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Ameliorative Effect of Organic Fertilizers in the Presence Of Mineral Fertilizers on Lettuce and Sorghum Yields and Their Components

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Abstract: A pot experiment was conducted at National Research Centre, Egypt and designed in randomized complete blocks in two successive vegetative seasons. Lettuce was used as indicator plants. Three organic treatments were used. The first was composted cotton stalks, the second was composted chicken manure and the third was a mixture of chicken manure and cotton stalks at ratio (1:1). They were added to the soil then, enriched with various forms of NK mineral fertilizers which included calcium nitrate, ammonium sulphate, potassium sulphate and potassium chloride. The influence of the above mentioned treatments on availability of some macronutrients and fresh and dry weight of lettuce plants was studied and the residual effect of the same treatments on sorghum plants was studied as well. The obtained results indicated that addition of chicken manure compost as an organic fertilizer, the most effective among the other treatments on increasing yield of lettuce plants and availability of macronutrients, while the lowest value was obtained from the treatment fertilized by cotton stalks compost. On the other hand, mineral fertilizer treatments differed widely in their effect on the parameters under study. Calcium nitrate plus potassium sulphate showed the highest effect on fresh, dry weight and nutrients uptake of lettuce plant compared with the other mineral fertilizers. Concerning the residual effect of the treatments under study, the cotton stalks compost treatment gave the most significant increase in fresh and dry weight of sorghum plants and the availability of macronutrients However, the lowest value was obtained from the treatment fertilized by chicken manure compost. Regarding the effect of inorganic fertilizers, calcium nitrate plus potassium sulphate was the superior relative to the other mineral fertilizers. The minimum value was obtained by applying chicken manure with ammonium sulphate plus potassium chloride. In general, using organic manure compost combination with the mineral fertilizers increased the availability of macronutrients and yields of both lettuce and sorghum plants which may help decreasing the mineral fertilizers requirements and reducing the environmental pollution.

Key words: Lettuce. sorghum, organic and mineral fertilizers.

INTRODUCTION

Soils of arid and semi-arid regions have low organic carbon (OC) content and need organic amendments to improve their properties and consequently their productivity and natural fertility (Usman *et al*., 2004). Addition of organic matter, from different sources, to the agricultural soil is an important practice in improving its physical and chemical properties and consequently increasing its productivity. So, in Egypt, composting chicken manure is a useful method in reducing the environmental pollution and producing a valuable product that can be used for enriching the soil. (Abdel-Moez, 2001). Natural recycling of farm-waste organic matter through composting is a procedure aimed to minimize losses of nutrients, accumulation of wastes. So that, compost enhances the environmental sustainability of agriculture through decreasing chemical input and increasing soil organic matter (Mathur *et al*., 1993). Manure mineralized by microorganisms after incorporating into the soil increasing mineral content of the soils, water holding capacity, and cation exchange capacity (Kamar and Boyer, 1995). Van Noordwjk *et al*. (1995). Mentioned that lettuce yield and N, P and K uptake increased significantly by application of organic matter at rate 20 and/or 30 ton/fed. El-Nagar *et al*. (1995) and Hanana and El-Awag (2000) found that maize grain and stover yield were increased due to addition of organic matter at rate of 20 m^3/fed. Siam *et al*. (2008) stated that straw and grain yield of corn plants increased significantly and the N, P and K uptake were increased progressively with increasing N fertilization.

Potassium plays an important role in respiration, transpiration, translocation of sugar and carbohydrates, energy transformation and enzyme actions. Sarma and Kumari (1996) studded the effect of K application for 3 sorghum cultivars. Application of 33 kg K_2O/ha improved the yield components. Vanlavwe *et al*. (2001) stated

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that both N-inorganic and organic fertilizers are needed to increase plant production. Organic fertilizer inputs are needed to maintain the physical and physiochemical of soil, while mineral fertilizers are needed to supply sufficient amount of nutrients to the crop during the period of its maximum absorption. Sakar *et al*. (1992). Stated that dry matter and NPK uptake by wheat plant increased by addition of organic manures, Metwally and Khamis (1998) pointed out that NPK uptake by wheat plant significantly increased when sandy soil treated with FYM and /or N fertilizer with greatest effect for N-fertilizer. The need for supplying vegetable crops with organic and inorganic fertilizers was proved to be very essential for the production of higher yield and improving its quality (Borin *et al*., 1987). Soliman and Hassan (2004) showed that the application of organic materials either alone or in combination with chemical fertilizers increase in soil availability of N, P and K.
This study aimed to evaluate the capability of some composts, i.e. cotton stalks, chicken manure and their mixture in combination with different mineral sources of N and K on increasing and nutrients availability yield production of lettuce plant and their residual effect for sorghum.

