

Effects of chicken manure as component of organic production on yield and quality of eggplant (*Solanum melongena L.*) fruits.

Mohamed Abdalla Abbas¹, Saifel Din Mohamed Elamin² and Elamin Abdel Magid Elamin³.

Faculty of Agriculture ,University of upper Nile¹ College of Agricultural studies, Sudan University of Science and Technology².Faculty of Agriculture, University of Khartoum³.

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 and mineral fertilizers on yield and quality of eggplant fruits. Chicken manure showed a significant effect on eggplant yield. Fruit tissue analysis showed that 20m³ chicken manure had significant greater levels of total N%, NH₄-N%, NO₃-N% and no significant differences between treatments in nutrients P, K, Ca and Mg, but they are greater levels in chicken manure treatments and less Na.

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°C and night temperature 21-27°C are ideal for eggplant production ([htt.en-i.wikipedia.org.wiki eggplant](http://en.wikipedia.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-wikipedia.org.wiki eggplant](http://en.wikipedia.org/wiki/eggplant)).

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, to supply plant nutrients and control insects, weeds and pests. Certified organic products are those which have been produced, stored, processed, handled and marketed in accordance with precise technical specifications (standards) and certified as organics by certification body.

Lampkin (1990) reported that greater quality of nitrogen taken by plant would be in the form of NH₄-N in organic farming. Moreover Schuphen, (1975) (1976), ElSaidy (1982), Fisher and Richter (1986), Lairon (1986) Abele (1987), Bulling *etal.* (1987) and Badawi *etal* (2005) and Abou El Magd *etal.* (2008) found that manure increased nutrient content of the leaves and fruits (N, P and K) and Na content was lowered by organic manuring.

- To asses the effect of chicken manure on nutrient content of eggplant.
- To compare between chicken manure and Urea + superphosphate on nutrient of eggplant.
- To specify suitable dose of chicken manure for eggplant production.

MATERIALS and METHODS:

A field 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, 15 and 20 m³/ ha) were used in addition to Urea (125 kg/ ha) + superphosphate (62.5 kg/ha). Control plants were kept for comparison. Variety 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.

In crop sampling 5 fruits from each plot dried grinded and used for proximate analysis which were conducted according to the method of Kijhda. For plant total nitrogen plant sample of 0.2g digested in 6.5ml. H₂SO₄, NO₃-N using MgO and Defarda for NH₄-N. The other elements P, K, Ca, Mg and Na ash method was used sample of 2g using HCL 5N as a solvent. Chicken manure analysis showed: nitrogen 0.28%, phosphorus 0.18%, potassium 18.9%, ash 12.20%, organic carbon 48.7% and organic matter 84.05%. (Department of Soil Faculty of Agriculture University of Khartoum).

Pest control:

A mixture of Argel, Garlic and Neem were soaked, boiled, blended and filtered and used at rates of 100gs, 100gs and 400gs, in 4 liters of water and applied to all treatments.

The experiment was laid as a randomized complete block design

with 5 treatments and 4 replications. The means were separated using SAS system Duncan Multiple Range Test (DMRT).

RESULT and DISCUSSION:**Average total yield / hectare (ton):**

The average total yield of eggplant per hectare in the first season ranged between 2.23 and 8.50 tons/hectare. No significant difference between 15 m³, 20 m³, 10 m³ chicken manure treatments and urea + superphosphate treatment. However, 15 m³ chicken manure treatment was significantly greater than the control. In the second season, the yield of eggplant per hectare, range between 4.73 and 37.83 tons/hectare. These results revealed no significant differences between 20 m³, 15 m³ chicken manure treatments and urea + superphosphate treatment, but 20 m³ chicken manure treatment was significantly greater than 10 m³ chicken manure treatment and the control. Eggplant average total yield/hectare, ranged between 1.28 and 37.59 tons/hectare. The results indicated that 15 m³ and 20 m³ manure treatments were significantly greater than 10 m³ chicken manure treatment, urea + superphosphate treatment and the control (Table 1).

