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Contribution of chicken manure on soil chemical and physical properties compared with urea + superphosphate fertilizers.

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ABSTRACT: Afield experiment was carried out at the College of Agricultural Studies Sudan University of Sciences and Technology farm at Shambat for three successive seasons to determine the effect of different levels of chicken manure (10 m^3 , 15 m^3 and 20 m^3 tons/ha) on soil chemical and physical properties compared with Urea + Superphosphate (125 – 62.5 kg/ha) respectively. Egg plant black beauty cultivar was used. The soil chemical analysis at 30 cm depth revealed that the value of pH , Ca^+, Mg^+, K^+, P^+, total N; NH_4-N, O.C. and O.M, were higher in the chicken manure treatments compared to urea + superphosphate . The moisture content was kept higher in chicken manure treatment than that of urea + superphosphate. Clay and silt particles were higher but sand particles were lower in chicken manure plots compared with urea + superphosphate treatments.

INTRODUCTION:

Eggplant is a warm season crop. It requires a long and warm season for successful production. It is susceptible to lower temperatures than tomato and pepper. A day temperature of 25-32^{o}C and night temperature of 21-27^{o}C are ideal for eggplant production (htt.eni.wikpedia.org.wiki eggplant).

Comparatively it is a hardy crop, it can tolerate drought and heavy rainfall. However, it is advisable to select a dry climate or at least a season with low air humidity which discourages fruit rot and other diseases. Furthermore good soil and adequate fertilization are essential. Eggplant can be grown on different kinds of soil but does best on well drained silt loams or clay loams with pH 5.5-6.5 soil types (htt.eni.wikpedia.org.wiki eggplant).

The report on, modern farming and the soil, published by the Ministry of Agriculture, Fisheries and Food. (M A F F) of U.K. in 1970 concluded that the soils are now suffering from dangerously low organic matter levels and could not sustain the farming systems which have been imposed on them. The biological activity of the soil, which depends on the availability of nutrients and energy supplied by soil organic matter, crop and livestock residue, has declined correspondingly. Natural soil fertility provides the current growing crops with nutrient made available by the activity of soil micro-organism. Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and live stock feed additives. To the maximum extent feasible, organic farming system rely on crop rotation, crop residue animal manures, legumes, green manures, of farm organic waste and aspects of biological pest control to maintain soil productivity and tilth, supply plant nutrients and control insects, weeds and pests Lampkin (1990). Ohallorans *et al.* (1993) stated that poultry manure increased the presence of P, K and Mg in soil. Fiona *et al.* (1998) stated that farmyard manure had benefits to soil quality it increased soil total N, total O.C and exchangeable nutrient.

The objective of the study was to determine the effect of deferent levels of chicken manure and mineral fertilizers on soil physical and chemical properties and to recommend suitable does of chicken manure.

Materials and Methods:

The experiments were conducted during the growing season of 2005/2006, 2006/2007 and 2007/2008 in the College of Agricultural Studies Sudan University of Sciences and Technology farm –Shambat (Khartoum North). Afield experiments were conducted in the season of 2005/2006, 2006/2007 and 2007/2008 at the College of Agricultural studies Sudan University of Sciences and Technology farm at Shambat in this experiments different levels of chicken manure (10, 15and 20m^3/ ha)were used in addition to Urea (125 kg/ ha) + superphosphate (62.5 kg/has). Control plants were kept for comparison. Varity used was black beauty product of Germany. Plot size 3.5 × 3 m, spacing between ridges 70 cm and between plants 55 cm. Chicken manure broadcasted and irrigated 30 days before planting. Superphosphate broadcasted and irrigated 30 days before planting. Urea first dose added 15 days after transplanting and second dose after 15 days after the first one.

Soil samples were taken from each plot (30 cm depth) there were clean from debris, lumps were broken, mixed, thoroughly, and left to air dry. The soil was sieved by 0.5 cm mesh and some physical and chemical properties were determined according to the method of Kijhdal method . Paste method was used sample of 250g dry soil in the distilled water (Department of Soil Faculty of Agriculture University of Khartoum). The same plots were used for the same treatments during the three seasons.

The experiment was laid as a randomized complete block design with 5 treatments and 4 replications. The means where separated using SAS system Duncan Multiple Range Test (DMRT).