MATERIALS AND METHODS

A greenhouse experiment was carried out at national research center to evaluate the effect of some types of composts and mineral NK fertilizers on the availability of some macronutrients and yield components of lettuce plant on the other hand, the residual effect of the same fertilizers on sorghum yield components and availability of macro nutrients was also studied
The three organic treatments are:

- cotton stalks compost, which prepared from stalk of cotton, through their fermentation for 4-5 months.(compost1)
- Chicken manure (Ch.M.) Natural poultry residues which used directly' from the hangars of chicken without any industrial processes (compost2).
- Mixture compost, which included mixtures of chicken manure and cotton stalks at rates of 20 ton/fed., 3 ton/fed. Respectively. These residues were incubated for five months, under suitable conditions of humidity and temperature, to insure ideal media for increasing the growth and activities of microorganisms. (compost3)

The previous rates of organic composts were enriched with the mineral fertilizers. Super phosphate and potassium sulphate were added at the beginning of growing. Two different sources of NK mineral fertilizers were used namely, calcium nitrate and ammonium sulphate as the nitrogen fertilizers, at the rates of 40 kg N/fed and potassium sulphate and potassium chloride as the potassium fertilizers, at the rates of 40 kg K_2O/fed. Ammonium sulphate and calcium nitrate were added in two equal doses, The first one was after sowing of seeds and the second was added after 15 days from seeds emergence. Also the above-mentioned doses of organic manures were added two weeks before sowing then watered three times to permit time for their nutrients content to become readily available. Each pot received 10kg of air dried soil the experiment, was designed in randomized complete blocks with three replicates.

Table 1: Some chemical properties of the used soil.

Soil depth (cm)	Soil pH (1:25)	EC (dS/m)	Available macronutrients (ppm)			O.M.%	$CaCO_3$%
			N	P	K		
39476	7.8	2.79	70.8	30.1	841	2.27	1.87

The experiment included two successive seasons winter for lettuce plants and summer for sorghum plants lettuce seedlings of 40 days old were selected and transplanted. Three cuts were taken for sorghum after 45, 90 and 135 days from sowing. 1 cm above the soil surface and both fresh and dry weight of plant samples from all replicates were recorded. After each cut plant samples collected and prepared for analysis plant samples were washed before drying and were oven dried at 70°C and dry weight was recorded, ground and prepared for analysis. Nitrogen, P and K were determined according to methods described by Cottoni *et al.,* 1982 and Black (1982).

Table 2: Some chemical properties of the different organic composts

Organic compost	pH	C/Nratio	N%	P%	K%	C%	O.M%
Cotton stalkes	7.17	20.2	1.62	0.89	1.85	32.72	56.28
Chicken manure	7.20	12.00	2.84	1.60	2.40	34.00	58.62

Data were subjected to statistical and analysis of variance according to Snedecor and Cocharan (1980). Treatment means were compared using the least significant difference. Hassan and Mohy El-Din (2002) reported that N, P and K uptake by grains of wheat was increased due to application of organic manure.

RESULTS AND DISCUSSION

Fresh and Dry Weight of Lettuce Plants as Affected by Treatments:

Lettuce Plants:

Lettuce plants either leaves or roots responded significantly to the applied treatments under study. Treatment of chicken manure + various forms of mineral fertilizers showed the highest values among the other treatments especially that included calcium nitrate + potassium sulphate. The values reached 304.0 and 10.50gm/pot and 13.81 and 1.85 for fresh and dry weight of leaves ans roots respectively are presentd in Table (3). The treatment that included mixture of cotton stalks and chicken manure compost with the various forms of mineral fertilizers occupied the second order followed by cotton stalks treatment.

Table 3: Fresh and dry weight (g/pot) of lettuce plants as affected by organic and mineral fertilization treatments

Treatments	Source of mineral fertilizer (N & K)	Leaves		Roots	
		Fresh weight	Dry weight	Fresh weight	Dry weight
Control	Calcium nitrate+Potassium sulphate	82.75	3.50	4.20	0.48
	Calcium nitrate+Potassium cl	68	2.50	3.40	0.32
	Ammonium sulphate+Potassium sulphate	75.15	3.10	3.80	0.4
	Ammonium sulpate+Potassium cl	58.1	1.90	2.80	0.25
	mean	71	2.75	3.55	0.36
Compost 1	Calcium nitrate+Potassium sulphate	183	7.30	7.90	1.19
	Calcium nitrate+Potassium cl	142	5.47	6.23	0.75
	Ammonium sulphate+Potassium sulphate	160	6.20	6.74	0.96
	Ammonium sulpate+Potassium cl	95	4.00	5.16	0.55
	mean	145	5.74	6.51	0.86
Compost 2	Calcium nitrate+Potassium sulphate	304	10.50	13.81	1.85
	Calcium nitrate+Potassium cl	225	7.50	8.17	1.35
	Ammonium sulphate+Potassium sulphate	270	9.20	10.07	1.6
	Ammonium sulpate+Potassium cl	167	6.47	7.62	0.85
	mean	241.5	8.42	9.92	1.41
Compost 3	Calcium nitrate+Potassium sulphate	245	8.58	10.88	1.5
	Calcium nitrate+Potassium cl	192	6.30	7.55	0.9
	Ammonium sulphate+Potassium sulphate	213	7.75	8.55	1.2
	Ammonium sulpate+Potassium cl	105	5.30	6.82	0.65
	mean	188.75	6.98	8.45	1.06
LSD at 5%		8.88	0.37	0.29	0.09

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

In general, the treatments of compost could be arranged in the following order according to their effect on the Parameters under study (i.e. fresh and dry weight of leaves and roots) and Chicken manure compost > Mixture of cotton stalks and chicken manure compost > cotton stalks compost treatment > control**.** On the other hand, mineral fertilizers impact could be arranged as fallows:

- Calcium nitrate + potassium sulphate > ammonium salphate + potassium sulphate > calcium nitrate + potassium chloride > ammonium sulphate + potassium chloride.

