

ORGANIC MANURES AND MINERAL FERTILIZER OF ONION CROP AFFECTING IT'S GROWTH, CHEMICAL CONTENT, YIELD AND QUALITY

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ABSTRACT

Two field experiments were conducted in the two successive seasons of 2002/2003 and 2003/2004 in Assiut governorate to evaluate the two onion cultivars *i.e.* Shandaweel1 and Giza 6 under four fertilizing treatments *i.e.* chicken, cattle, mineral and check on vegetative growth, and mineral content as well as yield and quality of onion bulbs.

The results indicated that the vegetative growth expressed as plant height, leaf number and bulbing ratio recorded higher values with mineral fertilizer and chicken manure. Plant height and leaf number were not statistically affected by the two tested cultivars, in most cases. However, bulb ratio value of Giza 6 was higher than that of Shandaweel1.

Higher N, P and K content of onion plant were recorded by chicken manure. The two tested cultivars were not statistically different in their N, P, and K content.

The highest total and exportable yield were obtained by chicken manure followed by mineral fertilizer. Total yield was not statistically affected by the tested cultivars whereas, Shandaweel1 produced higher exportable yield than Giza 6 cv.

INTRODUCTION

Onion is one of the most important crops for local consumption and exportation in Egypt. It is one of the most important food crops in the daily diet of ever Egyptian, as it is usually included in most cooked vegetables, in salad as well as sometimes as green vegetable. It is well known that using higher amount of mineral fertilizer cause the loss of most of it in the ground water and the pollution of the soil and plant. It might be injurious for animal and humans. On the other hand, Organic manures are valuable as a source of fertilizers, and essential macro and micronutrients to plants, and serves as a good natural soil texture conditioner being rich in organic matter (Mishref *et al.*, 2000). Many studies, carried out in different locations reported the response of organic manure and mineral fertilizer on growth and yield of onion. Mohamed and Gamie (1999) found that total bulbs yield of onion produced by application of Farmyard manure (FYM) and chicken manure were amounted by 55.3% and 58.7 % from the total bulbs yield obtained by inorganic fertilizers, respectively. They found also that, the marketable bulbs yield obtained by FYM and chicken manure were about 53% and 61.7 % from the marketable bulbs yield produced by inorganic fertilizers, respectively, produced increases by 53% and 61.7 compared with inorganic fertilizers respectively. In this concern, Khalil *et al.* (2002) found that chicken manure produced the highest total and marketable bulbs yield by about 19.47% compared by inorganic fertilizers and the same treatment gave the highest concentration of P and K in onion leaves. In addition Abou El-Magd *et al.*

(2003) indicated that higher vegetative growth, dry matter content and total yield with better quality as well as higher N,P, K, Na, Fe, Mn, Zn and Cu contents of onion bulb were obtained by chicken manure whereas, the lower values were obtained by cattle manure or mineral fertilization. In another investigation Abou El-Magd *et al.* (2004) obtained higher vegetative growth, dry matter content and yield with higher quality by the high level of poultry manure compared with cattle manure or mineral fertilization.

As for cultivar effect, Waried and Loiza (1993) in study on 13 onion cultivars indicated that the cultivar had a significant influence on bolting, total yield and marketable yield. In addition Abd El-Rahim and El-Aref, (2001) evaluated three onion cultivars and six strains. They found that Giza 6 Mohassan gave the highest total and exportable yield compared with Behairy and Giza 20 cultivars. or the other six strains.

This work aimed to investigate the effect of chicken, cattle manures and mineral fertilization on the vegetative growth, N, P and K contents as well as yield and quality of onion crop compared with mineral fertilizer to find out their possibility of replacing or partially replacing mineral fertilizer.

MATERIAL AND METHODS

Two Field experiments were conducted in the Agriculture Experimental Station of the faculty of agriculture Al-Azhar university, Assiut Governorate during in the two successive seasons 2002 / 2003 and 2003 / 2004 to evaluate the two onion cultivars *i.e.* Shandaweel1 and Giza 6 under four fertilizing treatments *i.e.* chicken, cattle, mineral and check on vegetative growth, and leaves mineral content as well as yield and quality of onion bulbs. Soil properties of the experimental site is shown in Table (1) and chemical analysis of the organic fertilizers used is shown in Table (2).

Table (1): Some physical and chemical properties of the experimental soil.

