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RESPONSES OF ONION PLANTS TO SOURCES AND RATES OF ORGANIC FERTILIZERS

Farrag, Amal M.* and M.E. Hussein**

*** Dept. of Vegetable Crops , Fac. of Agric., Cairo, Univ.**

**** Dept. of Soils, Fac. of Agric., Cairo, Univ.**

ABSTRACT

Two field expermiments were carried out in which onion *(Allium cepa)* plants cv. Giza 20 were grown in clay soil supplied with different organic fertilizers i.e. poultry, sheep, cattle manures, sewage sludge and town waste composts, at the rate of 10, 20 or 30 tons/fed. for each. Also the inorganic fertilizer was applied at the rate of 400, 300 and 150 kg/fed. as amonium sulphate (20.5% N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48 % K_2O), respectively (the recommended rates). The pervious treatmemts were compared with control (without fertilization). The organic fertilizers significantly increased vegetative growth characters, bulbs yield and quality. Vegetative growth characters were determined at 4 months after transplanting. Applying 30 tons/fed. of poultry manure, 20 tons/fed. of poultry manure or in organic fertilizers caused the heighest plants (without significant differences among them), in the first season. In the second season the heighest plants were obtained by adding 30 tons/fed. of poultry manure, 30 tons/fed. of sheep manure or 20 tons of poultry manure in descending order.

The highest values of number of leaves and fresh weight of leaves / plant were obtained with supplying 30 tons/fed. of poultry manure or 30 tons/fed. of sheep manure, in the two seasons. Dry matter percentage of leaves and bulb fresh weight were the highest by application of 30 tons/fed. of poultry manure or 30 tons/fed. of sheep manure in the two seasons. The lowest values of bulbing ratio were obtained by addition of 30 tons/fed. of poultry manure or 30 tons/fed. sheep manure. In general increasing the rates of organic fertilizers increased their effect on vegetative growth. Application of sewage sludge followed by town waste composts gave the lowest values of vegetative growth characters. Using 30,20 tons/fed. of poultry manure followed by 30 tons/fed. of sheep manure produced the highest bulbs yield and average fresh weight of bulb. Dry matter percentage of bulb at harvest were the highest by using 30 tons/fed. of poultry manure 30 tons/fed. of sheep or 30 tons/fed. of cattle manure in the first season. On the other hand the highest values were obtained by applying 30 tons of poultry manure 30 tons of sheep manure or inorganic fertilizer, in the second season. Total soluble solides and total carbohydrates contents were the highest by adding 30 tons/fed. of poultry manure, 20 tons/fed. of poultry manure or 30 tons/fed. of sheep manure in descending order, in the two seasons. The effect of cattle manure on bulbs yields and quality was moderate. The lowest values of the yield and quality were obtained with the application of sewage sludge and town waste composts, in the two seasons. Application of 30 tons/fed. of poultry manure caused the highest N, P and K contents of leaveas and bulbs. Whereas, appliction of 10 tons/fed. of town waste compost resulted in the lowest N,P,K content of leaves and bulbs.

The highest contents of (Zn, Mn and Fe) in leaves and bulbs of onion plants were obtained by applying sewage sludge compost, cattle and sheep manures, respectively. The highest contents of Cu, Cd and Pb in leaves and bulbs were obtained by addition of sewage sludge followed by town waste composts.

In general, applying poultry manure at the rate of 30 tons/fed. is recommended for onion bulb production.

INTRODUCTION

Onion (*Allium cepa*) is one of the most important vegetable crops in Egypt for both local consumption and export. On arid zones, soil organic matter is less than 2% (Bear, 1968). Organic and bio-fertilizers are very important sources for providing the plants with their nutritional requirements without having an undesirable impact on the environment. Rumpel (1998) reported that organic nitrogen fertilizatizer have advantages over mineral nitrogen salts, it is postulated that they release nutrients slowly, they are source of trace elements as well as they improve soil structure and increasing soil organic matter content. Cattel, Poultry manure, sewage sludge, town waste compost and green manure can be used successfully. Allaa – El – Din (1980) stated that production of organic manure from Egyptian farms is about 187.4 million m^3/year with net production of FYM being about 119.2 million m^3/year and the production of poultry manure in Egypt is about 250.000 m^3/year which may by considered a source of 2300, 4500, 641 tons/year of nitrogen, phosphorus and potassium respectively. This production represents about 56% from Egyptian requirements which has been reported by Riad (1982) to be 70 million tons/year for 17.5 million feddan. Many investigators compared the effect of different organic manures, mineral fertilizater and their combination on vegetative growth and bulbs yield. Oiken and Asiegbu (1993) who reported that fruit yields of tomato were the best with swine or poultry manure applied at 10 t/ha., followed by sewage sludge or rabbit manure applied at 20 t/ha., then 100 kg N + 40 kg P + 100 g K kg / ha. Very high manure application (30 t/ha). depressed growth and yield. On the other hand, Galbiatti and Castellane (1990) found that mineral fertilizer at 30 N, 240 P_2O_5 and 115 K_2O kg/ha. gave higher onion bulb yield than cattle manure at 60 m^3 / ha. Warade *et al.* (1996) mention that the highest bulb yield was obtained with 40 t FYM/ha. + NPK (75,50 and 50 Kg / ha., respectively). Dixit (1997) showed that Application of 120 Kg N/ha. with 20 t farmyard manure, increased yield by 42.79% as compard with the control (no fertilizer). Singh *et al.* (1997) mention that farmyard manure at 25 t/ha. produced the highest gross and marketable yield as compared with 25 t/ha. green manure or 2 t/ha. vermicomposte. When framard manure was combined with 100 kg N + 25 kg P + 25 kg K / ha., gross and marketable yields were increased. Rumpel (1998) reported that onion yields were significantly higher with the combined fertilizer treatment (F Y M at 40 t/ha. and NPK at 150 : 100 : 200 kg / ha.) compared to FYM alone which itself was significantly higher than NPK alone.