The previous impact of mineral fertilizers was noticed regard less the applied compost treatment. Also these results attributed to the positive effect of organic fertilizer may be due to improve the behaviour of several elements in soils through their active groups (Fulvic and humic acids) which have the. Improve in plant growth and yield both quantitatively and qualitatively (Aravjo *et al.*, 1982, Soliman *et al.*, 1991 and Shafeek & El-Habbash, 2000). Furthermore, organic manure encourage the fresh and dry weight of plant through the simulation effect on the meristematic activity of tissues, where these organic manures are rich in N, P, k and other minerals which required proplant growth (Safia *et al.,* 2001).Obtained results are in agreement with those reported by (Corrales *et al.,* (1990), El-Sheikh and Salam (1997), El Morsy (1997), and Badran *et al.,* (2000), Fatma and El-Shikha (2003), El Ghanam *et al.,* 2005, and Siam *et al.,* 2008. These were in line with those obtained by El-Naggar (1996) who mentioned that organic manure contributes to plant growth by improving soil structure there by improving aeration and retention of moisture and also by serving as a source of essential nuteients such as N, P and micronutrients. In addition, application of mixture (compost 3) in combination with $Ca(NO_3)_2 + K_2SO_4$ revealed significant enhancing effect on fresh and dry weight either leaves or roots by lettuce plant by 34.00 and 18-61%) for leaves and (38 and 26%), for dry weight for roots compared to cotton stalks plus ($Ca(NO_3)_2 + K_2SO_4$). It could be due the mixture manure contained more pronounced of available NPK than cotton stalks, consequently, more release of nutrients in the available form was resulted in the decomposition of chicken manure of applied to mixture compost to cotton stalk, chicken manure could lower the high C/N ratio of organic compost, also, favorable purposes could be achieved for rapid composting to produce compost very rich in their nutrients content because the nutrients content in chicken manure is very high (Diaz *et al.,* 1993).

On the other hand, the lowest value recorded when plants received cotton stalk in combined with mineral, it could be attributed to cotton compost stalks are slightly used in soil fertilization. It can be attributed to the relatively high C/N ratio and application of compost to soil is associated mobilization of N compared with a negative effect on the nutrients availability reflect upon yield (Harison *et al.,* 1987). Generally, chicken manure in combined with Ca $(NO_3)_2$ + K_2SO_4 increased significantly fresh and dry weight by 33.88 and 21.33% for leaves, (37.72 and 26%)for roots respectively compared with cotton stalks in combined with Ca $(NO_3)_2$ + K_2SO_4 respectively.

On the other hand, under such condition, the presented data in Table (3) indicate that treating lettuce plant by calcium nitrate and potassium sulphate as mixed it with chicken manure increased significantly fresh and dry weight of leaves (90 and 98%) and (102 and 185%) of roots than mixture compost and (220 and 163%) for leaves and (168 and 236%) for roots than cotton stalks compost respectively if mixed with $(NH_4)_2$ SO_4 + KCl

These results attributed to that calcium nitrate application reduced soil pH (El-Fakhrani and Al-Redhaiman (1999) and Bhandri *et al.* (1992) Furthermore calcium nitrate was superior than ammonium sulphate may be due to the fact that NH_4+ and not NO_3-N Can be fixed on clay particles.

Uptake of Macronutrients as Affected by Treatments:

Data recorded in Tables (4, 5) indicated that the uptake of NPK by lettuce plants significantly increased by all treatments compared to control treatment (without organic compost). Generally the highest values of N or K forms when addition to any sources of organic fertilizer, the first values Ca $(NO_3)_2$ + K_2SO_4 treatment recorded the highest value as NPK uptake followed $(NH_4)_2$ SO_4 + K_2SO_4 came at the second order Ca $(NO_3)_2$+ KCl came at the third order and $(NH_4)_2$ SO_4 + KCl treatment came in the last order respectively.

Table 4: Mean values of effect of organic source and the forms of NK frertilizers on N, P and K uptake (mg/plant) by leaves of lettuce plants

Treatments	Source of mineral fertilizer (N & K)	NPK uptake by leaves		
		N	P	K
Control	Calcium nitrate+Potassium sulphate	38.5	9.10	45.5
	Calcium nitrate+Potassium cl	20.5	4.50	25
	Ammonium sulphate+Potassium sulphate	29.45	6.82	35.65
	Ammonium sulpate+Potassium cl	11.4	2.66	16.15
	mean	24.96	5.77	30.58
Compost 1	Calcium nitrate+Potassium sulphate	148	31.00	161
	Calcium nitrate+Potassium cl	92	18.00	95
	Ammonium sulphate+Potassium sulphate	118	24.00	118
	Ammonium sulpate+Potassium cl	56	11.00	61
	mean	103.5	21.00	108.75
Compost 2	Calcium nitrate+Potassium sulphate	353	70.00	290
	Calcium nitrate+Potassium cl	203	36.00	180
	Ammonium sulphate+Potassium sulphate	285	50.00	235
	Ammonium sulpate+Potassium cl	120	25.00	129
	mean	240.25	45.25	208.5
Compost 3	Calcium nitrate+Potassium sulphate	214	48.00	211
	Calcium nitrate+Potassium cl	123	26.00	141
	Ammonium sulphate+Potassium sulphate	169	39.00	170
	Ammonium sulpate+Potassium cl	80	19.00	95
	mean	146.5	33.00	154.25
	LSD at 0.5%	14.94	2.37	10.33

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

Table 5: Mean values of effect of organic source and the forms of NK frertilizers on N, P and K uptake (mg/plant) by roots of lettuce plants.