Mechanical analysis			Texture	pH	EC	CaCo3	P	K	Ca	Mg	Cl	Hco3 ⁻	So ₄
Sand %	Salt %	Clay %											
90	5	5	Sandy soil	8.20	1.50	5.5	0.44	570	2.63	2.4	33	3.83	55

Table (2) : Some chemical properties of cattle and chicken manure .

Organic manure	C	O.M	C/N Ratio	N	P	K	Ca	Mg	Fe	MN
	%	%	%	%	%	%	%	%	%	ppm
Cattle mnure	18.71	37.41	11.62	1.61	0.73	1.27	0.17	0.70	0.65	190
Chicken manure	18.48	36.96	4.48	4.12	0.18	2.25	1.19	0.52	0.06	203

Onion seedlings were on 20th of November for the two seasons. Every experiment included eight treatments which were the possible combinations of four fertilizer treatments and two cultivars. Experimental design was split plot with three replicates. Were cultivar treatments were represented in the main plots and fertilizer treatments occupied the sub- plots. The plot area was

10.50 m² (consisted of 5 ridges, 3.5 m long and 60 cm width). Organic manures were applied before transplanting, while mineral fertilizer treatment were divided into three equal portions. The first was added after 30 days, the second after 60 days and the third after 90 days from transplanting. All the recommended practices of growing onion in upper Egypt area were followed.

Treatment of this experiment were as follows :

- A. Cultivar *i.e.*, Shandaweel 1 and Giza 6 .
- B. Fertilizing treatments : (80 N units / feddan)
 - 1- chicken manure.
 - 2- cattle manure.
 - 3- Urea.
 - 4- control (without fertilizers)

A random sample of the plants was taken from each plot after 90 days from transplanting in the following plant growth measurements :

- 1- plant height "cm"
- 2- Number of leaves per plant .
- 3- Bulbing ratio : Neck diameter / Bulb diameter
- 4- Average bulb weight (gm)

Samples of plant were oven dried at 70°C till the constant weight , fine grounded , acid digested and kept for chemical analysis. Total N, P and K were determined according to Cottenie *et al.* (1982).

The obtained data were statistically analyzed using Costat Software (1985) and treatment means were compared by using Duncans's multiple range test at 5% level according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A. Vegetative growth :

1. Effect of fertilization:

Vegetative growth of onion plants expressed as plant height, leaf numbers, bulb weight and bulbing ratio was widely influenced by organic and mineral fertilization (Table 3). The highest vegetative growth of onion crop was obtained by mineral fertilization in the two seasons. Addition of urea to onion crop recorded the tallest plants, denser leaves, heaviest bulbs and higher values of bulbing ratio. Chicken manure recorded the second order of onion growth in the abovementioned characters. On the other hand, lower vegetative growth of onion plant was obtained by cattle manure of onion crop, but the poorest growth was recorded by the plants without fertilization. Similar results on onion, Khalil *et al.*, 2002, Abou El-Magd *et al.*, 2003; Abou El-Magd *et al.*, 2004; Ali *et al.*, 2001 and El-Bassyoni, 2002 on garlic, Abou El-Magd and El-Abagy 2003; Badwi *et al.*, 2005 a and b and Abou EL-Magd *et al.*, 2005 on sweet fennel.

2. Effect of cultivar :

The two cultivars Shandaweel 1 and Giza 6 were different in their vegetative growth in the two seasons. Plant height of the two cultivars was statistically different in the second season, but the difference did not reach the level of significance in the first seasons.

Table (3): Effect of organic and in-organic fertilizers , cultivars and their interaction on plant height, leaf number and bulbing ratio of onion plants.

Treatments	Plant height (cm)			leaf number			Bulbing Ratio (Cm)		
	Shandaweel1	Giza 6	Mean	Shandaweel1	Giza 6	Mean	Shandaweel1	Giza 6	Mean
	Giza 6	Giza 6	Mean	Giza 6	Giza 6	Mean	Giza 6	Giza 6	Mean
	2002/2003								
Cattle Manure	70.00 a	71.00 a	70.50 b	7.45 a	7.75 a	7.58 c	0.45 a	0.51 a	0.48 b
Chicken Manure	81.67 a	82.67 a	82.17 a	8.18 a	8.34 a	8.31 b	0.53 a	0.59 a	0.56 a
Mineral	84.00 a	85.00 a	83.67 a	8.35 a	8.60 a	8.48 a	0.53 a	0.59 a	0.56 a
Control	64.00 a	65.00 a	64.50 c	6.62 a	6.87 a	6.74 d	0.41 a	0.46 a	0.44 c
Mean	74.92 A	75.5 A		7.67 A	7.90 A		0.48 B	0.54 A	
	2003/2004								
Cattle Manure	71.67 a	72.67 a	72.17 b	7.35 a	7.60 a	7.48 c	0.46 a	0.53 a	0.50 c
Chicken Manure	81.00 a	82.00 a	81.50 a	8.48 a	8.73 a	8.61 c	0.52 a	0.58 a	0.55 b
Mineral	82.67 a	83.67 a	83.17 a	8.25 a	8.50 a	8.78 b	0.55 a	0.62 a	0.59 a
Control	64.00 a	64.83 a	64.42 c	6.52 a	6.75 a	6.63 d	0.39 a	0.45 a	0.42 d
Mean	74.83 B	75.79 A		7.65 A	7.90 A		0.48 B	0.53 A	