Many investigators studied the effect of sewage sludge and town waste composts as new fertilizers on the yield of onion. Haroon and Ramulu (1990) studied the response of onion to sludge application at (40 or 80 t/ha.) and sewage irrigation. Compared with untreated controls, sewage irrigation increased yields of the first season and also sewage sludge application. Onion yields decreased as sludge application rate was increased. Rajan and Raj (1998) mention the pot culture experiments were carried out using different combination of sewage sediments and sand (0, 25, 75 and 100%). One set was irrigated with oxidized sewage and another set by ordinary

borehole water. The maximum yield of onion was attained in 100% sediment with oxidized sewage as irrigation water. Many investigators studied the effect of waste composted on yields of vegetables.

Chattopadhyay *et al.* (1992) mention that rice cv. Ratna was given 120 kg N/ha. as city waste compost or urea, 60 kg P_2O_5/ha. as compost + 60 kg N as urea and 30 kg P_2O_5 as compost + 30 kg P_2O_5 as superphosphate or rock phosphate. A following crop of tomato cv. Pusa Ruby was grown without further compost or fertilizer applications. Application of compost with urea gave the highest yield of rice and the following tomato crop. Sagiv *et al.* (1994) reported that carrot were supplied with cattle manure at 0, 3 or 9 tons/dunam or composted town waste at 3 tons/dunam. In addition 0, 10, 20, 30 K N/dunam was applied via irrigation. The yield in the organic manure treatment with no added N were double those of control. The highest yield overall were obtained with combination organic manure and N at 30 kg/dunam.

Regarding to the effect of mineral fertilizers. Hence, the need for each nitrogen, phosphorus and potassium fertilizaters all together were very much important for high productivity of onion crop (Bruckner 1998) and Vachhani and Patel (1996). Farghali and Zeid (1995) found that addition of P increased total yield and up take by plants. The highest yield of onion were obtained with 240 or 360 K superphosphate / fed. Both average bulb weight and diameter increased with increasing P rate. Rizk (1997) indicated that increasing NPK rate increased all vegetative growth parameters measured and increased the yield of bulbs. Kumar *et al.* (1998) found that N at 150 kg/ha. gave the best results with regard to bulb diameter, bulb fresh and dry wieght NaGaich *et al.* (1999) reported that application of 80 kg K_2O/ha. significantly increased bulb weight / plant and horizontal diameter of the bulb.

The aim of this study was to determine the most suitable sources and rates of organic fertilizers on growth, yield and quality as compared with those of conventional NPK or without fertilization.

MATERIALS AND METHODS

The investigation was carried out at the Agricultural Experimental Station, Faculty of Agriculture, Cairo University, Giza during the two successive seasons of 1995-1996 and 1996-1997. Seeds of onion (*Allium cepa*). Giza 20 cultivar were sown in the nursery on 15th september in the two seasons. At the age of 75 days, seedling were transplanted at 10 cm apart on both sides of ridges (50 cm) wide and 4 m length. A complete randomized block design with 3 replicates was used. The experimental unit consisted of 5 ridges (10 m^2). Furrow irrigation system was followed in both seasons.

Chemical properties of the experimental soil during the two seasons according to Jackson (1962) are shown in Table (1).

The experiments included the following treatments, five organic fertilizers viz., poultry, sheep, cattle manures, sewage sludge and town waste composts, were applied during the soil preparation at the rates of 10, 20 or 30 tons/fed. for each. Mineral fertilizer were added at the rate of 400 kg/fed. amonium sulphate (20.5% N), 300 kg/fed. calcium superphosphate (15.5% P_2O_5) and 150 kg/fed. potassium sulphate (48% K_2O). During the soil

preparation calcium superphosphate was applied, while N and K fertilizers were divided into two equal portions to be added at 30 and 60 days after transplanting. The control treatment was without fertilization.

Chemical analysis of organic fertilizers used in both seasons is shown in Table (2).

Table (1): chemical analysis of the experimental soil

Season	Organic matter %	pH	Available nutrients (ppm)					
			N	P	K	Fe	Zn	Mn
1995/1996	1.92	7.92	78	32	445	4.2	5.2	8.7
1996/1997	1.98	7.65	82	26	338	5.3	4.6	6.9

Table (2): chemical analysis of the used organic fertilizers

Fertilizers	Organic matter %	N%	P%	K%	Fe%	Mn PPm	Zn PPm	Cu PPm	Cd PPm	Pb PPm
Poultry manure	73.2	2.53	1.35	0.75	0.84	196	174	125	1.82	15.8
Sheep manure	65.4	1.99	1.2	0.61	1.21	187	200	100	1.91	18.4
Cattle manure	60.7	1.01	0.8	0.70	1.33	264	98.7	87.6	2.11	21.5
Sewage sludge compost	45.6	1.63	1.09	0.38	1.09	219	524	239	3.73	56.7
Town waste compost	42.3	0.85	0.69	0.42	0.92	180	163	140	2.61	30.0

Data were recorded on the following characters :

I- Vegetative growth characters were estimated, at 4 months after transplanting as follows :

Plant height (cm), number of leaves / plant, fresh weight of leaves / plant (g), dry matter percentage of leaves and bulbing ratio as neck diameter / bulb diameter.