Treatments	Source of mineral fertilizer (N & K)	NPK uptake by roots		
		N	P	K
Control	Calcium nitrate+Potassium sulphate	1.82	0.86	2.4
	Calcium nitrate+Potassium cl	0.9	0.35	1.22
	Ammonium sulphate+Potassium sulphate	1.32	0.60	1.72
	Ammonium sulpate+Potassium cl	0.6	0.20	0.83
	mean	1.16	0.50	1.54
Compost 1	Calcium nitrate+Potassium sulphate	10.11	2.98	11.31
	Calcium nitrate+Potassium cl	4.88	1.35	5.93
	Ammonium sulphate+Potassium sulphate	7.2	2.02	8.06
	Ammonium sulpate+Potassium cl	3.25	0.83	3.58
	mean	6.36	1.80	7.22
Compost 2	Calcium nitrate+Potassium sulphate	24.98	5.92	25.9
	Calcium nitrate+Potassium cl	13.5	3.24	14.04
	Ammonium sulphate+Potassium sulphate	19.2	4.48	20.16
	Ammonium sulpate+Potassium cl	7.65	1.70	8.16
	mean	16.33	3.84	17.07
Compost 3	Calcium nitrate+Potassium sulphate	16.5	4.35	17.25
	Calcium nitrate+Potassium cl	9.75	1.80	7.92
	Ammonium sulphate+Potassium sulphate	11.88	3.00	13.2
	Ammonium sulpate+Potassium cl	5.07	1.11	5.4
	mean	10.8	2.57	10.94
	LSD at 0.5%	0.99	0.13	1.00

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

Chicken manure treatment in combination with Ca $(NO_3)_2$ + K_2SO_4 recorded the highest values as NPK uptake (353, 70 and 290 mg/plant) by lettuce plant in leaves and roots (24.98, 5.92 and 25.9 mg/plant), respectively than Ca $(NO_3)_2$ + KSO_4 alone (without chicken manure (38.50, 9.10 and 45.5 mg/plant) respectively and roots (1.82, 0.86 and 2.40 mg/plant) respectively.

These results agree well with the findings of (El-Ghanam *et al.*, 2005), and Tolanur and Badanur (2003) who found that organic manure application, decreased soil pH which may be due to the formation of CO_2 and other organic acids during decomposition of the organic fertilizers. In this concern, organic manure contributes through (a) release of nutrients through the decomposition of organic matter (b) lowering of nutrients fixation through several mechanisms such as cheleation and formation of complex relatively available for plants (C) production of humates which could exchange for absorbed anions such as P which should be available.

In the same Tables, adding chicken manure gave the highest P uptake both leaves or roots of lettuce plant. This may be due to the ability of plants to absorb P only as a mineral form beside another part released from the organic matters. Also carbon dioxide produced during the decomposition of organic manure had a role in increasing phosphorous availability.

Recently, Delibacak *et al.* (2000) considered that addition of different levels of FYM 2, 8, 14 ton/fed. increased porosity, total soluble salts, organic matter, structure stability index and aggregation percentage. Unemya and Sekiya (1985) pointed out that N, P, K, Ca and Mg of soil were increased by heavy application of poultry manure.

In the same Tables, data also showed that mixture compost treatment came between chicken manure and cotton stalks compost treatment. Moreover data represented in Tables (4,5) revealed that application of mixture compost with Ca $(NO_3)_2$+K_2SO_4 had the superiority in increasing N, P, K uptake in leaves and roots of lettuce plant than cotton stalks with Ca$(NO_3)_2$ + K_2SO_4. These increases were (45, 55 and 31%) respectively, for leaves as compared to applied of cotton, stalks and Ca $(NO_3)_2$ + K_2SO_4 treatment. Generally, it could be summarized that mixture of chicken manure with cotton stalks compost may be effective in promoting correcting the final C/N ratio of the mixture.

These results agree with Abd El-Moez *et al.* (1999) who evaluated three compost types namely sheep manure, organic residues and water hyacinth plant compost mixed with chicken manure. They found that the application of organic composts significantly increased the fennel and coriander plants and uptake of N, P, K, Ca and Mg. Similar improving effect on plant growth due to organic fertilizer application have been reported (Badran *et al.,* 2000). In addition, application of cotton stalks compost with mineral ammonium sulphate and potassium chloride fertilizers gave the minimum values (56.00, 11.00 and 61.00 mg/plant) for leaves and roots (3.25, 0.83 and 3.58 mg/plant) for roots compared with other treatments. These results are due to the slow release of nutrients from the compost. Furthermore, application of cotton composted fertilizer may be caused excessive nutrients immobilization temporary nutrients starvation of plants in early stage of growth. Also, may be due to high C/N ratio of the cotton composted in early stage of growth such circumstance may encourage the immobilization process of N particularly (Charles *et al.,* 1991).

