine digesta 75%		Bovine digesta 100%		Bovine digesta 125%		Bovine digesta 150%		F value Between groups	F value between days	Significance between groups	Significance between days
	Mean ± SD																	
	45th day	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**	**45th day**	**90th day**				
RN	0.25 ± 0.01	0.28 ± 0.01	0.21 ± 0.01	0.20 ± 0.01	0.16 ± 0.01	0.25 ± 0.01	0.38 ± 0.01	0.24 ± 0.01	0.2 ± 0.01	0.25 ± 0.01	0.27 ± 0.01	0.19 ± 0.01	0.32 ± 0.02	0.27 ± 0.01	188.17	34.615	0.00	0.00
RP	0.06 ± 0.01	0.19 ± 0.01	0.14 ± 0.01	0.2 ± 0.01	0.05 ± 0.01	0.2 ± 0.01	0.52 ± 0.01	0.18 ± 0.01	0.25 ± 0.01	0.22 ± 0.00	0.32 ± 0.01	0.13 ± 0.01	0.23 ± 0.01	0.12 ± 0.01	544.90	357.14	0.00	0.00
RK	0.51 ± 0.02	0.66 ± 0.01	0.47 ± 0.01	0.60 ± 0.01	0.51 ± 0.01	0.54 ± 0.01	0.39 ± 0.01	0.60 ± 0.01	1.19 ± 0.02	0.57 ± 0.02	0.81 ± 0.01	0.61 ± 0.01	0.88 ± 0.02	0.61 ± 0.01	1043.1	589.79	0.00	0.00
SN	0.9 ± 0.01	1.96 ± 0.01	0.83 ± 0.01	1.94 ± 0.01	1.02 ± 0.03	1.59 ± 0.01	1.09 ± 0.01	1.51 ± 0.01	1.01 ± 0.01	1.62 ± 0.01	1.06 ± 0.01	1.46 ± 0.01	1.00 ± 0.01	1.38 ± 0.01	286.03	33125	0.00	0.00
SP	0.23 ± 0.01	0.59 ± 0.01	0.50 ± 0.01	1.05 ± 0.01	0.21 ± 0.01	0.67 ± 0.01	0.41 ± 0.01	0.66 ± 0.01	0.56 ± 0.02	0.66 ± 0.01	0.65 ± 0.01	0.54 ± 0.01	0.32 ± 0.02	0.47 ± 0.01	1248.4	7476.0	0.00	0.00
SK	1.81 ± 0.01	2.83 ± 0.01	2.28 ± 0.01	4.02 ± 0.02	1.76 ± 0.01	4.68 ± 0.01	1.36 ± 0.03	2.26 ± 0.01	2.67 ± 0.01	1.71 ± 0.02	3.14 ± 0.01	1.39 ± 0.01	3.93 ± 0.01	1.92 ± 0.01	10735.6	4512.5	0.00	0.00
LN	1.66 ± 0.01	1.5 ± 0.01	1.28 ± 0.01	1.69 ± 0.01	1.3 ± 0.01	1.19 ± 0.01	1.35 ± 0.02	1.21 ± 0.01	1.32 ± 0.02	1.61 ± 0.01	1.76 ± 0.01	1.31 ± 0.01	1.38 ± 0.01	1.46 ± 0.01	993.76	12.1	0.00	0.00
LP	0.22 ± 0.01	0.55 ± 0.01	0.27 ± 0.01	0.93 ± 0.01	0.25 ± 0.01	0.53 ± 0.01	0.31 ± 0.01	0.40 ± 0.01	0.31 ± 0.01	0.57 ± 0.01	0.43 ± 0.01	0.45 ± 0.01	0.26 ± 0.01	0.35 ± 0.01	817.07	9937.9	0.00	0.00
LK	1.23 ± 0.01	2.89 ± 0.01	0.86 ± 0.01	3.98 ± 0.01	1.17 ± 0.01	2.77 ± 0.01	1.76 ± 0.02	2.95 ± 0.01	2.12 ± 0.01	1.36 ± 0.01	2.56 ± 0.01	1.64 ± 0.02	2.07 ± 0.02	1.22 ± 0.01	3574.5	39364	0.00	0.00
CN	0.00 ± 0.00	2.08 ± 0.01	0.00 ± 0.00	2.40 ± 0.02	0.00 ± 0.00	**2.75 ± 0.01**	0.00 ± 0.00	**2.47 ± 0.01**	0.00 ± 0.00	2.12 ± 0.01	0.00 ± 0.00	2.24 ± 0.01	0.00 ± 0.00	2.27 ± 0.288	3420.7	133840	0.00	0.00
CP	0.00 ± 0.00	0.91 ± 0.01	0.00 ± 0.00	1.40 ± 0.02	0.00 ± 0.00	1.36 ± 0.01	0.00 ± 0.00	0.59 ± 0.02	0.00 ± 0.00	**1.09 ± 0.01**	0.00 ± 0.00	0.83 ± 0.01	0.00 ± 0.00	0.84 ± 0.01	2448.0	193017	0.00	0.00
CK	0.00 ± 0.00	1.98 ± 0.01	0.00 ± 0.00	**2.03 ± 0.01**	0.00 ± 0.00	1.34 ± 0.02	0.00 ± 0.00	1.67 ± 0.01	0.00 ± 0.00	**1.73 ± 0.03**	0.00 ± 0.00	1.34 ± 0.01	0.00 ± 0.00	1.73 ± 0.287	1068.8	245226	0.00	0.00