So this in a agree with the results and conclusions that reported by many investigators. (Firdaus *et al.* (1992), Paustain *et al.* (1992), Eltilb *et al.* (1995), Romero *et al.* (2000), Ojeniyi and Adeyob (2002), Ojeniyi and Adegboyega (2003), Saleh *et al.* (2003), Kamal (2005), El Desuki *et al.* (2001), Ali (2002), El Ghawwas *et al.* (2002), Kandil (2002), Elshakry (2005), Badawi *et al.* (2005) and Ojeniyi *et al.* (2007). Who stated that organic fertilizers increased yield.

Table 1: Average eggplant total yield/hectare for the three seasons 2005-2006/2006-2007/2007-2008 under Shambat growing conditions:

Treatment	Total yield / hectare(ton)		
	1 st season	2 nd season	3 rd season
Chicken manure 10m ³	3.08ab	13.73bc	19.42bc
Chicken manure 15m ³	8.50a	20.85ab	37.59a
Chicken manure 20m ³	4.66ab	33.83a	34.44ab
urea + superphosphate	2.71ab	20.48ab	8.41cd
Control	2.23b	04.73c	1.28d

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

Fruit total nitrogen content:-

In the second season, the only treatment which had significant effect ($P \leq 0.05$) on total nitrogen content of egg plant fruits over the control was addition of 20m³/ha of chicken manure similarly the same result was observed in the third season more over, 20m³ chicken manure/ha resulted in significantly higher nitrogen content in fruits compared to those treated with chemical fertilizers in the second and third season. The increase in the fruit nitrogen due to the application of 20m³ chicken manure/ ha was 3.17 times and

3.02 times higher than that in the control treatments in the second and third seasons, respectively. This agreed with the findings by Miyazawa *etal.* (1990), Paustain *etal.* (1992), Firdaus *etal.* (1992), Romeno *etal.* (2000), Kamal (2005), El Desuki *etal.* (2001), Ali (2002), El Ghawwas *etal.* (2002), Kandil (2002), El Shakry (2005), Badawi (2005) and Abou El Magd *etal.* (2008) those found that successive application of manure significantly increased N uptake, and increased fruit N.

Table2: Eggplant fruit total nitrogen, ammonium nitrogen, nitrate nitrogen and phosphorous contents for the two seasons 2005-2006-2007-2008 under Shambat growing conditions:

Treatment	N%		NH ₄ -N%		NO ₃ -N%		P%	
	2 nd season	3 rd season	2 nd season	3 rd season	2 nd season	3 rd season	2 nd season	3 rd season
chicken manure 10m ³	2.48ab	2.35b	1.70b	2.20b	0.63b	0.85b	0.070a	0.045a
chicken manure 15m ³	2.97ab	3.25b	2.41ab	2.35b	0.43b	0.80b	0.066a	0.060a
chicken manure 20m ³	6.60a	7.10a	4.40a	5.20a	1.37a	1.70a	0.086a	0.065a
urea + superphosphate	2.34b	2.90b	1.67b	2.10a	1.30a	0.90b	0.066a	0.055a
Control	2.08b	2.35b	1.54b	1.95b	0.72a	0.70b	0.053a	0.045a

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

Fruit ammonium nitrogen content:

Eggplant fruit $\text{NH}_4\text{-N}$ content in the second season varied between 1.54 and 4.40 %. Treatments 20 m^3 chicken manure and 15 m^3 chicken manure were not significantly different, but 20 m^3 chicken manure treatment was significantly greater than 10 m^3 chicken manure, urea + superphosphate and the control treatments. No significant differences between 15 m^3 , 10 m^3 chicken manure, urea + superphosphate treatments and the control. In the third season, Eggplant fruit $\text{NH}_4\text{-N}$ content varied from 1.95 to 5.20 % Treatment 20 m^3 chicken manure was significantly greater than 15 m^3 , 10 m^3 chicken manure, urea + superphosphate and control treatments, but these four treatments were not significantly different (Table 2).