Result and Discussion:

Soil pH:

In the first season at 30 cm depth, the pH levels ranged between 7.73 and 8.40 where treatments 10m^3 chicken manure, 20m^3 chicken manure urea + superphosphate, and 15m^3 chicken manure were not significantly different, but 10m^3 chicken manure was significantly higher than the control. No significant difference between 20m^3, urea + superphosphate, 15m^3 chicken manure and the control (Table 1). The same trend was observed in the second and the third season. These results showed an increase in the pH under continuous application of chicken manure. This was attributed from buffering of bicarbonates and organic acid in the chicken manure. These results need more investigation. These results in agree with Ozenic *etal*. (2001), Sondek (2002) and Samuel *etal*. (2003). Those mentioned that organic amendment significantly increesd the soil pH.

Soil total nitrogen content:

The N content at 30cm depth in the first season ranged between 0.025 and 0.059 %. Treatments 20 m^3, 15 m^3 and 10 m^3 chicken manure were not significantly different, but treatment 20 m^3 was significantly greater than urea + superphosphate and the control treatments. Treatments 15 m^3, 10 m^3 urea + superphosphate and the control were not significantly different (Table 2). The same trend was observed in the second and the third season. The above results indicated that 20 m^3 chicken manure in the first and second season had significant effect on N content of the soil. None of the treatments had a significant effect in the third season

This was due to the nitrogen released from chicken manure. Joan *et al*. (2000), Samuel *etal.* (2003), Ojeniyi *et al*. (2007) and Kamal (2005). Those found that organic manure increase total N.

Table 1: Soil pH at 30(cm) depth in eggplant plots for the three seasons 2005-2006/2006-2007/2007-2008 under Shambat growing conditions :

	PH at 30(cm) in eggplant plots		
Treatment	1st season	2nd season	3rd season
Chicken manure 10m^3	8.40a	7.71b	7.38b
Chicken manure 15m^3	8.12ab	7.83ab	8.04a
Chicken manure 20m^3	8.21ab	7.83ab	8.05a
urea + superphosphate	8.19ab	7.82ab	7.73b
Control	7.73b	8.01a	7.53b

Means with the same letter are not significantly different using (DMRT) at $P \leq 0.05$.

Soil ammonium nitrogen content:

In the second season, the NH_4-N contents at 30 cm depth ranged between 0.026 and 0.105 %. 20 m^3 chicken manure treatment was significantly higher than, urea + superphosphate, 15 m^3, 10 m^3 chicken manure and the control, but there were no significant differences between these four treatments (Table 2). The same trend was observed in the third season. These results indicated that chicken manure increased soil NH_4-N% especially when the rate was increased. Zhou (1993), Lampkin (1990), Hasey *et al*. (1995-1997). Those found that there was a trend for organic system to have high NH_4-N concentration in the soil.

Soil nitrate nitrogen:

The NO_3-N contents at 30 cm depth showed a variation from 0.016 to 0.045%. 20 m^3 chicken manure treatment was significantly higher than 15 m^3, 10 m^3 chicken manure, urea + superphosphate treatments and the control in the second season. However, there were no significant differences between these four treatments (Table 2). The same trend was observed in the third season. This showed that the NO_3-N contents were lower than NH_4-N in the organic manure plots but NO_3-N contents was higher than the NH_4-N in the urea + superphosphate plots. Zhao *et al*. (1998), Nishwake and None (1996) and Vanek *et al*. (2003). Those recommended that soil with regular application of organic manure showed a trend of lower NO_3-N.

Table 2: Soil total nitrogen, ammonium nitrogen and nitrate nitrogen at 30 (cm) depth in eggplant plots for the three seasons 2005-2006/2006-2007/ 2007-2008 under Shambat growing conditions:

Treatment	**N%**			**NH_4-N%**		**No_3-N%**	
	1st season	2nd season	3rd season	2nd season	3rd season	2nd season	3rd season
Chicken manure 10m^3	0.041ab	0.055b	0.06a	0.040b	0.035b	0.016b	0.019b
Chicken manure 15m^3	0.048ab	0.059b	0.130a	0.046b	0.040b	0.026b	0.020b
Chicken manure 20m^3	0.059a	0.128a	0.135a	0.105a	0.095a	0.045a	0.044a
urea + superphosphate	0.033b	0.052b	0.060a	0.030b	0.040b	0.019b	0.022b
Control	025b	0.041b	0.05a	0.026b	0.040b	0.020b	0.016b

Means with the same letter are not significantly different using (DMRT) at $P \leq 0.05$.