Leaf numbers was statistically different in the first season, but the difference was not statistical in the second one. Bulbing ratio was statistically higher with Shandaweel 1 compared with Giza 6. These results reflected better growth and bulbing ratio for Shandaweel 1 cultivar than that of Giza 6.

3. Effect of interaction :

Interaction of fertilization and cultivars did not reflect any statistical differences in the vegetative growth of onion crop expressed as plant height, leaf numbers, average bulb weight and bulbing ratio (Table 3). These results indicated that cultivars and fertilization act independently in growing onion.

B. Chemical content :

1. Effect of fertilization :

N, P and K percentages were statistically influenced by manuring or mineral fertilization. Higher content of N, P and K was recorded in onion leaves by chicken manure. In addition, lower N,P and K percentages in onion leaves were recorded by mineral, cattle and control treatments in a descending order. These results were true and similar in the two seasons of the experiment. These results are in accordance with those obtained by Abou El-Magd *et al.*, 2003 and Abou El-Magd *et al.*, 2004 on onion crop and Ali *et al.*, 2001 and El-Bassyouni, 2002 on garlic and Abou El-Magd and El-Abagy 2003, El-Shakry, 2005, Badawi *et al.*, a and b 2005 and Abou El-Magd *et al.*, 2005 on sweet fennel.

2. Effect of cultivars:

N, P and K percentages in onion plant were not statistically different between the two tested cultivars. N, P and K content of the leaves of Shandaweel 1 and Giza 6 were not statistically different. These results were true and similar in the two seasons.

3. Effect of interaction :

Interaction of fertilization and cultivars did not reflect any statistical results in N, P and K percentages of onion plants . These results were true and similar in the two seasons. These results indicated that cultivars and fertilization act independently with respect to N, P and K content of onion leaves.

C. Total yield of bulbs :

1. Effect of fertilization :

Organic and mineral fertilization statistically increased total yield of onion crop compared with the control Table (5). The highest total yield of onion crop was obtained by chicken manuring in the two seasons. Lower total yield was obtained by mineral fertilization and cattle manuring in a descending order, but the lowest yield of bulbs was recorded by the unfertilized treatment. These results were similar and true in the two seasons of the experiment. The superiority of chicken manure yield might be attributed to its favourable effect on the soil conditions. Chicken manuring enhances soil aggregation, aeration and water holding capacity of the soil. In addition, chicken manuring offers slow release nutrients flow through the soil solution. These results might be attributed also to the higher N, P and K content of onion leaves obtained by chicken manure (Table 4).

Table (4): Effect of organic and in-organic fertilizers , cultivars and their interaction on N,P and K percentage of of onion leaves .

Treatments	N %			P %			K %		Mean
	Shandaweel 1 Giza 6	Giza 6	Mean	Shandaweel 1 Giza 6	Giza 6	Mean	Shandaweel 1 Giza 6	Giza 6	
	2002 / 2003								
Cattle Manure	2.15 a	2.17 a	2.14 c	0.32 a	0.31 a	0.32 c	2.60 a	2.58 a	2.59 b
Chicken manure	3.20 a	3.15 a	3.17 a	0.53 a	0.51 a	0.52 a	2.84 a	2.75 a	2.78 a
Mineral	3.05 a	3.05 a	3.04 b	0.48 a	0.43 a	0.46 b	2.50 a	3.23 a	2.49 c
Control	1.17 a	1.70 a	1.70 d	0.18 a	0.18 a	0.18 d	2.0 a	3.80 a	1.99 d
Mean	2.52 A	2.50 A		0.38 A	0.36 A		2.48 A	2.45 A	
	2003 /2004								
Cattle Manure	2.06 a	2.05 a	2.05 c	0.43 a	0.41 a	0.42 c	2.44 a	2.45 a	2.43 b
Chicken manure	3.05 a	3.02 a	3.04 a	0.53 a	0.52 a	0.53 a	2.50 a	2.46 a	2.48 a
Mineral	2.90 a	2.90 a	2.90 b	0.46 a	0.44 a	0.46 b	2.30 a	2.25 a	2.27 c
Control	1.65 a	1.65 a	1.65 d	0.21 a	0.22 a	0.22 d	1.80 a	1.79 a	1.79 d
Mean	2.41 A	2.40 A		0.41 A	0.40 A		2.25 A	2.24 A	