This findings confirmed the conclusions by Lampkin (1990) who reported that the use of organic manures and emphasis on nutrient release by microbial activity for plant nutrition, meant that a greater quantity of the nitrogen taken by plants would be in the form of $\text{NH}_4\text{-N}$ in organic farming system. Hasey *et al.* (1977) concluded that there was a trend for organic system to have high $\text{NH}_3\text{-N}$ concentration.

Fruit nitrate nitrogen content:

The $\text{NO}_3\text{-N}$ content in Eggplant fruit in the second season ranged between 0.43 and 1.37 %. There are no significant differences between all treatments. Eggplant fruit $\text{NO}_3\text{-N}$ in the third season, varied from 0.70 to 1.70 %. Treatment 20 m^3 chicken manure was significantly greater than urea + superphosphate, 10 m^3 , 15 m^3 chicken manure and the control, but no significant differences between these four treatments (Table 2).

These findings are in agree with Hasey *et al.* (1977) who reported that organic system had high $\text{NH}_4\text{-N}$ and lower $\text{NO}_3\text{-N}$, also Nishiwake and None (1996) found that Nitrates content increased with the amount of chemical fertilizer. Various

studies by Schuphan (1995), (1976), El Saïdy (1982), Fischer and Richter (1986), Abele (1987), Bulling *et al.* (1987), and Kerpen (1988), Stated that increasing mineral fertilizers were resulting in higher nitrate levels, higher free amino acid, oxalates and other undesirable compounds.

Fruit phosphorous content:-

Eggplant fruit P content in the second season ranged between 0.053 and 0.086 %. All treatments were not significantly different. Eggplant fruit P content in the third season varied between 0.045 to 0.065 %. There were no significant differences between 20 m^3 , 15 m^3 chicken manure, urea + superphosphate, 10 m^3 chicken manure treatments and control (Table 2).

These results showed that chicken manure released P that was available to the plant. This confirmed the findings by Eltilb *et al.* (1995), Juang *et al.* (1997), Guu *et al.* (1997), Ozenc *et al.* (2001), Ojeniyi and Adejob (2002), Ojeniyi (2003), Ojeniyi *et al.* (2007), Kamal (2005), El Desuki *et al.* (2001), El Ghawwas *et al.* (2002), Kandil (2002), El Shakry (2005), Badawi *et al.* (2005) and Abou El Magd *et al.* (2008) who stated that organic manure increased (N P K) content of the leaves and fruits.

Fruit potassium content:-

In the second season, Egg plant K content ranged between 1.35 and 2.15%, where treatments 20 m^3 , 15 m^3 chicken and the control, were not significantly different, but 20 m^3 chicken manure was significantly higher than 10 m^3 chicken manure and urea + superphosphate. No significant difference between 15 m^3 chicken manure, control, 10 m^3 chicken manure and urea + superphosphate. Potassium content in Eggplant fruit in the third season ranged between 2.00 and 3.80 %. Treatments 20 m^3 , 15 m^3 , 10 m^3 chicken manure, urea + superphosphate

and control were not significantly different (Table 3).

These findings showed that K content in chicken manure treatments was higher than that of urea + superphosphate due to the availability of K in the soil. This coincided with previous findings by Guu *et al.* (1977), Ozenc *et al.* (2001), Juang *et al.* (1997), Ojeniyi *et al.* (2007), El Desuki *et al.* (2000), Ali (2002), El Ghawwas *et al.* (2002), Kandil (2002), El Shakry (2005) and Badawi *et al.* (2005) and Abou El Magd *et al.* (2008) who concluded that organic manure increased (N P K) content of the leaves and fruits.