The data also revealed that application of potassium sulphate on fresh and dry weight and some macronutrients (N, P and K) of lettuce plant either leaves or roots, may be due to the stimulating effect of these fertilizers on plant growth where the bulk of potassium is mainly taken and uptake this increase in the K uptake can also be occurred as a result of enhancing the metabolic activity of the plant root when mineral nutrient are supplied through the fertilizers application into the soil. The aforementioned stimulating effect of mineral and organic fertilizers on uptake by K plant are in consonance with Kapulnik *et al.* (1985 & 1987) and Nadasy and Ihorasi (1999). Fresh, dry weight, N, P and K uptake of lettuce plants grown in soil treatments mixture of calcium nitrate plus potassium sulphate gave the highest values when mixed with organic sources. On the other hand the lowest values of fresh, dry weight, N, P and K uptake was detected with mixture of ammonium sulphate or nitrate plus potassium chloride. These results were true in both leaves and roots.

Moreover, application of chicken manure with Ca $(NO_3)_2$+K_2SO_4 increased significantly of N, P, K uptake (mg/plant) (194% and 180%) than addition of chicken manure with $SO_4(NH_4)$+KCl. Vanlavwe *et al.* (2001) stated that both N-inorganic and organic fertilizers are needed to increase productivity of soils. Organic fertilizers inputs are needed to maintain the physical and physiochemical health of soil, while mineral fertilizers are needed to supply sufficient amount of nutrients to the crops during their maximum absorption.

Chicken manure was reached of elements and constricted by the release of appreciable quantities of carbon dioxide which when dissolved in water forms carbonic acid which is capable of weathering certain primary. Applying Ch.M plus NPK to potato plants increased fresh and dry weight/plant. This effect may be due to that the chicken manure increased supply of P and K to the soil. On the other hand, applying Ch.M improves soil fertility and 90% of N in chicken manure becomes available (Mathers and Goss, 1979 and Abdel-Ati, 1998).

Residual Effect (Re) of Different Applied Fertilizers:

Sorghum Plants:

Sorghum (*Sorghum bicolor* L.) is one of the important cereal crops in upper Egypt in summer season. The

present investigation was carried out to study residual effect of organic materials litter in form of compost on crop residues and mixture of them with combined the different sources of N and K had beneficial effects on yield production and nutrients availability on sorghum.

Fresh and Dry Weight as Affected by Treatments:

Residual effect of both forms of nitrogen and potassium when mixed with organic compost, obtained result of Tables (6, 7) and Fig. (1) showed that the increased significantly fresh (F.W) and dry weight (D.W) of sorghum plants compared with control. These results attributed to residual effect of organic compost addition could be reputed to type of and organic in soil, resulting more release forms of plant available nutrients show release forms of nitrogen include natural organic materials such as cotton stalks (from recycling the plant residues) and animal products (chicken manures) these material release nitrogen over period time and natural organic materials are broken down slowly by soil microorganisms (Hegazy *et al.,* 1994 and Abady and Barakat, 1997). Safia *et al*. (2001) also reported that the addition of chemical fertilizer caused superiority in plant growth criteria and yield of sweet pepper plants followed in descending order by those plants, which applied the Nile compost as an organic fertilizer.

Table 6: Fresh weight (g/pot) of sorghum plants as affected by organic and mineral fertilization treatments.

Treatments	Source of mineral fertilizer (N & K)	Fresh weight		
		Cut1	Cut2	Cut3
Control		Calcium nitrate+Potassium sulphate		
		20.15	24.70	15
	Calcium nitrate+Potassium cl	14.65	18.10	10.25
	Ammonium sulphate+Potassium sulphate	17.25	21.60	12.95
	Ammonium sulpate+Potassium cl	11.25	15.20	8.1
	mean	15.83	19.90	11.58
Compost 1	Calcium nitrate+Potassium sulphate	82.75	115.00	54
	Calcium nitrate+Potassium cl	45.15	65.00	30.3
	Ammonium sulphate+Potassium sulphate	63.28	88.00	45
	Ammonium sulpate+Potassium cl	35.65	47.10	28
	mean	56.71	78.78	39.33
Compost 2	Calcium nitrate+Potassium sulphate	45.37	63.20	34
	Calcium nitrate+Potassium cl	32.16	42.30	19
	Ammonium sulphate+Potassium sulphate	38.5	55.15	27
	Ammonium sulpate+Potassium cl	24.22	30.10	17
	mean	35.06	47.69	24.25
Compost 3	Calcium nitrate+Potassium sulphate	64.5	90.15	41
	Calcium nitrate+Potassium cl	40.67	53.50	25
	Ammonium sulphate+Potassium sulphate	50.29	72.20	35
	Ammonium sulpate+Potassium cl	30.24	38.34	23
	mean	46.43	63.55	31
	LSD at 0.5%	2.97	6.88	2.9

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

Table 7: Dry weight (g/pot) of sorghum plants as affected by organic and mineral fertilization treatments.

