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**THE RESPONSE OF SQUASH TO SOURCES OF ORGANIC MANURE
AND CHEMICAL FERTILIZER LEVELS
BY**

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ABSTRACT

Two experiments were carried out during the two successive summer seasons of (2005-2006) at Barrege Horticulture Research Station of Agriculture Research Center. The experiment included 10 treatments which were NPK chemical fertilizer at 50 or 100 % of the recommend rate. Chicken and farmyard manures at the rates of 2 and 4 tons per feddan, separately or in combinations in addition to control treatment without addition of either chemical fertilizer or organic manure.

The obtained results showed that the 50% of the recommended NPK chemical fertilizer + chicken manure at 2 ton/fed. gave the highest values of growth characteristics, chlorophyll content in leaves, yield and fruit quality. Concerning fruit content. The highest values of N, K were detected from 50% of the recommended NPK + chicken manure at 2 ton/fed., 100% of the recommended NPK + chicken manure at 2 ton/fed. or chicken manure alone at 2 ton/fed. without significant differences among them . As for P content of fruits, the highest values were recorded from treatments of chicken manure in the two seasons followed by 50 % recommended NPK + chicken manure at 2 ton/fed. On the other hand, NO₃ content recorded the highest value from addition of chemical fertilizer and the lowest values from all used organic manure while the combination between chemical fertilizer and organic manure showed intermediate values.

It could be concluded, in general, that the addition of the combination between 50% of the recommended NPK chemical fertilizer and chicken manure at a rate of 2 ton/fed. gave safe and high fruit yield of squash.

INTRODUCTION

Squash is one of the most popular vegetable crops grown in Egypt. It is produced all over the year to obtain fresh fruits. According to the statistics of Ministry of Agriculture in Egypt, the total cultivated area in 2005 was 95736 feddans produced about 278230 tons.

Egyptian soils are low in organic matter (about 2%) (Balba, 1976). To conserve their low level of organic matter, Egyptian soils should receive about 82

million tons annually (Raid, 1982). Now with increasing the cost of mineral fertilizers and questions as to their future viability, In Egypt, farmyard manure is usually used as organic fertilizer.

Pelaez *et al.* (1984), on squash, found that yield and number of marketable fruits were the highest (27.8t/ha and 4.2 fruits/ plant, respectively) from plot receiving 10 t/ha poultry manure. Shehata (2001), on squash, found that application of compost consisted of (water hyacinth + peas + orange + chicken manure) significantly increased all growth parameters, i.e., vine length, number of leaves, fresh and dry weight of branches and leaves as well as fruit yield/plant or/m² followed by plots receiving 100Kg N, 300 Kg P₂O₅ and 75 kg K₂O/ha. Pant *et al.* (2001) recorded that the highest yield of squash was obtained when poultry manure was applied at the rate of 23.6 Kg/m². Moreover, Martinetti and Paganini (2006), on Zucchini squash, using chemical fertilizers and pelleted farmyard manure, showed that all treatments significantly increased size, weight and number of fruits, weight of leaves and stems as compared with the control. The yield was significantly higher in the treatments with slow release fertilizer and organic manure + top dressing than the organic manure single and organic manure gave the highest yield than the control.

Saad (1999) indicated that using farmyard and chicken manure media combined with or without sand produced the maximum early and total yields of cucumber plants expressed as number and weight of fruits/m². Abou Hadid *et al.* (2001) found that adding organic manure as chicken manure and composted cucumber plant wastes at rate of 30m³ increased early and final yield in cucumber as compared with the control. Moreover, Abd-El-Kawy (2003) reported that combining of organic manure with inorganic fertilizers increased early and total yield of cucumber compared to the inorganic manure only and the highest yield was recorded with 75% chicken manure while the highest marketable yield was recorded with 50% chicken manure. Also, Rageh (2003) reported that using 40 m³ chicken manure/fed gave a higher marketable yield of cantaloupe as compared to 10m³ chicken manure + full dose of mineral fertilizer (control).