II – Yield and quality :

Culls as doubles and bolters were excluded, yield was estimated as kg / plot and calculated as tons/fed. Average fresh weight of bulb, dry matter percentage of bulb, total soluble solids (TSS) of bulb were also detected.

III – Chemical composition :

Nitrogen, phosphorus and potassium percentages of leaves after four months from transplanting and of bulbs after harvest were estimated by methods described by Pregl (1945), Murphy and Riley (1962) and Brown and Lilliland (1946), Micro – elements, i.e. Mn, Zn, Fe, Cu, Cd, Pb, PPm of leaves and bulbs were determined according to the method described by Ramirez – Munoz (1968). Total carbohydrates of bulbs after harvest was determined by method of Smith *et al.* (1956).

All data were statistically analysed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Vegetative growth :

Data presented in Table (3) indicated the effect of different sources of organic and incorganic fertilizers on vegetative growth, i.e. plant height, number of leaves per plant, fresh weight of leaves per plant, fresh weight of bulb, dry matter percentage of leaves and bulbing ratio, at 4 months after transplanting.

Plant height :

Significant differences were detected in plant height. The highest values were obtained by adding poultry manure at 30, 20 tons/fed. or inorganic fertilizer as compared with control. On the other hand, applying sewage sludge, town waste composts or sheep manure at 10 tons/fed. for each reduced the plant height as compared with control, in the first season. In second season, the highest values were recorded by using 30 tons/fed. of poultry manure or 30 tons/fed. sheep manure, followed by 20 tons/fed. poultry manure, or 30 tons/fed. of cattle manure. The lowest value was obtained by adding 10 tons/fed. of town waste compost as compared with control. In general, application of waste town compost caused the lowest values of vegetative growth parameters due to its poor contents of macro and micro nutrients (Chatopadhyay *et al.* 1992).

The increase in plant height could be attributed to the effect of substrates on the improvement of chemical and physical properties of the soil. (Rumpel 1998). Vegetative growth characters increased by using poultry manure could be interpreted that it contains twice nitrogen as a farmyard manure and it has much higher phosphorus and potassium than FYM (Cooke, 1972). Also, Widjajanto and Widodo (1982) found that increasing the rates of FYM increased plant height. Chindo and Khan (1986) observed that, vegetative growth charaters were increased with increasing the level of poultry manure.

Number of leaves / plant and their fresh weight :

Data presented in Table (3) showed that the different organic manures and incorganic fertilizers significantly increased number of leaves and their fresh weight as compared with control (without fertilization). The highest values were recorded on plants receiving 30 tons/fed. of poultry or sheep manures for each. The effect of inorgaric fertilizer nearly equaled that of cattle manure and sewage sludge compost. The lowest values were obtained by supplying waste town compost, in both seasons.

Dry matter percentage of leaves :

Data presented in Table (3) showed that dry matter percentage of leaves, at 4 months after transplanting, was increased significantly by the application of different organic manures and inorganic fertilizer. The highest values were obtained by adding 30 tons/fed. of poultry manure, 30 tons/fed. of sheep manure or 20 tons/fed. of poultry manure. The lowest dry matter percentage of leaves was recorded with application of 10 tons/fed. of sewage sludge or town waste compost as compared with control, in the first season. In the second season the highest dry matter percentage of leaves were detected in plants were grown in soil were supplied with poultry manure at 30 or 20 tons/fed. The effect of sewage sludge composte was nearly similar to that of cattle manure. The lowest values were obtained by using town waste compost as compared with control. In general, increasing the rate of different organic manures increased the values of vegetative growth parameters.

Fresh weight of bulb :

Data presented in Table (3) shown that the fresh weight of bulb, at 4 months after transplanting, was significantly increased applying by different rates of organic manures or mineral fertilizer. The highest values were obtained by adding 30 tons/fed. of poultry manure or sheep manure for each, followed by 30 tons/fed. of cattle manure and sewage sludge compost for each. The effect of inorganic fertilizer was moderate. Town waste compost reduced the fresh weight of bulb, in both seasons.

Bulbing ratio :

Bulbing ratios of the two seasons were recorded in Table (3). Data showed significant differences between different organic manures and inorganic fertilizer as compared with control (without fertilizer). The lowest values of bulbing ratio were recorded on plants grown in soil were supplied with 30 tons/fed. poultry manure or 30 tons/fed. of sheep manure, increasing the rate of organic manure decreased the bulbing ratio. On the other hand, the highest values were obtained by adding town waste compost. The moderate values of bulbing ration were obtained by using cattle manure and sewage sludge compost. The pervious organic fertilizers contained moderate values of NPK as compared with poultry manure or town waste compost. These results are in a line with those reported by Abo-Hussein (1995) who revealed that, the growth of potato plants expressed as plant height, number of leaves, fresh and dry matter content of whole plant and its parts were increased as a result of applying cattle manure at 60 m^3/fed. or chicken manure at 20 m^3/fed. or cattle manure at 30 m^3/fed. combined with chicken at 10 m^3/fed. However, the highest growth rate was obtained by applying cattle manure at 30 m^3/fed. combined with chicken manure at 10 m^3/fed. Kumar *et al.* (1998) studied the influence of nitrogen on growth and yield of onion, they found that N at 150 kg/ha as urea gave the best results with regard to plant height, length and diameter of the longest leaf., diameter of the thickest stem, number of leaves / plant; bulb diameter, bulb FW and DW, length of the longest root, and bulb yield.