Treatments	Source of mineral fertilizer (N & K)	Dry weight		
		Cut1	Cut2	Cut3
Control		Calcium nitrate+Potassium sulphate		
		7.5	8.25	5
	Calcium nitrate+Potassium cl	5.5	6.35	3.1
	Ammonium sulphate+Potassium sulphate	6.9	7.45	4.2
	Ammonium sulpate+Potassium cl	4.2	5.48	2.45
	mean	6.03	6.88	3.69
Compost 1	Calcium nitrate+Potassium sulphate	21.7	25.00	15.3
	Calcium nitrate+Potassium cl	13.75	15.85	9.5
	Ammonium sulphate+Potassium sulphate	16.3	19.10	12.1
	Ammonium sulpate+Potassium cl	10.6	12.75	7.8
	mean	15.59	18.18	11.18
Compost 2	Calcium nitrate+Potassium sulphate	13.5	16.75	10
	Calcium nitrate+Potassium cl	10.15	12.00	6.9
	Ammonium sulphate+Potassium sulphate	11.6	13.75	9
	Ammonium sulpate+Potassium cl	8.1	9.95	5.6
	mean	10.84	13.11	7.88
Compost 3	Calcium nitrate+Potassium sulphate	15.7	20.10	11.5
	Calcium nitrate+Potassium cl	11.2	13.50	8.5
	Ammonium sulphate+Potassium sulphate	13.1	16.20	10.55
	Ammonium sulpate+Potassium cl	9.5	11.30	6.75
	mean	12.38	15.28	9.33
	LSD at 0.5%	0.85	1.00	0.43

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

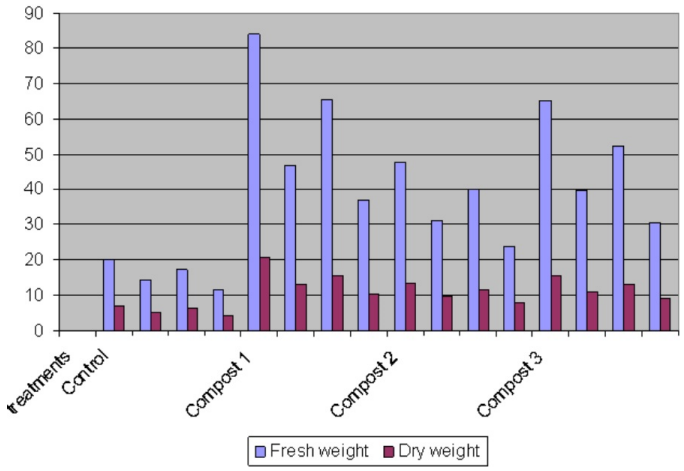

Fig. 1: Mean values of Fresh and dry weight (g/pot) of sorghum plants as affected by organic and mineral fertilization treatments.

The residual effect of cotton compost was more effective than mixture or chicken manure revealed significantly of the fresh and dry weight of sorghum plants. Cotton stalks compost in combined with ca $(NO_3)_2$+ K_2SO4 treatment in the Tables (6, 7) and Fig. (1) gave higher fresh and dry weight the mean values for three cuts (83.92 F.W - 20.67 D.W) g/pot for leaves than $Ca(NO_3)_2$+ KSO_4 without cotton stalks. (19.95 F.W- 6.92 D.W) g/pot. It could be attributed cotton composted is an organic form which decomposition into mineral form after an enough time under the suitable environmental condition for the microorganisms. So, at the early stage of plant growth, inorganic mineral is more suitable than organic fertilizer, on the contrary at the later time cotton compost will be more suitable for plant growth. It means, that inorganic is necessary in early stage and cotton stalks will complete the plant needs for the longer time This results is in harmony with the findings of Wong *et al.* (1999), MeKail *et al.* (2000) and (Risk, 2001).

Furthermore, in the same Tables, residual effect of chicken manure with Ca $(NO_3)_2$+K_2SO_4 treatment came in last order. The mean values for the three cuts were (47.52 F.W- 13.42 D.W) g/pot and mixture compost came in between 65.22 F.W- 15.77 D.W) g/pot. Data also indicated that the residual effect of mixture manure with ca $(NO_3)_2$+ K_2SO_4 had highly significant increase in fresh and dry weight as residual effect of mixture manure compared with residual effect of chicken manure with $Ca(NO_3)_2$ +K_2SO_4. It could be summarized that mixture of chicken with organic as well as the best fresh and dry weight compared with the residual effect of chicken manure. These may be attributed the composted solely release, but contains in mineral form plant absorbed it first, and cotton composted is an organic form which decompose into mineral form after the enough time. These resulted are in accordance with those obtained by Negm *et al.* (2002). Data in Tables (6 and 7) show that generally, maximum increased mean values of fresh and dry weights of leaves by sorghum plant for three cuts had increased significantly were (76.6 and 54%) ,respectively resulted of residual effect of mixture manure with $Ca(NO_3)_2$ + K_2SO_4 compared to residual effect of chicken manure plus $Ca(NO_3)_2$ + K_2SO_4 treatment, respectively, these results indicated that, the slow release of nitrogen from organic sources gave better growth of plant (Ristimakie *et al.,* 2000 and Rizk *et al.,* 2002).