Accumulation of nitrate in fruits has many detrimental effects on human health. Nitrite may be accumulated from nitrate after ingestion, causing methaemoglobinemia (Wright and Davison, 1964). The world Health Organization has tentatively fixed the acceptable daily intake of nitrate at 3.65 mg/Kg body weight and for nitrite at 0.13 mg/Kg (Reinink, 1988). Nitrate could be accumulated in vegetable crops, while nitrite may be formed from NO₃ after ingestion. When nitrite ions absorbed into the blood, the Fe⁺⁺ of hemoglobin may be oxidized to Fe⁺⁺⁺ producing methemoglobin which can not transport oxygen. Babies are more susceptible to methaemoglobinemia than older children or adults (Luthrs, 1973).

Abd-Elkawy *et al.* (2002) and Abd-Elkawy (2003) found that the addition of inorganic fertilizer for cucumber plants gave the highest nitrate content in fruits, while, 100% compost manure gave the lowest concentration of nitrate. El-Behairy *et al.* (2004) using nutrient film technique under unheated

plastic house found that fruit content of NO₃ with organic manure treatment (chicken manure compost, pigeon manure compost) was very low compared to that obtained with inorganic treatment.

Therefore, the aim of this work was to study the effect of chemical fertilizer and organic manure application on growth, yield and quality of squash as well as nitrate accumulation in fruits to produce safe and clean fruits of squash.

MATERIALS AND METHODS

Two field experiments were performed in summer seasons of (2005/2006) at Barrage Horticulture Research Station of Agriculture Research Center. Some chemical properties of soil used in this study were estimated as shown in Table (1) according to Jackson (1965). Seeds of Eskandrani summer squash cultivar were sown on April 1 in both seasons. Each experimental plot (12.8m²) consisted of four rows, each row was 4 meter long and 80cm width.. Seeds of squash were sown in hills 50 cm apart on one side of the ridge.

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

Sand %		Silt (%)	Clay (%)	Texture	pH	Organic matter %
Coarse	Fine					
1.45	35.11	31.98	31.01	Clay loam	8.30	2.41

E.C dS/m ²	CaCO ₃ %	Total N %	P %	K %	Ca %	Mg %	Zn ppm	Mn ppm	Cu ppm	Pb ppm
0.64	2.1	1.4	0.56	1.4	2.9	1.15	0.80	0.55	0.48	2.8

The experiment included 10 treatments as follows:

1. Control treatment (without chemical fertilizer or organic matter) (C)
2. Mineral fertilization with 100% recommended NPK, i.e., 60 Kg N, 30Kg P₂O₅ and 48 Kg K₂O/fed. (F₂)
3. Mineral fertilization with 50% recommended NPK, i.e., 30KgN, 15Kg P₂O₅ and 24KgK₂O/fed. (F₁)
4. Farmacyard manure at a rate of 4 ton/fed. (FYM)
5. Chicken manure at a rate of 2 ton/fed. (Chic)
6. Mineral fertilization with 100% of recommended NPK + Farmacyard manure. (F₂ + FYM)
7. Mineral fertilization with 100% of recommended NPK + chicken manure. (F₂ + Chic)
8. Mineral fertilization with 50% of recommended NPK + farmacyard manure. (F₁ + FYM)
9. Mineral fertilization with 50% of recommended NPK + chicken manure. (F₁ + Chic)
10. Farmacyard manure at a rate of 2 ton/fed + 1ton/fed chicken manure. (1/2 FYM +1/2 Chic)

The treatments were arranged in a complete randomized blocks design with four replicates. The sources of NPK chemical fertilizers were ammonium sulphate (20.5%), calcium superphosphat (15.5%), and potassium sulphate (48% K₂O) for N, P and K, respectively. The amounts of NPK fertilizers per plot were added in two equal parts, i.e., after 30 and 45 days from planting, in bands as side dressing. On the other hand, the allocated amount per plot of organic manures was added during the soil preparation, in ditches on one side of the row at 50cm depth and covered with soil. All other cultural practices were carried out according to the recommendation for squash crop.

The chemical analysis of different organic manures are shown in Table (2) according to Jackson (1965).