These favourable conditions might be reflected as increases in onion crop. Khalil *et al.*, 2002 and Abou El-Magd *et al.*, 2003 and 2004 on onion and Abou El-Magd *et al.*, 2003 on sweet fennel found that organic manuring enhanced onion yield. Similar results were obtained by El-Bassyouni, 2002 on garlic. Similar results were also by Abou El-Magd and El-Abagy, 2003; El-Shakry, 2005; Badawi *et al.*, 2005 a and b and Abou El-Magd *et al.*, 2005 on sweet fennel.

2. Effect of cultivars :

The two tested cultivars Shandaweel 1 and Giza 6 were not statistically different in their total yield. These results were similar and true in the two seasons of the experiment. These results might be the reflection of the heavier vegetative growth of the two cultivars in the two seasons. Abd El-Rahim and El-Aref evaluated three onion cultivars and six new strains. They found that Giza 6 Mohassan gave the highest total and exportable yield of bulbs compared with Behairy and Giza 20.

3. Effect of interaction :

There was no differences in the total yield of onion resulting from the interaction between fertilization and cultivars. These results was the direct reflection of the insignificant effect of interaction on the vegetative growth. Results of Table (3) indicated that onion cultivars and fertilization act independently on onion growth and total yield. These results were true and similar in the two seasons of the experiment.

C. Bulb quality :

I. Effect of fertilization :

Exportable yield was statistically affected by organic and inorganic fertilization. Chicken manure treatment recorded the highest percentage of exportable yield followed by mineral fertilization and cattle manure in a descending order. The lowest exportable yield was recorded by the unfertilized treatment. These results were true and similar in the two seasons. Mean bulb weight was also affected significantly by nitrogen sources. The heaviest bulbs were obtained by mineral fertilization followed by chicken and cattle manures in a descending order. Plant without fertilization (control) recorded the lowest mean bulb weight. These results are in agreement with those obtained by Abou El-Magd *et al.*, 2003 and Abou El-Magd *et al.*, 2004 on onion crop.

Total soluble solids content of onion bulb was differed affected by organic and mineral fertilization (Table 6). Bulbs of mineral fertilization treatment recorded the highest values of T.S.S. content in the first season, but those of chicken manure treatment recorded higher T.S.S. content in the second season. Lower values of T.S.S. were recorded by cattle manure treatment bulbs. The lowest values of T.S.S. were obtained by those plants without fertilization (control).

2. Effect of cultivars :

Exportable yield was statistically different between the two tested cultivars (Table 5). Higher and statistical values of exportable yield were obtained by Shandweel 1 cultivar compared with Giza 6. These results were true and similar in the two seasons of the experiment.

Table (5): Effect of organic and in-organic fertilizers , cultivars and their interaction on total yield, average weight of bulb, exportable yield and T.S.S .