Yield and quality :

Bulbs yields and average fresh weight of bulb :

Data recorded in Table (4) showed significant differences between the various organic and inorganic fertilizers and the control in the bulbs yield and average fresh weight of bulb in both seasons. The highest values were obtained with application of 30 tons/fed. of poultry manure followed by 20 tons/fed. of poultry manure or 30 tons of sheep manure, then 30 tons/fed. of cattle manure. On the other hand, applying sewage sludge or town waste composts each at 10 tons/fed. reduced the bulbs yield and average fresh weight of bulb as compared with control in both seasons.

The poultry manure caused the highest bulbs yield and average fresh weight of bulb as a result of its higher nutrient contents as compared with other organic fertilizers. This was resulted in more vigorous vegetative growth and bulb fresh weight.

Moreover, increasing the rate of organic fertilizers increased the concentration of macro and micro nutrients in the soil and its positive effect on physical and chemical properties of the soil.

Dry matter percentage of onion bulb :

Data presented in Table (4) showed significant effect due to the use of organic and inorganic fertilizers on dry matter percentage of onion bulb as compared with the control (without fertilizer) in both seasons. Data indicated in the first season that the highest values were obtained with application of 30 tons/fed. of poultry, sheep or cattle manures then 30 tons/fed. of sewage sludge compost. Wheras the lowest values of bulb dry matter percentage were obtained with applying 10 tons/fed. of sewage sludge or town waste composts for each. On the other hand, in the second season the highest value of bulb dry matter percentage were obtained with adding 30 tons/fed. of poultry manure following by 30 tons/fed. sheep manure or inorganic fertilizer. These results may indicate that the highest values of macro and micro nutrients present in poultry and sheep manures promoted the vegetative growth and increased the photosynthesis rate and formation sugars and carbohydrates.

Decreasing the rate of organic manure decreased bulb dry matter percentage.

Total soluble solides of onion bulbs (TSS) :

Data presented in Table (4) showed significant differences between the different organic and inorganic fertilizers on total soluble solides of onion bulbs as compared with control in both seasons. The highest values were obtained with applying 30, 20 tons/fed. of poultry manure or 30 tons/fed. of sheep manure in both seasons. Whereas, the lowest values were obtained by adding 10 tons/fed. of sewage sludge and town waste composts, in both seasons.

Total carbohydrates :

Concerning the effect of organic and inorganic fertilizers on total carbohydrates of bulbs, (Table 4) data indicated significant differences in both seasons.

The highest values were obtained with suppling 30 tons/fed. of poultry, 30 tons/fed. of sheep manures or 20 tons/fed. of poultry manure. However, the lowest values of carbohydrates were obtained with application of town waste compost.

These results are in accordance with those obtained by Lazic *et al.* (1992) who mentioned that several vegetables grown with organic fertilizer and without chemical sprays. Onion produced good yields and had high dry matter. On the other hand the effect of inorganic fertilizers on dry matter percentage of bulbs were studied by many investigators. Dhian *et al.* (1991) demonstrated that bulb DW was inceased with increasing N application rate up to 80 kg/ha. . Gaviola *et al.* (1998) stated that the greatest total bulb yield and dry matter were obtained with 100 kg N + 30 kg P/ha.

Chemical composition :

Macro nutrients content of leaves Nitrogen :

Nitrogen :

As regard to nitrogen percentage in leaves of onion at 4 months after transplanting, data presented in Table (5) showed that all organic and inorganic fertilizers significantly increased nitrogen percentages as compared with control in both seasons. Plants were supplied with 30 tons/fed. of poultry manure gave the highest values followed by 20 or 10 tons/fed of poultry manure. Applying sheep or cattle manures were of lower effect and the town waste compost gave the lowest values of N content of leaves as compared with control treatment.

Phosphorus :

Concerning phosphorus percentage in leaves of onion, data presented in Table (5) showed that all organic and inorganic fertilizers significantly increased phosphorus content in onion leaves over those of control ones. Plants supplied with 30 tons/fed. of poultry manure or 30 tons of sheep manure gave the highest values of P content in the both season. On the contrary, the lowest values were found when waste town compost was applied.

Potassium :

Results indicated that all used organic and inorganic fertilizers significantly increased potassium percentage in leaves of onion over those of control ones (Table 5). Data showed that plants were supplied with 30 tons/fed. of poultry manure gave the highest potassium content, 30 tons/fed. of cattle manure or 30 tons/fed. of sheep manure, in the first season. Whereas in the second season. Plants were grown in 30 tons/fed. of poultry manure gave the highest content of potassium percentage, 30 tons of sheep manure or 20 tons/fed. of poultry manure. The lowest values were obtained by using town waste compost in both seasons.

Macro nutrients content of bulbs at harvest :

Data presented in Table (5) showed that all organic and inorganic fertilizers significantly increased N, P and K contents in bulbs in both seasons as compared with control (without fertilizer).

Nitrogen :

As regard to nitrogen percentage content of bulbs, plants supplied with 30 tons/fed. of poultry manure gave the highest nitrogen percentages in bulbs followed by 20 tons/fed. of poultry manure then 10 tons/fed. of poultry manure or inorganic fertilizer treatment.