Table (2): The chemical analysis of the tested organic manures

Organic manure	N %	P %	K %	Ca %	Mg %	Zn ppm	Mn ppm	Cu ppm	pH	E.C. (dS)/m ²
Farmyard	1.6	0.54	0.91	0.29	0.39	103	400	71	7.7	10.3
Chicken	3.54	0.94	1.20	0.32	0.37	127	340	62	7.1	12.1

Experimental procedures

1- Plant growth measurements:

A random sample of three plants from each treatment was taken at 60 days after sowing to record plant height, leaves number and Fresh weight/ plant .

2- Yield and fruit characteristics:

At harvesting time, fruits were harvested from each treatment at three - days intervals and weighed to calculate total yield, and 10 fruits chosen at random to determine average fruit weight, average fruit length and average fruit diameter

3- Chemical composition:

- a. **Chlorophyll content:** Leaf disks were taken at 50 days from sowing to determine chlorophyll a, b according to the method described by Wettesterne (1957).
- b. **Nutrient content:** Samples of fruits were wet digested to determine total nitrogen, phosphorus, potassium and nitrate according to Cottenie *et al.* (1982).

All recorded data were subjected to statistical analysis according to Gomer and Gomez (1984).

RESULTS AND DISCUSSION

1. Effect of chemical and/or organic fertilizer on growth:

Data presented in Table (3) show that chicken manure alone, F₁ + chic or F₂ alone gave the highest values of vegetative growth expressed as plant height, number of leaves and total fresh weight of plant in both seasons, with slight

differences among them. However, all treatments significantly increased all fore mentioned characters as compared with the control.

The superiority of chicken manure or F_1 + chic fertilizer on vegetative growth characteristics may be due to that chicken manure is well fermented organic manure free from pathogen and seed weeds and plays an important role as soil amendment .In addition to that the general benefits of organic- N + chemical fertilizer is considered a good source for most macro and micronutrients and increase soil porosity and improved aeration of such clay loam soil of this experiment as reported by Shehata (2001), Martinetti and Paganini (2006) on squash, Abd El-Kawy (2003) and Abou Hadid (2001) on cucumber.

Chlorophyll content: Data in Table (4) show that chicken manure alone or with 50 or 100% NPK fertilizers and 100% NPK were the most effective treatments for increasing the application of chicken manure combined with 50% NPK gave the highest values chlorophyll a, b and total chlorophyll as compared with the control and other treatments. These results are in agreement with those obtained by Shehata (2001), Ali (2002) on squash leaves.

2. Effect of chemical and/or organic fertilizer on fruit yield:

Data in Table (5) and Figures (1 & 2) indicate that F_1 + chicken manure gave the highest fruit yield/plot or per fed of squash as compared with all other treatments. Chicken manure alone came in the second rank.

Table (3): Vegetative growth of squash as affected by chemical fertilizer and organic manure application.