Soil phosphorous content:

The P content at 30cm depth in the first season ranged between 2.38 and 4.5 %. There were no significant differences between the deferent treatments. A similar trend was observed in the second and the third season 20 m^3 chicken manure significantly exceeded the effect of control in the second and third seasons and Urea + Superphosphate in the third season. Our results obtained indicated that manure increased soil P in spite of the fact that superphosphate was added with urea. This increase was due to the available P released by chicken manure. Thengual and Prabakaren, (2003), Ojeniyi and Adegboyego (2003) and Saleh *et al*. (2003).Those concluded that available P increased with level of manure.

Soil potassium content:

K^+ content at 30cm depth, varied from0.12 to 0.20 $mmol^+/L$. Treatments 20 m^3 chicken manure and 15m^3 chicken manure were not significantly different, but 20 m^3 chicken manure was significantly higher than 10 m^3 chicken manure, urea + superphosphate treatments and the control. However, no significant differences between 15 m^3, 10 m^3 chicken manure and urea + superphosphate. Treatment 15 m^3 chicken manure was significantly higher than the control treatment. No significant difference between treatments 10 m^3 chicken manure, urea + superphosphate and the control (Table 3). In the second and third seasons the trend was the same. These results indicated that soil K contents were greater in chicken manure treatments than that in urea + superphosphate treatment. This was due to the fact that organic manure released K that was added to the soil. Fiona *et al.* (1998) and Ojeniyi and Adejob (2002), those reported that organic manure increased K in the soil.

Soil calcium and magnesium content:

Ca+ Mg contents at 30 cm depth showed a range between 4.38 and 5.88 $mmol^+/L$. No significant differences between treatments 15 m^3,10 m^3 and 20 m^3 chicken manure, urea + superphosphate and the control (Table 3). Ca + Mg content at 30 cm depth in the second season ranged between 2.25 and 4.13 $mmol^+/L$, treatment 15 m^3 chicken manure significantly higher than treatments 20 m^3, 10 m^3 chicken manure, urea + superphosphate and the control, but no significant difference between 20 m^3, 10 m^3 chicken manure urea + superphosphate and the control (Table 3). Moreover, in the third season the Ca + Mg contents at 30cm depth ranged between 2.00 and 4.5 $mmol^+/L$ where treatments 15 m^3, 20 m^3, 10 m^3 chicken manure and urea + superphosphate were not significantly different, but 15 m^3 was significantly higher than the control. No significant differences between treatments 20 m^3, 10 m^3 chicken manure, urea + superphosphate and control (Table 3). The above mentioned results indicated that application of chicken manure increased soil Ca+ Mg content more than urea + superphosphate. This was due to the solubility and availability of the Ca + Mg released by the organic manure in the soil. Fiona *et al.* (1998) and Ojeniyi and Adejob (2002), those recommended that organic manure increased Ca and Mg in the soil.

Soil moisture content:-

The moisture contents at 30 cm depth in the first season varied from 20.02 to 23.60%. No significant difference between the different treatments 20 m^3, 15 m^3, 10 m^3 chicken manure, the control and urea + superphosphate (Table 4). A similar trend was observed in the third season. Our results showed an improvement of soil moisture in the organic manure plots

compared with conventional fertilizers. This due to the improvement of the physical properties of the soil (e.g. lower bulk density and high water holding capacity). Gupta *et al*. (1988), Azizi (2001) and Ojeniyi *et al*. (2007) concluded that soil moisture content increased with the level of manure, while bulk density decreased.

Soil organic carbon content:

The organic carbon content at 30 cm depth in the first season ranged between 0.018 and 0.033%. There were no significant differences between the treatments (Table 4). The same trend was observed in the third season. These results indicated that organic carbon content increased by application of chicken manure in comparison to Urea + Superphosphate. This due to the decomposition of the chicken manure. Borowska and Koper (2002), Zaniewics *et al*. (2003) and Kamal (2005). Those recommended that organic manure increased organic carbon content in soil.

Soil organic matter content:

At 30cm depth, the organic matter contents in the first season varied from 0.02 to 0.04%. No significant differences between the treatments (Table 4). In the third season the same trend was observed. The above mentioned results concluded that soil organic matter increased by application of organic manure than conventional fertilizers. Hasey *et al*. (1977), Ozenc *et al*. (2001) and Ogeniyi *et al*. (2007).Those found that organic matter increased with level of manure.