Phosphorus :

Concerning phosphorus percentage content of bulbs. The highest values of phosphorus percentages in bulbs were obtained by applying poultry manure at 30 or 20 tons/fed. then 30 tons/fed. of sheep manure as compared with control in both seasons. Plants grown in soil were supplied with sheep, cattle manures or sewage sludge compost at the rate of 30 tons/fed. for each gave moderate values of nitrogen and phosphorus percentage in bulbs.

Potassium :

With regard to potassium percentage content in bulbs. The highest values of potassium percentage in bulbs in the first season were obtained by application 30 or 20 tons/fed. of poultry manure followed by 30 tons/fed. of sheep or 10 tons/fed. of poultry manures. On the other hand, the highest values were obtained by 30 tons/fed. of poultry manure followed by 30 tons/fed. of sheep manure, in the second season.

In addition, the present results also indicate that increasing the rates for different organic fertilizers increased the concentration of macro nutrients of bulb tissues. The lowest N, P and K percentages were obtained by application at town waste compost.

Chicken and farmyard manures had higher contents of N, P and K. Thus, onion plants could utilize and uptake the released nutrients during the decomposition of the used manure. These results are in line with those obtained by Eissa (1996) and Abd-El-Aty (1997) who indicated that cucumber or pepper plants grown in chicken and cattle manure had higher N, P and K contents than those grown in soil only. Mallanagouda *et al.* (1995) showed that applying the recommended rate of NPK + 20 t/ha. FYM. Gave the highest yield of onion. Treated plants from this treatment also exhibited the highest uptake of N, P and K (186.32, 24.69 and 102.09 kg/ha. respectively).

Zhou Lixiang *et al.* (1994) mention that the analysis of undigested sewage sludge showed that it contained high levels of organic matter, N and P and low levels of K and heavy metals (except Zn). When the sludge was added to a loamy soil, sewage derived N and P were readily taken up by vegetables and yields were increased. Ozores – Hampton *et al.* (1998) found that immature wastes compost contained phytotoxic compounds which had harmful effect on seed germination and growth. They also added that applying mature composted waste materials improved the growth and yields of vegetables in general.

Micro nutrients contents of leaves and bulbs :

Data in Table (6) show the effect of organic and inorganic fertilizers on micro nutrient contents (Zinc, manganese and iron) in leaves at 4 months after transplanting and bulbs at harvest. Data showed that all organic and inorganic fertilizers significantly increased (Zn, Mn and Fe) contents of leaves and bulbs as compared with control (without fertilizer). The highest values of Zn were obtained by application sewage sludge compost at all rates (10,20 and 30 tons/fed.). These results may be due to its higher contents of Zn as indicated in Table (2). Thus, the availability of nutrients for plant uptake were increased and then accumulated in leaves and bulbs of onion plants.

With regared to Mn contents in onion leaves at 4 month after transplanting and in bulbs at harvest. Data presented in Table (6) showed that the highest imanganese content in leaves and bulbs were obtained by addition of 30 tons/fed. of cattle manure followed by 30 tons/fed. of sewage sludge compost. These results may be due to the positive effect of organic manures on the availability of nutrients for plant uptake. Cattle manure and sewage sludge compost had higher contents of Mn comparing with other

organic fertilizers as indicated in Table (2). Concerning Fe contents in leaves and bulbs of onion. The highest Fe content was obtained with suppling cattle manure followed by sheep manure at all rates for each. Cattle and sheep manures had higher content of Fe as compared with other organic fertilizers. Warman (1998) reported that conventionally fertilized soils are generally higher in P and K but lower than compost-fertilized soils in C, Ca, Mg, Mn, Cu and Zn. Singh and Tiwari (1995) mentioned that Zn singly or combined with Fe and B were the most effective for increasing all growth parameters of onion plants. In addition, Sindhu and Tiwari (1996) stated that bulb yield, TSS and total sugar contents were the highest when 1 PPm Cu + 3 PPm Z + 0.5 PPm B + 100 PPm Fe was applied twice.

Heavy metals :

Concerning heavy metals (Cu, Cd and Pb) contents in leaves at 4 month after transplanting and bulbs at harvest, data presented in Table (6) indicated significant differences among treatments. The higher contents of Cu, Cd and Pb were obtained when onion plants were supplied with sewage sludge followed by town waste composts as compared with other organic manure and inorganic fertilizer. These results may be due to the higher contents of Cu, Cd and Pb in such composts as indicated in Table (2).

The present results are in line with those obtained by Berthet *et al.* (1984) who found that Cu levels in sludge were higher than in fertilized and unfertilized soils. Onions particularly the roots, were the greatest accumulators of Cu. Also, they reported that the use of sewage sludge is unlikely to cause Cu contamination of leached water or vegetables. On the other hand, Procida *et al.* (1998) determined micro elements contents (Pb, Cd, Cr, Ni and Zn) in some vegetables and in associated soil from greenhouses managed by traditional and organic methods. Preliminary results showed that micro elements were accumulated in the vegetables and soils in both conventional and organic greenhouse systems. The concentrations found in all samples were so low that no possible danger could arise for the consumer from either conventional or organic products.

The accumulation of Cu and Cd were higher in bulbs than those in leaves, whereas the accumulation of Pb were higher in leaves than that in bulbs. These results agreed with those obtained by Jasiewicz (1993). Taleva and Djonova (1998) studied the effect of Cu and Cd on onion plants. They found that the increase in the concentration of Cu (160 mg/kg) and Cd (5 mg/kg) decreased the plant development.

The present results indicated that applying organic manure particulary poultry manure at high rate seemed to be the most efficient treatment in this investigation. This treatment improved vegetative growth, bulbs yield and its quality. The use of sewage sludge compost is unlikely as it causes accumulation of heavy metals in plants and soil, so it is not recommended for vegetable production.