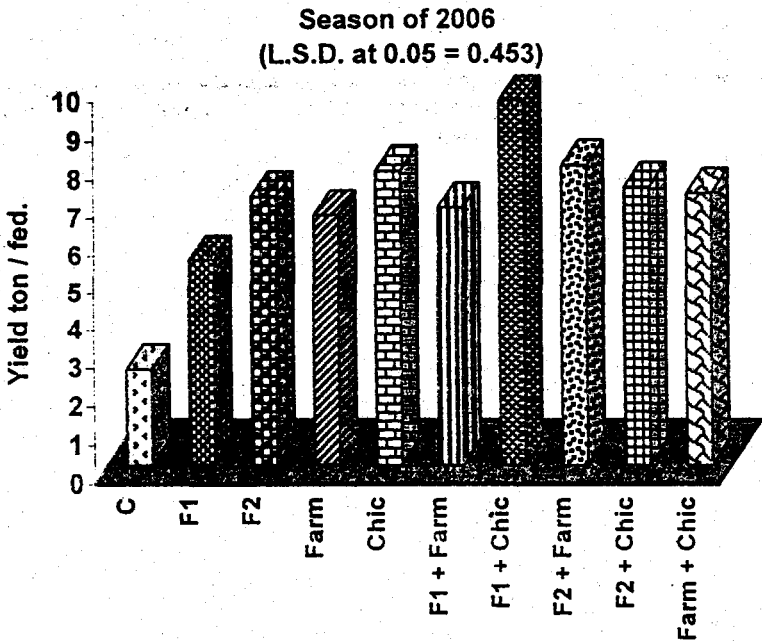
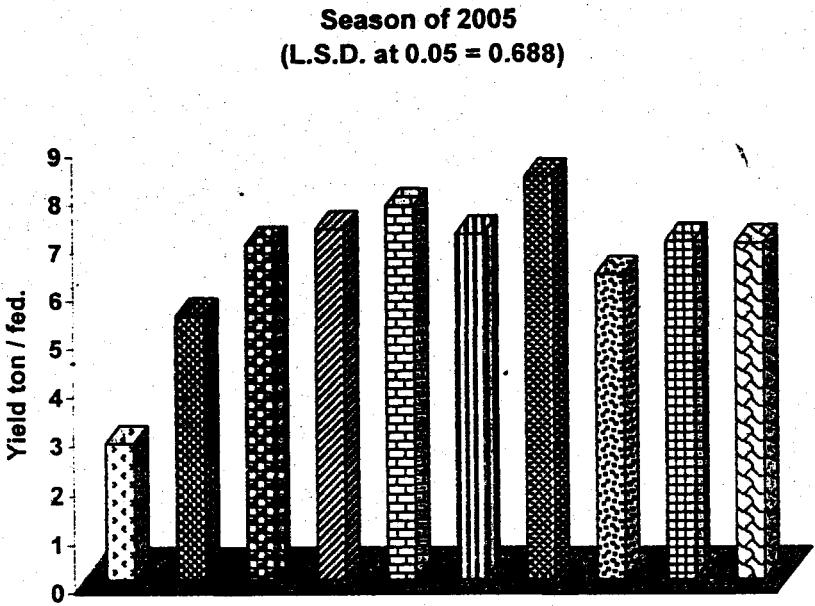
Treatments	First season (2005)			Second season (2006)		
	Plant height (cm)	Number of leaves/plant	Total fresh weight kg/plant	Plant height (cm)	Number of leaves /plant	Total fresh weight kg /plant
C	23	11	0.300	28	12	0.500
F_1	39	28	1.800	42	27	1.500
F_2	58	35	1.700	53	27	1.400
FYM	54	30	1.493	53	25	1.100
Chic	60	37	2.000	59	28	1.400
F_1 + FYM	53	37	1.600	43	18	0.940
F_1 + Chic	58	38	1.816	58	26	1.350
F_2 + FYM	54	28	1.600	45	19	1.100
F_2 + Chic	50	33.	2.000	56	28	1.370
FYM + Chic	42	15	1.150	49	23	1.050
L.S.D. at 0.05	4.05	3.780	1.798	5.20	2.207	1.572

C: Control F_1 =50% chemical fertilizer

FYM = farm yard manure

F_2 =100% chemical fertilizer

Chic = chicken manure



Figs. (1 and 2): Fruit yield of squash as affected by chemical fertilizer and organic manure application.

Table (4): Chlorophyll content (mg /100g F.w) of squash leaves as affected by chemical fertilizer and organic manure application

Treatments	First season (2005)			Second season (2006)		
	Chl. A	Chl. B	Chl. A+B	Chl. A	Chl. B	Chl. A+B
C	98.0	41.0	139.0	101.0	43.7	144.7
F ₁	131.1	58.9	190.0	126.4	62.9	189.3
F ₂	147.2	64.7	211.9	151.0	69.1	220.1
FYM	141.4	63.1	204.5	144.0	68.4	212.0
Chic	139.7	68.4	208.1	149.2	72.8	222.0
F ₁ + FYM	129.0	59.1	188.1	128.1	64.9	193.0
F ₁ + Chic	149.0	66.1	215.1	155.4	71.0	226.4
F ₂ + FYM	140.0	54.2	194.2	141.0	69.9	210.9
F ₂ + Chic	151.3	61.9	213.2	154.2	68.7	222.9
FYM + Chic	146.2	60.1	206.3	139.9	64.3	204.2
L.S.D. at 0.05	4.914	2.902	2.030	5.197	3.379	2.312

C: Control F₁=50% chemical fertilizer F₂ = 100% chemical fertilizer
 FYM = farm yard manure Chic = chicken manure

Table (5): Fruit yield of squash as affected by chemical fertilizer and organic manure application.