Soil texture:

The clay particles contents at 30 cm depth, gave a range between 48.95 and 55.83%. No significant differences between treatments 15 m^3, 20 m^3 chicken manure, urea + superphosphate and 10m^3 chicken manure, but 15 m^3 chicken manure was significantly greater than the control. Treatments 20m^3 chicken manure, urea + superphosphate, 10m^3 chicken manure and the control were not significantly different (Table 5). In the silt particles contents at 30cm depth in the first season ranged between 9.41 and 10.80%. Treatments 20 m^3, 15 m^3 and 10 m^3 chicken manure were not significantly different, but treatments 20 m^3 and 15m^3 chicken manure were significantly higher than urea + superphosphate and the control. No significant differences between 10 m^3 chicken manure, urea + superphosphate and the control. In the third season the same trend was observed (Table 5). At 30cm depth in the first season, the sand particles contents varied from 35.4 to 42.4%. None of the treatments had a significant effect in sand practical.

Table 3: Soil phosphorous, potassium and Calcium + magnesium at 30(cm) depths in eggplant plots for the three seasons2005-2006/2006-2007/2007-2008 under Shambat growing conditions:

Treatment	P^+ %			K (mmol$^+$/ 1)			Ca^++Mg^+ (mmol$^+$/ 1)		
	1st season	2nd season	3rd season	1st season	2nd season	3rd season	1st season	2nd season	3rd season
Chicken manure 10m^3	3.12a	3.33bc	3.30bc	0.14bc	0.07a	0.125a	4.38a	2.75b	2.50ab
Chicken manure 15m^3	3.31a	3.40abc	3.50ab	0.18ab	0.09a	0.115a	9.40a	4.13a	4.50a
Chicken manure 20m^3	4.50a	3.65a	3.80a	0.20ab	0.12a	0.140a	10.24a	300b	3.00ab
urea + superphosphate	3.92a	3.45ab	2.70c	0.13bc	0.06a	0.105a	6.80a	2.75b	2.50ab
Control	2.38a	3.18c	3.05bc	0.12c	0.04a	0.100a	4.35a	2.25b	2.00b

Means with the same letter are not significantly different using (DMRT) at $P \leq 0.05$.

A similar trend was observed in the third season (Table 5). Barzeger *et al*. (2002), Kutuk and Caycer (2002), and Uganoz *et al*. (2002), Also Zahid (2001), Krislaponyte (2002), and Kamal (2005) reported that organic manure significantly improved soil physical properties and structure.

Chicken manure showed significant effect on soil chemical and physical properties. Where chicken manure tretments indicated that there was higher value than urea + superphosphate in pH, Ca + Mg, K, P, total N, NH_4-N% and less No_3-N%, high O.C, and organic matter. Soil physical properties in the chicken manure plots had higher moisture% content, silt and clay particles and lower sand particles.

Conclusion:

Table 4: Soil moisture, organic carbon and organic matter contents at (30) cm depth in eggplant plots for the Two seasons 2005-2006/ 2007-2008 under Shambat growing conditions:

Treatment	M.C%		O.C%		O.M%	
	1stseason	3rd season	1st season	3rd season	1st season	3rd season
Chicken manure 10m3	22.22a	22.50a	0.025a	0.040a	0.03a	0.055a
Chicken manure 15m3	22.22a	25.00a	0.025a	0.045a	0.04a	0.055a
Chicken manure 20m3	23.60a	27.00a	0.033a	0.050a	0.04a	0.065a
urea + superphosphate	20.02a	23.00a	0.025a	0.035a	0.03a	0.050a
Control	21.00a	23.00a	0.018a	0.030a	0.02a	0.040a

Means with the same letter are not significantly different using (DMRT) at $P \leq 0.05$

Table 5: Soil Clay, Silt and Sand particles at 30 (cm) depth in eggplant plots for the two seasons

Treatment	Clay%		Silt %		Sand%	
	1stseason	3rd season	1st season	3rd season	1st season	3rd season
Chicken manure 10m3	49.70ab	51.80b	10.08ab	13.05b	39.10a	35.15a
Chicken manure 15m3	55.83a	57.80a	10.60a	17.55a	35.40a	24.65c
Chicken manure 20m3	53.48ab	57.15a	10.80a	16.05a	35.60a	28.20bc
urea + superphosphate	51.85ab	55.95a	9.70b	12.30b	38.10a	31.75ab
Control	48.95b	56.10a	9.41b	12.10c	42.00a	30.30ab

Means with the same letter are not significantly different using (DMRT) at P 0.05.

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