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استجابة نباتات البصل لأنواع ومعدلات مختلفة من الأسمدة العضوية

أمل محمد فراج* و محمد الشربينى حسين**

*** قسم الخضر ـ كلية الزراعة ـ جامعة القاهرة .**

**** قسم الأراضى ـ كلية الزراعة ـ جامعة القاهرة**

أجريت تجربتين حقليتين حيث زرعت نباتات البصل فى أرض طينية وسمدت بأنواع مختلفة من الأسمدة العضوية وهى سماد الدواجن وسماد الغنم وسماد الماشية وسماد مخلفات المجارى وسماد القمامة . واستعمل كلاً منهم بمعدل ١ ، ٢٠ ، ٣٠ طن للفدان ، وأضيف أيضاً الأسمدة الكيماوية الموصى بها وهى ٤٠٠ كجم سلفات أمونيوم ، ٣٠٠ كجم سوبر فوسفات كالسيوم ، ١٥٠ كجم سلفات بوتاسيوم للفدان . وقد قورنت المعاملات السابقة بالكنترول وهو الزراعة بدون استعمال أسمدة . وقد أوضحت النتائج أن الأسمدة العضوية سببت زيادة معنوية فى صفات النمو الخضرى ومحصول الأبصال وجودتها . وقد قدرت صفات النمو الخضرى بعد ٤ شهور من الشتل ووجد أن إضافة ٣٠ طن للفدان من سماد الدواجن أو ٢٠ طن للفدان من سماد الدواجن أو السماد الغير عضوى أعطت أكثر النباتات طولاً فى الموسم الأول . أما فى الموسم الثانى إضافة ٣٠ طن للفدان من سماد الدواجن أو ٣٠ طن للفدان من سماد الغنم أو ٢٠ طن للفدان من سماد الدواجن أعطت أكثر النباتات طولاً . أكبر عدد من الأوراق . وأعلى وزن طازج للأوراق للنبات تم الحصول عليها بإضافة ٣٠ طن للفدان من سماد الدواجن أو ٣٠ طن للفدان من سماد الغنم فى الموسمين . وقد أوضحت أيضاً النتائج أن أعلى نسبة مئوية للمادة الجافة للأوراق وكذلك الوزن الطازج للبصلة تم الحصول عليها بإضافة ٣٠ طن للفدان من سماد الدواجن أو ٣٠ طن للفدن من سماد الغنم . وقد أظهرت النتائج أيضاً أن أقل نسبة تبصيل تم الحصول عليها كانت بإضافة ٣٠ طن للفدان من سماد الدواجن يليه ٣٠ طن للفدان من سماد الغنم . وعموماً وجد أن زيادة معدل الأسمدة العضوية يؤدى إلى زيادة تأثيرها على صفات النمو الخضرى . وأن استعمال أسمدة المجارى وأسمدة القمامة أعطت أقل قيم لصفات النمو الخضرى . وقد وجد أيضاً أن استعمال ٣٠ طن للفدان من سماد الدواجن يليه ٣٠ طن للفدان من سماد الغنم أو ٢٠ طن للفدان من سماد الدواجن أنتجت أعلى محصول أبصال . وقد وجد أن أعلى متوسط وزن طازج للبصلة ، وأعلى نسبة مئوية للمادة الجافة للأبصال عند الحصاد كانت باستعمال ٣٠ طن للفدان من سماد الدواجن يليه ٣٠ طن للفدان من سماد الغنم أو٣٠ طن للفدان من سماد الماشية فى الموسم الأول ، ومن ناحية أخرى فإن أعلى نسبة مئوية للمادة الجافة للأبصال حصل عليها بإضافة ٣٠ طن للفدان من سماد الدواجن يليه ٣٠ طن من سماد الغنم أو السماد الغير عضوى فى الموسم الثانى . أعلى محتوى مادة صلبة ذائبة كلية وكربوهيدرات كلية للأبصال حصل عليه بإضافة ٣٠ أو ٢٠ طن للفدان من سماد الدواجن يليه ٣٠ طن من سماد الغنم فى الموسمين . وقد أوضحت النتائج أن تأثير سماد الماشية على محصول الأبصال ونوعيتها كان متوسط وأن إضافة أسمدة المجارى و القمامة أعطت أقل محصول أبصال وأقل جودة فى الموسمين . إضافة ٣٠ طن للفدان من سماد الدواجن أعطت أعلى محتوى من النتروجين والفوسفور والبوتاسيوم فى الأوراق والأبصال بينما إضافة ١٠ طن للفدان من سماد القمامة سبب فى الحصول على أقل محتوى من عناصر النتروجين والفوسفور والبوتاسيوم فى الأوراق والأبصال . وقد أوضحت النتائج أن أعلى محتوى من الزنك والمنجنيز والحديد فى الأوراق والأبصال كان بإضافة سماد المجارى وسماد الماشية والغنم على التوالى وأعلى محتوى من النحاس والكادميوم والرصاص فى الأوراق والأبصال كان بإضافة سماد المجارى يليه سماد القمامة . وعموماً استعمال سماد الدواجن بمعدل ٣٠ طن للفدان يمكن أن يوصى بها لإنتاج البصل .