Treatments	First season (2005)		Second season (2006)	
	Yield/kg plot	Yield (ton/fed)	Yield/kg plot	Yield (ton/fed)
C	8.900	2.781	7.920	2.475
F ₁	17.300	5.406	17.300	5.406
F ₂	21.570	6.740	22.700	7.093
FYM	23.100	7.218	21.100	6.593
Chic	24.600	7.687	24.800	7.750
F ₁ + FYM	22.750	7.110	21.720	6.787
F ₁ + Chic	26.550	8.301	30.540	9.545
F ₂ + FYM	20.120	6.256	25.220	7.882
F ₂ + Chic	22.260	6.956	23.430	7.321
FYM + Chic	22.170	6.928	22.920	7.160
L.S.D. at 0.05	00.845	0.688	1.092	0.453

C: Control F₁=50% chemical fertilizer F₂ = 100% chemical fertilizer
 FYM = farm yard manure Chic = chicken manure

The superiority of adding 50% NPK with chicken manure to adding 100% of the recommended NPK fertilizers (the increase was 23.0 and 34.5% in the two seasons) may be referred to the easier and quicker analysis of organic-N when soil received half of N in the mineral form which increased the availability of NPK in the soil, and increased the microorganism activity in the same time. This was in harmony with those of Follett *et al.* (1981) how reported that. Moreover, such treatments increased photosynthetic rate as a result of higher

concentration of photosynthetic pigments (Table, 4) and in turn increased vegetative growth and fruit yield. In addition, the obtained results are confirmed with those of Saad (1999) and Abd El-Kawy (2003) on cucumber and Rageh (2003), on cantaloupe, who found that adding organic-N and mineral NPK fertilizer together increased crop yield than adding each N-source alone.

3. Quality of squash fruits:

As presented in Table (6), the application of chicken manure combined with 50% NPK fertilizer gave the best values of fruit weight, length and diameter as compared with all treatments or the control, in both seasons.

Table (6): Quality characteristics of squash fruits as affected by chemical fertilizer and/or organic manure application.

Treatments	First season (2005)			Second season (2006)		
	Fruit length (cm)	Fruit diameter (cm)	Fruit wt. (gm)	Fruit length (cm)	Fruit diameter (cm)	Fruit wt. (gm)
C	11.00	2.60	49.5	10.00	2.43	44.5
F ₁	15.6	3.60	100.2	14.00	3.60	86.5
F ₂	17.00	3.15	110.4	16.56	4.03	113.5
FYM	15.8	3.40	100.0	16.10	4.01	110.0
Chic	16.5	3.50	107.0	16.34	4.06	112.0
F ₁ + FYM	16.3	3.90	107.5	15.24	3.80	98.5
F ₁ + Chic	17.8	4.31	118.0	16.50	4.56	115.7
F ₂ + FYM	16.9	3.49	108.0	16.10	4.00	100.1
F ₂ + Chic	17.1	3.10	110.5	16.00	3.90	106.5
FYM + Chic	15.9	3.20	100.8	15.35	3.80	99.2
L.S.D. at 0.05	0.737	0.734	1.672	0.898	0.152	2.628

C: Control F₁=50% chemical fertilizer F₂ = 100% chemical fertilizer
 FYM = farm yard manure Chic = chicken manure

In this respect, many workers reported that fruit physical characteristics such as fresh and dry weight of squash fruit were significantly increased with adding organic manure as compared with mineral NPK alone (Shehata, 2001; Ali, 2002; Martinetti and Paganini 2006 on squash).

This result may be due to the interaction between organic-N and mineral-N on the mineralization and availability of nitrogen in the soil as previously mentioned.