Fruit calcium content:

The results of Eggplant fruit Ca content gave values varied between 0.69 and 2.20 % in the first season where 15 m³ chicken manure was significantly higher than urea + superphosphate, 20 m³, 10 m³ chicken manure treatments and the control. However, urea + superphosphate and 20 m³ chicken manure treatments were not significantly different, but both treatments were significantly greater than 10 m³ chicken manure, and the control. No significant difference between 10 m³ chicken manure and the control treatments. The Ca⁺ content in eggplant fruit in the second season varied from 5.86 to 7.88 %. There were no significant differences between the different treatments. In the third season Eggplant fruit Ca⁺ content ranged between 6.60 and 10.40 %. Treatments 15 m³, 20 m³ chicken manure, urea + superphosphate, 10 m³ chicken manure and the control were not significantly different (Table 3). The results obtained indicated that organic manure increased Ca content of the fruits. This was obtained by many researchers. (Penabosa *et al.* (1994), Ohallorans *et al.* (1993) and Saleh *et al.* (2003)).

Fruit magnesium content:

Mg content in Eggplant fruit ranged between 0.14 and 1.19 % in the first season where no significant differences between the different treatments were obtained. Eggplant fruit Mg content in the second season ranged between 3.00 and 3.40 %. There were no significant differences between the different treatments. On the other hand, eggplant fruit Mg content in the third season, showed variation between 3.47 and 5.45 %. Treatments 15 m³, 20 m³ chicken manure, urea + superphosphate control and 10 m³ chicken manure were not significantly different (Table 3).

These results showed that chicken manure improve the fruit Mg content due to the fact that Mg was available to the plant. This findings confirmed by Ohallorans *et al.* (1993), and Saleh *et al.* (2003) who stated that poultry manure increased solubility of Ca and Mg⁺ in soil. Also Guu *et al.* (1997) reported that organic manure had a significant effect on soil fertility by increasing exchangeable Mg.

Fruit Sodium content:-

Eggplant fruit Na content ranged between 0.04 and 0.08 % in the first season with no significant differences between treatments. On the other hand in the second season the Eggplant fruit Na content varied from 0.02 to 0.03 %, where different 15 m³ chicken manure, control, 10 m³, 20 m³ chicken manure and urea + superphosphate treatments were not significantly different. Eggplant Na content ranged between 0.015 and 0.052 % in the third season. There were no significant differences between the different treatments (Table 3).

Table 3: Eggplant fruit potassium ,calcium, magnesium and sodium contents for the three seasons 2005-2006/2006-2007/2007-2008 under Shambat growing conditions:

Treatment	K ⁺ %		Ca ⁺ %			Mg ⁺ %			Na ⁺ %		
	2 nd season	3 rd season	1 st season	2 nd season	3 rd season	1 st season	2 nd season	3 rd season	1 st season	2 nd season	3 rd season
chicken manure 10m ³	1.40b	2.98a	0.71c	5.86a	6.90a	0.61a	3.25	3.47a	0.04a	0.025a	0.035a
chicken manure 15m ³	1.60ab	3.40a	0.20a	7.56a	10.40a	1.40a	3.25a	5.45a	0.08a	0.030a	0.028a
chicken manure 20m ³	2.18a	3.80a	1.07bc	7.88a	9.90a	0.88a	3.40a	5.13a	0.07a	0.020a	0.015a
urea + superphosphate	1.35b	2.29a	1.39b	6.62a	9.20a	1.19a	3.25a	4.20a	0.05a	0.020a	0.052a
Control	1.45ab	2.00a	0.69c	7.25a	6.60	0.41a	3.00a	3.63a	0.04a	0.030a	0.052a

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

These results in the three season showed that on the long run the Na content decreased in organic manure treatments compared with conventional fertilizers. So this was confirmed by different investigators. Gupta *et al.* (1988), Zakaria (2003), El Desuki (2001), Ali (2002), El Ghawwas *et al.*(2002), Kandil (2002), El Shakry (2005), Badawi (2005), and Abou El Magd *et al.* (2008) those stated that organic manure fruit Na content was lowered by organic manuring.

CONCLUSION:

Chicken manure showed a positive effect on the yield of eggplant and the quality of eggplant fruits.

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