Table (3): Effect of organic and inorganic fertilizers on vegetative growth of onion plants at 4 months after transplanting

Fertilizers	Rates Tons/ fed.	1995 – 1996						1996 – 1997					
		Plant height cm	No. of leaves/ plant	F.W of leaves/ plant (g)	F.W of bulb/ plant (g)	Dry matter of leaves %	Bulbing ratio	Plant height cm	No. of leaves/ plant	F.W of leaves/ plant (g)	F.W of bulb/ plant (g)	Dry matter of leaves %	Bulbing ratio
Without		61.6	8.0	75.4	70.4	8.17	0.61	65.6	8.1	82.5	68.1	8.4	0.59
Inorganic		67.5	10.3	102.9	90.7	10.33	0.52	72.3	9.7	110.8	89.3	10.19	0.51
Poultry	10	65.8	10.2	118.0	83.0	9.49	0.53	70.7	10.6	120.02	85.5	9.83	0.54
manure	20	67.8	10.9	127.4	96.5	10.67	0.50	74.1	11.2	129.2	92.3	10.59	0.52
	30	70.0	12.2	137.6	111.1	10.99	0.47	75.4	11.9	132.5	107.3	11.02	0.46
Sheep	10	62.2	10.3	119.2	80.2	9.91	0.56	68.4	10.0	117.5	81.0	9.52	0.56
manure	20	63.3	10.6	125.9	89.6	10.35	0.53	70.6	10.8	123.3	93.9	10.01	0.52
	30	65.8	11.0	128.5	104.9	10.85	0.50	75.1	11.4	130.7	102.0	10.40	0.48
Cattle	10	64.5	9.2	108.1	83.4	9.60	0.57	67.3	9.4	105.8	75.9	9.34	0.58
manure	20	64.8	9.3	110.6	90.5	9.71	0.54	72.5	9.7	106.7	87.7	9.74	0.58
	30	65.5	9.5	113.7	98.3	10.59	0.53	73.7	10.1	113.2	94.5	10.33	0.53
Sewage	10	62.5	9.0	100.3	80.0	9.21	0.57	69.1	9.0	97.5	82.5	9.37	0.56
sludge	20	64.2	9.2	107.4	92.4	9.64	0.55	70.7	9.5	103.4	90.8	9.69	0.55
compost	30	67.0	9.8	111.8	94.1	10.07	0.54	72.9	9.9	109.2	95.5	9.94	0.52
Town waste	10	62.3	8.7	94.5	73.3	8.40	0.59	66.5	8.6	90.0	70.9	8.39	0.60
compost	20	64.2	8.7	97.3	78.7	9.13	0.56	69.5	8.9	97.1	80.0	9.25	0.57
	30	66.8	8.8	100.9	81.6	9.69	0.55	71.4	9.1	98.3	83.8	9.58	0.57
L.S.D 0.05		6.27	1.36	5.71	6.24	0.99	0.052	5.11	0.73	11.59	12.28	0.54	0.052

Table (5): Effect of organic and inorganic fertilizers on nitrogen, phosphorus and potassium percentages in leaves of onion plants at 4 month after transplanting and in bulbs at harvest

Fertilizers	Rates Tons/ fed.	Leaves at 4 month after transplanting						Bulbs at harvest					
		1995 – 1996			1996-1997			1995-1996			1996 – 1997		
		N%	P%	K%	N%	P%	K%	N%	P%	K%	N%	P%	K%
Without		2.96	0.267	3.04	2.67	0.291	3.12	2.10	0.125	1.94	2.02	0.143	1.97
Inorganic		3.86	0.341	4.38	3.36	0.335	4.24	2.66	0.232	2.22	2.71	0.235	2.20
Poultry	10	4.12	0.406	4.35	3.98	0.395	4.42	2.56	0.219	2.38	2.74	0.220	2.39
manure	20	4.15	0.413	4.53	4.27	0.440	4.58	2.69	0.263	2.51	2.80	0.257	2.40
	30	4.43	0.458	4.66	4.77	0.474	4.81	2.84	0.282	2.54	3.15	0.270	2.63
Sheep	10	3.76	0.376	4.44	3.53	0.381	4.27	2.32	0.201	2.19	2.41	0.210	2.15
manure	20	3.79	0.397	4.48	3.68	0.388	4.33	2.40	0.209	2.25	2.58	0.222	2.23
	30	3.96	0.416	4.59	3.81	0.400	4.65	2.47	0.225	2.41	2.70	0.247	2.45
Cattle	10	3.59	0.329	4.07	3.61	0.342	4.18	2.33	0.197	2.09	2.39	0.189	2.18
manure	20	3.87	0.363	4.35	3.70	0.354	4.27	2.42	0.200	2.20	2.45	0.215	2.25
	30	3.91	0.369	4.60	3.74	0.372	4.49	2.44	0.211	2.22	2.65	0.220	2.31
Sewage	10	3.66	0.303	3.91	3.43	0.299	3.83	2.28	0.161	2.13	2.35	0.170	2.12
sludge	20	3.71	0.311	4.01	3.52	0.325	4.11	2.37	0.163	2.15	2.31	0.189	2.18
compost	30	3.75	0.338	4.19	3.58	0.377	4.25	2.38	0.174	2.33	2.53	0.190	2.28
Town	10	3.43	0.263	3.44	3.08	0.297	3.40	2.19	0.138	1.97	2.22	0.140	2.00
waste	20	3.52	0.291	3.63	3.29	0.301	3.82	2.24	0.143	2.03	2.39	0.159	2.10
compost	30	3.56	0.300	3.79	3.41	0.315	3.85	2.35	0.150	2.12	2.43	0.168	2.11
L.S.D 0.05		0.263	0.053	0.273	0.646	0.017	0.541	0.241	0.016	0.223	0.324	0.016	0.241