4. Fruit chemical characteristics:

Data shown in Table (7) indicate that the addition of chicken manure alone, F₁ + chic. (50% NPK + chicken) or F₂ + chicken (100% NPK + chicken) gave the highest values of N, K content in the fruits with significant difference as compared with the control. However, application of 100% NPK + chicken manure gave the highest K value in the second season. While the highest values of P were noticed in fruits of chicken manure treatments in the two seasons followed by F₁ + chic. This

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result, indicate that the addition of more than one source of organic manures had a beneficial effect on macro-element concentrations in squash fruits. This result agrees with those reported by Cooke (1972) who found that organic manure had improving effect on the soil properties, and consequently encourage the uptake of nutrients by plant roots.

NO₃-N content:

Data shown Table (7) and Figures (3 & 4) indicate that the 100% of the recommended NPK treatment significantly increased nitrate concentration in fruits in both seasons as compared with the control and treatments of organic manure or combination of organic and/or chemical fertilization. This result agrees with that of Abd El-Kawy *et al.* (2002) on cucumber and El-Behary *et al.* (2004) on cantaloupe.

Table (7): N, P, K and NO₃-N percentage of squash fruits as affected by chemical fertilizer and/ organic manure application.

Treatments	First season (2005)				Second season (2006)			
	N %	P %	K %	NO ₃ -N %	N %	P %	K %	NO ₃ -N %
C	1.300	0.320	1.190	0.220	1.470	0.240	1.520	0.310
F ₁	2.580	0.540	2.193	0.610	2.880	0.650	2.520	0.610
F ₂	2.640	0.590	2.043	0.640	2.947	0.750	2.120	0.670
FYM	2.740	0.660	2.570	0.430	3.100	0.780	2.880	0.470
Chic	2.740	0.960	2.730	0.440	3.250	0.990	3.00	0.430
F ₁ + FYM	2.560	0.850	2.010	0.500	2.670	0.710	2.040	0.550
F ₁ + Chic	2.880	0.840	2.620	0.520	3.160	0.860	3.050	0.530
F ₂ + FYM	2.620	0.670	2.590	0.500	2.983	0.810	2.603	0.560
F ₂ + Chic	2.890	0.570	2.680	0.530	3.180	0.840	3.160	0.550
FYM + Chic	2.600	0.607	2.490	0.350	2.810	0.780	2.760	0.370
L.S.D. at 0.05	0.254	0.052	0.121	0.053	0.121	0.054	0.108	0.054

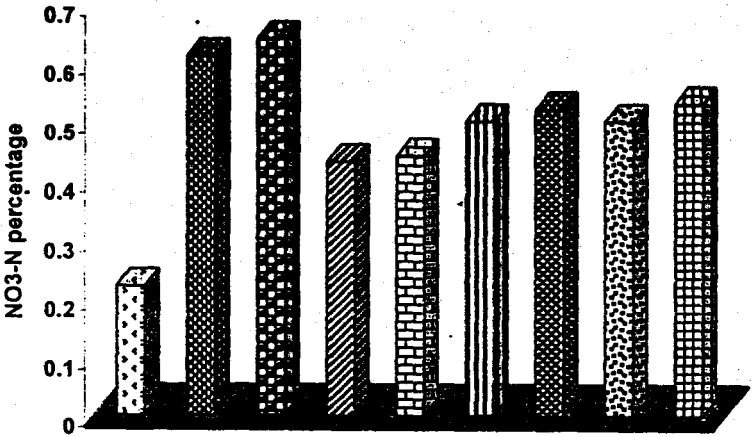
C: Control F₁=50% chemical fertilizer F₂ = 100% chemical fertilizer
 FYM = farm yard manure Chic = chicken manure

The reduction of nitrate content in squash fruits could result in producing safe product. Similar conclusion was reported by Wright and Davison (1964) and Luthrs (1973).