Mineral Composition:

The residues of organic composted had positive effect on N, P and K uptake by sorghum plants, as compared with the control (inorganic fertilizer alone). Data in Tables (8, 9, 10) and Fig. (2) revealed that the absorption of N, P, K by sorghum plants was influenced by Residual Effect of organic and inorganic fertilizer. The mean value of NPK uptake for three cuts by sorghum plants ranged from, 29.68, 4.51and 44.80mg/pot for $SO_4(NH_4)_2$ KCl treatments to 475, 109 and 1260.33 mg/pot for $Ca(NO_3)_2$ + K_2SO_4 with cotton stalks while the least mean values were 235, 58 and 673 mg/pot for chicken manure and mixture compost came in between (300.67,76 and 861mg/pot), respectively it could be, therefore assumed that the residual effect of cotton stalks helped in providing more NPK uptake in the form of $Ca(NO_3)_2$ + K_2SO_4 combined with cotton compost which might be it rich in element values with increasing its rate in the rooting zone it means that the availability and absorption of the elements increase nutritional thus their concentrations in plant tissues also increased. The obtained results are in good accordance with those obtained by Singh (1990); Oborn *et al.* (1995) and Abdel-Mouty *et al.* (2001).

Table 8: Effect of organic source and the forms of N, K frertilizers on N uptake (mg/plant) by sorghum plants.

Treatments	Source of mineral fertilizer (N & K)	Dry weight		
		Cut1	Cut2	Cut3
Control	Calcium nitrate+Potassium sulphate	82.5	103.00	55.56
	Calcium nitrate+Potassium cl	46.8	63.50	21.7
	Ammonium sulphate+Potassium sulphate	69	85.68	33.6
	Ammonium sulpate+Potassium cl	29.4	44.93	14.7
	mean	56.93	74.28	31.39
Compost 1	Calcium nitrate+Potassium sulphate	488	613.00	324
	Calcium nitrate+Potassium cl	254	333.00	138
	Ammonium sulphate+Potassium sulphate	355	466.00	202
	Ammonium sulpate+Potassium cl	154	217.00	101
	mean	312.75	407.25	191.25
Compost 2	Calcium nitrate+Potassium sulphate	234	318.00	153
	Calcium nitrate+Potassium cl	150	192.00	90
	Ammonium sulphate+Potassium sulphate	186	238.00	129
	Ammonium sulpate+Potassium cl	107	149.00	63
	mean	169.25	224.25	108.75
Compost 3	Calcium nitrate+Potassium sulphate	298	408.00	196
	Calcium nitrate+Potassium cl	179	240.00	117
	Ammonium sulphate+Potassium sulphate	229	308.00	164
	Ammonium sulpate+Potassium cl	143	184.00	83
	mean	212.25	285.00	140
	LSD at 0.5%	12.1	14.19	8.98

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

Table 9: Effect of organic source and the forms of NK frertilizers on P uptake (mg/plant) by sorghum plants.

Treatments	Source of mineral fertilizer (N & K)	Dry weight		
		Cut1	Cut2	Cut3
Control	Calcium nitrate+Potassium sulphate	18	23.10	10
	Calcium nitrate+Potassium cl	8.25	11.43	3.41
	Ammonium sulphate+Potassium sulphate	13.8	17.14	17.71
	Ammonium sulpate+Potassium cl	4.62	7.67	1.23
	mean	11.17	14.84	8.09
Compost 1	Calcium nitrate+Potassium sulphate	113	148.00	66
	Calcium nitrate+Potassium cl	53	76.00	32
	Ammonium sulphate+Potassium sulphate	80	101.00	46
	Ammonium sulpate+Potassium cl	39	55.00	24
	mean	71.25	95.00	42
Compost 2	Calcium nitrate+Potassium sulphate	61	80.00	34
	Calcium nitrate+Potassium cl	30	38.00	19
	Ammonium sulphate+Potassium sulphate	46	62.00	27
	Ammonium sulpate+Potassium cl	22	28.00	11.76
	mean	39.75	52.00	22.94
Compost 3	Calcium nitrate+Potassium sulphate	75	109.00	44
	Calcium nitrate+Potassium cl	39	58.00	26
	Ammonium sulphate+Potassium sulphate	59	81.00	37
	Ammonium sulpate+Potassium cl	31	43.00	19
	mean	51	72.75	31.5
	LSD at 0.5%	4.22	7.85	3.35

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

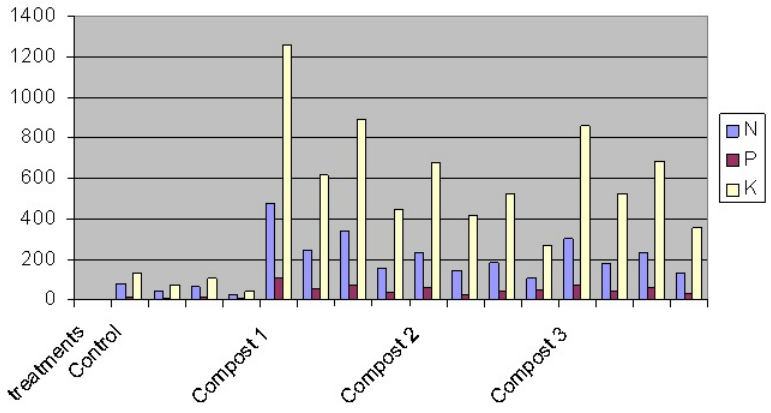

Fig. 2: Mean values of N, P and K (g/pot) of sorghum plants as affected by organic and mineral fertilization treatments.