Table (4) Effect of organic and inorganic fertilizers on the yield and quality of onion plants

Fertilizers	Rates Tons/ fed.	1995 – 1996					1996 – 1997				
		Bulb yield Tons/ fed.	F.W of bulb (g)	Dry matter of bulb %	T.S.S	Total carbohydrates	Bulb yield Tons/ fed.	F.W of bulb (g)	Dry matter of bulb %	T.S.S	Total carbohydrates
Without		10.822	116.6	14.61	12.81	31.40	11.384	118.8	14.03	13.93	32.1
Inorganic		15.137	152.4	16.23	14.37	34.11	16.713	152.7	17.45	14.58	35.9
Poultry	10	17.706	171.5	16.11	15.25	36.5	17.462	164.1	16.48	15.33	36.3
manure	20	20.560	187.2	16.36	15.64	39.4	20.054	176.2	16.70	15.83	38.2
	30	22.390	192.5	17.99	15.98	40.7	22.896	190.3	18.56	16.17	42.1
Sheep	10	16.729	168.8	15.78	15.10	33.3	16.291	160.2	15.90	14.50	33.7
manure	20	18.203	182.5	16.71	15.33	36.7	17.454	171.2	16.89	15.50	35.1
	30	19.706	187.5	17.80	15.60	39.4	20.333	177.8	18.13	15.50	39.0
Cattle	10	15.460	164.9	15.43	14.41	34.5	15.917	162.4	15.71	14.33	33.2
manure	20	17.663	175.0	16.22	15.00	34.9	17.078	167.7	16.68	14.80	34.7
	30	18.318	180.6	17.54	15.32	36.7	18.374	172.9	17.13	15.33	36.2
Sewage	10	15.120	154.9	15.00	14.00	34.0	15.229	149.1	15.53	14.20	34.3
sludge	20	16.890	163.7	15.63	14.44	35.8	17.270	161.0	15.99	14.70	35.2
compost	30	17.836	167.1	16.78	15.09	36.5	18.874	162.3	16.1	15.30	37.0
Town waste	10	13.872	142.0	14.98	14.20	32.1	14.803	144.1	15.15	14.08	31.8
compost	20	15.162	154.7	15.26	14.38	35.3	15.926	145.0	15.73	14.75	36.0
	30	16.576	159.5	15.88	14.77	36.2	18.280	153.4	15.90	14.83	36.7
L.S.D 0.05		1.426	12.36	1.532	1.97	4.518	1.556	8.288	1.103	0.932	3.025

Table (6): Effect of organic and inorganic fertilizers on Zn, Mn, Fe, Cu, Cd and Pb contents (PPm) in leaves of onion plants at 4 month after transplanting and in bulbs at harvest.

Fertilizers	Rates Tons/fed.	1995 – 1996						1995 – 1996					
		Leaves at 4 month after transplanting						Bulbs at harvest					
		Zn	Mn	Fe	Cu	Cd	Pb	Zn	Mn	Fe	Cu	Cd	Pb
Without		108.2	99.9	617.4	6.1	2.42	8.8	88.3	69.2	260.6	5.6	3.69	7.7
Inorganic		131.0	120.7	771.5	12.1	5.65	12.1	101.5	93.4	281.6	12.4	8.25	11.4
Poultry	10	109.1	158.6	622.0	12.9	3.58	14.6	94.2	110.1	310.2	12.6	5.64	13.4
manure	20	124.8	183.7	643.3	13.1	3.62	16.3	109.6	161.4	325.9	13.7	5.79	16.0
	30	135.5	220.1	672.8	13.5	3.68	16.9	119.2	186.9	346.8	14.3	6.06	15.6
Sheep	10	129.7	132.8	797.9	11.1	3.78	17.2	103.6	102.7	388.5	9.3	6.21	16.2
manure	20	137.9	161.5	813.2	11.7	3.80	17.6	119.4	113.6	421.8	11.9	6.42	16.2
	30	149.2	186.4	850.0	12.2	3.98	17.9	128.4	148.3	445.1	12.6	6.48	16.7
Cattle	10	120.4	169.3	901.3	7.1	4.02	19.4	87.1	140.1	413.3	9.1	6.66	14.1
manure	20	126.5	198.0	978.6	8.3	4.12	20.2	91.8	182.5	448.4	9.6	6.81	18.2
	30	133.5	227.9	992.1	8.8	4.22	21.3	92.3	199.6	465.7	11.4	6.87	20.8
Sewage	10	148.9	153.1	718.2	13.1	6.58	42.9	121.5	100.0	352.8	15.9	10.41	39.2
sludge	20	177.7	200.7	734.0	14.5	6.72	47.5	147.6	175.4	375.3	16.2	10.47	42.9
compost	30	186.9	217.2	765.7	16.4	6.76	50.1	166.2	190.7	389.5	20.4	10.62	46.8
Town waste	10	114.7	150.4	698.9	13.4	5.34	29.1	95.8	111.2	318.6	13.3	8.64	25.4
compost	20	120.8	189.9	712.1	13.7	5.38	32.4	99.8	150.9	328.2	14.8	8.70	26.7
	30	132.7	200.6	730.5	14.2	5.48	36.6	103.4	162.3	346.7	15.4	8.73	31.1
L.S.D 0.05		17.75	28.93	48.3	2.06	0.828	4.653	13.53	26.93	45.88	1.38	0.756	2.66