Where RN- root Nitrogen, RP- Root Phosphorous, RK – Root potassium, SN- stem nitrogen, SP- stem phosphorous, SK- stem potassium, LN- leaf nitrogen, LP- leaf phosphorous, LK – leaf potassium, CN – cob nitrogen, CP – cob phosphorous and CK- cob potassium. Where* indicates nitrogen equated with urea.

Bovine digesta when analysed for NPK content showed a higher values of nitrogen, phosphorous and potassium than farmyard manure. The present study reveals that bovine digesta a major slaughter house waste can be recycled and used as organic fertilizer replacing commonly used fertilizer. Bovine digesta 75%* showed best results in height of the plant as well as number of leaves when compared with other groups (Plain control, Urea control, farm yard manure control, Bovine digesta 100%*, 125%* and 150%*). Improvement in height and number of leaves was also reported in chilli, tomato and brinjal when another type of organic fertilizer BBRDM (bovine blood rumen digesta mixture) has been used by Roy *et al.,* 2013. Similar findings have been reported by Oyedeji *et al.,* 2014 where poultry manure when used as organic fertilizer improved the plant height as well as the number of leaves in Amaranths deflexus and Amaranths hybridus. Bovine digesta 100%*, 125%* and 150%* showed best results in producing number of cobs when compared with other groups (Plain control, Urea control, farm yard manure control and Bovine digesta 75%*). Similar findings have been reported by Farhad *et al.,* 2009 and Enujeke, 2013 for poultry manure, when there is an increase in the dosage of poultry manure which was used as an organic fertilizer, the number of cob production have been improved. Similar findings have been reported by Okoroafor *et al.,* 2013 where poultry droppings and pig dung when used as organic fertilizer improved the number of cob production in maize when compared with plain control. Bovine digesta 100%* and 125%* showed best results in soil phosphorous and potassium release when compared with other groups (Plain control, Urea control, farm yard manure control, Bovine digesta 75%* and 150%*). Bovine digesta 125%* showed best results (276.46 kg/ha) in nitrogen release in soil and Bovine digesta 75%* showed best results in nitrogen content in cobs when compared with other Bovine digesta groups (Bovine digests 75%*, 100%* and 125%*). Urea control showed best results in nitrogen release (284kg/ha) and nitrogen content in cobs (2.75%) when compared with other groups (Plain control, farm yard manure control, Bovine digesta 75%*, 100%*, 125%* and 150%*). Bovine digesta 100%* showed best results in phosphorous content in cobs (1.09%) and potassium content in cobs (1.73%) when compared with other Bovine digesta groups (Bovine digests 75%*, 125%* and 150%*). Farm yard manure control showed best results in phosphorous content (1.4%) in cobs and potassium content (2.03%) in cobs when compared with other groups (Plain control, urea control, Bovine digesta75%*, 100%*, 125%* and 150%*). Similarly an average NPK content in grains have been found and reported when cattle manure was used as fertilizer when compared to inorganic fertilizer by Melissa Herman (2011).

In the present study it is concluded that the Bovine digesta 125%*(nitrogen equated with urea) showed best results in terms of soil Nitrogen, phosphorous and potassium release as well as the number of cobs produced.

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