Table 10: Effect of organic source and the forms of NK frertilizers on K uptake (mg/plant) by sorghum plants.

Treatments	Source of mineral fertilizer (N & K)	Dry weight		
		Cut1	Cut2	Cut3
Control	Calcium nitrate+Potassium sulphate	127.5	206.25	76
	Calcium nitrate+Potassium cl	68.75	120.65	31
	Ammonium sulphate+Potassium sulphate	103.5	163.90	50.4
	Ammonium sulpate+Potassium cl	37.8	79.46	17.15
	mean	84.39	142.57	43.64
Compost 1	Calcium nitrate+Potassium sulphate	1248	1638.0	895
	Calcium nitrate+Potassium cl	613	802.0	437
	Ammonium sulphate+Potassium sulphate	888	1146.0	641
	Ammonium sulpate+Potassium cl	435	601.0	304
	mean	796	1046.8	569.25
Compost 2	Calcium nitrate+Potassium sulphate	662	913.00	445
	Calcium nitrate+Potassium cl	438	586.00	227
	Ammonium sulphate+Potassium sulphate	539	700.00	333
	Ammonium sulpate+Potassium cl	267	378.00	168
	mean	476.5	644.25	293.25
Compost 3	Calcium nitrate+Potassium sulphate	809	1176.0	598
	Calcium nitrate+Potassium cl	510	716.00	348.5
	Ammonium sulphate+Potassium sulphate	668	915.00	474.75
	Ammonium sulpate+Potassium cl	361	463.00	243
	mean	587	817.50	416.06
	LSD at 0.5%	47.07	54.57	75.81

Cotton stalks compost: compost1; Chicken manure (Ch.M): compost2; Mixture compost: compost3.

In this respect, Nimje and Jadisheth (1988) who reported that application of organic composts as cotton stalks increases the absorptive power of the soil to cations and anions particularly phosphates and nitrates. These absorbed ions are released slowly for benefit of crop during the growth period and thus there is a high possibility for increasing uptake of these nutrients by plants in turn.

The largest value was obtained from Tables (8, 9 and 10) illustrated that positive effect of mixture manure with $Ca(NO_3)_2 + K_2SO_4$ occurred on N, P and K uptake in sorghum plant increase significantly as compared with Residual Effect of chicken manure + $Ca(NO_3)_2 + K_2SO_4$. may be due to chicken manure combined with cotton composted may correct the final C/N ratio of the mixture in order to obtain a preferable condition for enhancing the mineralization of the organic N may be explained chicken manure and its combination with composted may be explained either by height native content of these element or by chelating process and thus there availability could be gradually increased (Singh and Dehima 1980). Mixture manure was superior to chicken manure, it could be attributed to the mixture manure contained more pronounced of available NPK uptake than Chicken manure + Ca $(NO_3)_2 + K_2SO_4$

Furthermore, residual effect of mixture manure caused significantly increased NPK uptake of sorghum plants at 27.9, 30 and 72.87% respectively than residual effect of chiken manure + $Ca(No_3)2 + K_2SO_4$. The presence of the chicken manure together with the cotton stalks compost lower the C:N ratio mixture and encourage rapid compostion to produce compost very rich in their nutrients content (Diaz *et al.,* 1993 and Bhandari *et al.,* 2000). Also, mineral nutrients suplemention under different combinations must have helped in balancing the nutrients in soil solutions and thus enhanced activity and uptake (Murugupan *et al.*, 1998).

Further more, the increased availability of K might be due to the higher and comparable K content of organic manures which could be steadily released to the available pool during their process of decomposition. In the same Tables the behaviour of N may be attributed to net immobilization of N at the first season followed by net mineralization at the second one by the microbial action. The superiority of mixture manure on N uptake by sorghum plant compared with chicken manure may be due to that conversation of N-organic to available form through microbial activity which takes more time Abdel-Ghani and Bakry (2005). Similar results were obtained by Shaban (2005). Generally, data presented in tables(8, 9, 10) and Fig. (2) show that the highest mean values increased significantly of N, P and K uptake by sorghum plant for three cuts were obtained the highest values of NPK uptake for the Residual Effect of cotton stalkes plus Ca (NO_3) 2 + K_2SO_4 was used enhanced the N, P and K uptake value, (102, 87 and 87%), respectively than which residual effect of chicken manure fertilizer with Ca (NO_3) 2 + K_2SO_4.

In this concern increased significantly fresh and dry weight and uptake of N, P and K of plant cut I and cut II resulted nutrients composted slowly released nutrients from the organic pool and hence the less fixation losses while sorghum plant growth and uptake of nutrients at cut III (Third cut) decreased for all treatments may be due to loking up some nutrients microbial taking part in the mineralization. During the process of mineralization, the fixation and release process by plans during stage growth finally, utilization of poultry manure and/or cotton stalks as a sources of important nutrients resulted in a significant increase in available N, P and K in equilibrium solution and maintain continuous K supply in the soil during most of growing periods of plants either lettuce or sorghum as indicated by quantity intensity parameters and plant nutrients uptake, and could be utilized as good

sources of N, P and K for lettuce and sorghum. In generally, the results of this study could be a good starting point to study the applicability of cotton stalks and chicken manure as sources of N, P and K for crop production economically over a wide range of environmental field conditions.

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