Treatments	Total yield (Ton / Feddan)			Average weight of bulb(gm)			Exportable yield (%)			T.S.S		
	Shandawee1 Giza 6	Giza 6	Mean	Shandawee1 Giza 6	Giza 6	Mean	Shandawee1 Giza 6	Giza 6	Mean	Shandawee1 Giza 6	Giza 6	Mean
	2002 / 2003											
Cattle Manure	7.83 a	7.94 a	7.89 c	24.33 a	27.67 a	26.0 d	90.39 b	81.9 d	86.1 c	8.90 f	12.2 c	10.55 c
Chicken manure	12.04 a	11.66 a	11.84 a	35.5 a	37.67 a	36.58 b	94.32 a	88.7 b	91.5 a	9.0 f	12.65 b	10.83 b
Mineral	8.81 a	9.85 a	9.28 b	36.53 a	39.6 a	38.07 a	91.5 b	86.7 c	89.4 b	9.23 e	12.9 a	11.07 a
Control	5.81 a	5.29 a	5.66 d	32.33 a	35.5 a	33.92 c	84.3 c	69.1 e	77.0 d	8.0 g	12.0 d	10.0 d
Mean	8.62 A	8.65 A		32.18 B	35.1 A		90.0 A	82.2 B		8.78 B	12.43 A	
2003 /2004												
Cattle Manure	8.09 a	8.22 a	8.16 c	25.5 a	28.63 a	27.07 d	86.3 c	81.1 d	83.1 c	8.65 e	12.15 c	10.40 c
Chicken manure	12.34 a	12.50 a	12.42 a	33.70 a	36.73 a	35.55 b	91.4 a	88.9 a	90.15 a	8.90 d	12.80 b	10.85 a
Mineral	9.69 a	9.24 a	9.94 b	37.83 a	40.67 a	39.25 a	88.2 b	83.6 d	85.2 b	8.20 f	13.0 a	10.60 b
Control	5.45 a	5.87 a	5.66 d	32.5 a	35.5 a	34.0 c	75.1 e	72.7 e	73.2 d	8.10 f	12.05 c	10.08 d
Mean	8.89 A	8.96 A		32.55 B	35.38 A		85.2 A	81.7 B		8.46 B	12.5 A	

Data revealed that Shandaweel 1 cultivar yielded more exportable crop than Giza 6. These results were in agreement with those obtained by Abd El-Rahim and El-Aref (2001).

Mean bulb weight was statistically affected by cultivars (Table 5). Giza 6 bulbs were statistically heavier than those of Shandaweel 1. These results were similar and true in the two seasons. Similar results were obtained by Abd El-Rahim and El-Aref (2001).

Total soluble solids content of onion bulbs was statistically different between the two tested cultivars. T.S.S. content of Giza 6 was higher than that of Shandaweel 1 bulbs. These results were similar and true in the two seasons.

3. Effect of interaction :

Exportable yield percentage was widely affected by the combined effect of fertilization and cultivars. The highest exportable yield percentage was obtained by the combined effect of chicken manure and Shandaweel 1 cultivars. Shandaweel 1 cultivars receiving chicken manure yielded the higher exportable crop. On the other hand, the lowest exportable yield percentage was obtained by Giza 6 cultivar without fertilization. Other interaction treatments yielded exportable crop percentage ranging between these two treatments of interaction. These results were true and similar in the two seasons of this study.

Mean bulb weight was not statistically differed between interaction treatments in the two seasons. These results indicates that fertilization and cultivars act independently with respect to mean bulb weight.

Total soluble solids content of the bulbs was statistically affected by the interaction of fertilization and cultivars. Giza 6 cultivar receiving chicken manure recorded the highest T.S.S. content of the bulbs in the first season. In the second one, the highest T.S.S. content was obtained by the bulbs of Giza 6 receiving mineral fertilization. On the contrary T.S.S. content of the bulbs was obtained by Shandaweel 1 bulbs without fertilization in the two seasons of the experiment.

Conclusion

For obtaining high total and exportable yields with higher bulb quality Shandaweel 1 cultivar fertilized with chicken manure (80 N units/feddan) could be recommended in Assiout area.

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التسميد العضوي والمعدني لمحصول البصل وتأثيرهما على النمو والمحتوى الكيماوي والمحصول والجودة

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أجريت تجربتان حقليتان في محافظة اسيوط لتقييم صنفين من البصل هما شندويل ١ جيزه ٦ تحت أربعة معاملات تسميد هي سماد الدواجن وسماد الماشية والسماد المعدني والكنترول . وقد اظهرت النتائج تفوق النباتات المعاملة بالتسميد المعدني وسماد الدواجن عن باقي المعاملات في النمو الخضري معبرا عنه بارتفاع النبات وعدد الاوراق ونسبة التبصيل . لم تكن هناك فروق معنوية في ارتفاع النبات وعدد الأوراق بين الصنفين بينما تفوق الصنف جيزه ٦ في نسبة التبصيل . اعطت النباتات المسمدة بسماد الدواجن المحتوى الأعلى من النتروجين والفسفور والبيوتاسيوم . لم يكن هناك تأثير معنوي للأصناف على محتوى الأوراق من هذه العناصر . سجل التسميد بسماد الدواجن اعلا قيم للمحصول الكلي والقابل للتصدير تلاثة السميد المعدني. لم يكن هناك تأثير معنوي بين الصنفين على المحصول الكلي بينما اعطى الصنف شندويل اعلى محصول قابل للتصدير .