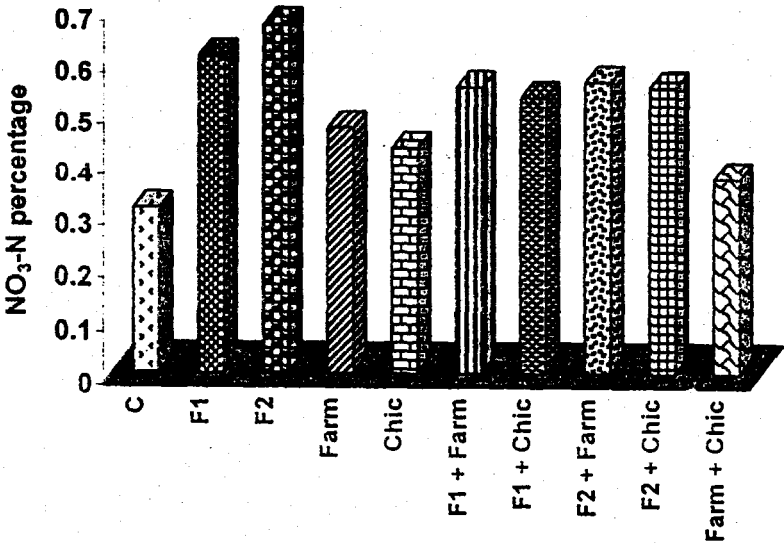
CONCLUSION

Generally from all obtained results it could be concluded that the use of organic manure and combination with "F₁ + organic manure" (50% NPK + organic manure) in our study, have the ability to obtain safe and clean product and improving fruit yield and quality. The best treatment was observed from 50% NPK chemical fertilizer with chicken manure (F₁ + Chic) application followed by chicken manure alone.

Season of 2005
(L.S.D. at 0.05 = 0.053)



Season of 2006
(L.S.D. at 0.05 = 0.054)



Figs. (3 and 4): NO₃ percentage of squash as affected by chemical fertilizer and organic manure application.

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استجابة الكوسة لمصادر من التسميد العضوي ومستويات من التسميد الكيماوي

حاتم محمد عبد العال ، سهام محمود علي
معهد بحوث البساتين - مركز البحوث الزراعية

أجريت هذه التجربة في الموسمين الصيفيين لعامي ٢٠٠٦/٢٠٠٥ بمزرعة محطة بحوث القناطر التابعة لمركز البحوث الزراعية .

اشتملت هذه التجربة علي ١٠ معاملات كالاتي : تسميد كيماوي بالمعدل الموسمي به: (٦٠ كجم ن + ٣٠ كجم فو ٢٠ + ٤٨ كجم بو ١٢ /فدان) ، تسميد كيماوي بـ ٥٠% من المعدل الموسمي به، وايضا نوعين من السماد العضوي هي سماد الدواجن وسماد المزرعة بمعدل ٢ طن ، ٤ طن علي التوالي ، التفاعلات المختلفة بين مستويات السماد الكيماوي ومصادر السماد العضوي ، و ٥٠% من سماد المزرعة + ٥٠% من سماد الدواجن بالإضافة إلي معاملة الكنترول بدون إضافة سماد عضوي أو كيماوي. وكانت النتائج كالتالي :

تفوقت معاملة المخلوط ٥٠% ن فو ٢٠ + ١٢ كجم بو ١٢ كيماوي + سماد الدواجن (بمعدل ٢طن/الفدان) حيث أعطت أعلى نتائج معنوية من حيث معظم صفات النمو الخضري ومحتوي الكلورفيل في الأوراق والمحصول وجودة الثمار . فيما يخص محتوى الثمار من النيتروجين والبوتاسيوم . فقد أوضحت النتائج أن المعاملات الأتية : ٥٠% سماد كيماوي + سماد دواجن ، ١٠٠% سماد كيماوي + سماد دواجن ، سماد دواجن فقط قد اعطت أعلى النتائج بدون فروق معنوية بينها. أما بالنسبة لمحتوي الفوسفور في الثمار قد أعطت معاملة سماد الدواجن فقط أعلى لنتائج في كلا الموسمين يليها ٥٠% سماد كيماوي + سماد دواجن.

من ناحية أخرى وجد أن أعلى محتوى من النترا ت بالثمار تحقق نتيجة إضافة السماد الكيماوي وأقل محتوى من النترا ت نتيجة إضافة الأسمدة العضوية بينما التفاعل بين السماد العضوي والسماد الكيماوي أعطت قيما متوسطة.

ربمكن التوصية باستخدام مخلوط ٥٠% من المعدل الموسمي به من السماد الكيماوي + سماد دواجن (بمعدل ٢طن/الفدان) للحصول علي منتج آمن وأعلى محصول من ثمار الكوسة