Assiut J. of Agric. Sci. 40 Special Issue (3 rd Conference Of Young Scientists, Fac. of Agric. Assiut Univ. April .,28, 2009.)(179-207)

A NITROGEN FERTILIZATION PROGRAM TO MINIMIZE N USE FOR SOME AROMATIC SEED CROPS.

A. M.A. Hassan@ ,H.M.A Ragheb*, M.M.M. Ahmed@ and H.G. Hassanein*
* Professors of soil fertility and plant nutrition, Soils and Water Sciences Department, Assiut University.
@Senior Researcher and Research assistance, Soil, Water, Environ. Res. Instit., ARC, Giza, Egypt

Abstract : A field experiment was conducted during the winter growth season of 2005/2006 at the Research Farm, Agricultural Research Station, El-Kharga, New Valley governorate, Egypt to study the effects of different N fertilization programs that based upon partially substitution of mineral N fertilizer with organic fertilizers on growth, oil contents in fruits, and oil- and fruit yield of three aromatic fruit crops, cumin, coriander and caraway. Two organic fertilizers i.e. farm yard manure (FYM) and Tacamoleia organo-mineral fertilizer (TOMF) made from the byproducts of sugar cane industry together with ammonium nitrate (mineral fertilizer) were used to establish eight N fertilization programs each supplied a total of 80 kg N fed^{-1} (the recommended N rate for these crops). The N fertilization programs could be summarized as follows: 1:control (without N), 2: 80 kg N /fed (mineral only), 3: 1/3 N (FYM) +2/3 N (mineral), 4: 2/3 N (FYM) +1/3 N (mineral), 5: 100% FYM, 6: 1/3 N (TOMF) +2/3 N (mineral), 7: 2/3 N (TOMF) +1/3 N (mineral), 8: 100% TOMF. The organic fertilizers were thoroughly incorporated into the surface 20 cm soil layer under the drip irrigation lines and the rest of required N was injected with irrigation water in 12 equal doses each applied once a week as mineral ammonium nitrate fertilizer. Plants were harvested before they were fully ripe. Total biomasses and fruit yields were recorded, and plants and soil samples were collected for chemical analyses and oil extraction from fruits. Total biomasses, fruit yields, uptake of N, P and K, and oil contents in fruits were measured.

Nitrogen fertilization programs that contained 1/3 of the recommended N rate either as FYM or TOMF produced the maximum total biomasses, fruits yields, and oil yields of the three studied aromatic fruit crops. The TOMF surpasses the FYM in its effects on the growth, fruit yields and oil yields of the three studied aromatic fruit crops. However, the differences between N fertilization programs including 1/3 or 2/3 organic manures on growth, yield and oil yield were limited. So under the conditions of the New Valley governorate, El-Kharga, and with using the drip irrigation system, it could be advisable to substitute up to 2/3 of the N recommended rates of the cumin, coriander and caraway by either FYM or TOMF to reduce the amounts of miner N fertilizer used. The obtained results showed that the organic fertilizers have a great benefit in enhancing the growth and uptake of N, P and K by the studied crops, and thus increased the apparent N use, the fruits yield, the oil content in fruits, and the oil yield of the three studied aromatic seed crops.

Key word: Nitrogen fertilization, aromatic fruit crops, cumin, coriander and caraway

Received on: 7/4/2009 **Accepted for publication on**: 25/4/2009
Referees: Prof.Dr.Kmal Kamel Atia Prof.Dr.Ahmed Khalab Mohamed

Introduction

Many investigators evaluate the effects of integrated use of some organic manures and chemical fertilizers on soil fertility in field experiments. The application of FYM and increasing N rates increased soil organic carbon, availability of N, P, K (Bokhtiar and Sakurai, 2005; Kaur *et al.*, 2005; Atia, 2007). Moreover, the availability of N, P, Fe, Mn, and Zn were increased with increasing the application rates of this organic material (Morsy and El-Dawwey, 1999). Abd El-Latif (2002) pointed out that application of cattle manure increased N, P, and K concentrations in plants compared to control. Application of mineral and cattle manure markedly increased NPK concentration and uptake of fennel plants (Bayoumi *et al.*, 2003). Moreover, Salem and Awad (2005) illustrated that the best results of concentration of N, P and K in fruits of coriander were obtained from the application of cattle manure together with 60 kg N/fed + micronutrients.

Studying the effects of FYM in combination with reduced rates of inorganic fertilizers on growth and fruits yield of coriander, Aly (2002) reported that the application of FYM at a rate 6 tons/fed +60% of the recommended (NPK)/fed increased fruits yield of coriander by more than 30% in comparison with the control. Using the fennel plants, Aly (2003), stated that the maximum values of plant growth parameters and fruits yield were recorded due to the application of 18 ton FYM/fed+20% of the recommended rates of NPK/fed.

Application of organic manure together with mineral N fertilizers improved percentage of essential oils in the fruits of aromatic plants (Aly, 2002). Using cumin (Patel *et al.*, 2004) and fennel (Ashorabadi *et al.*, 2003) as test plants showed that FYM alone produced the highest oil content in these plants. Abd El-Latif (2002) noted that cattle manure alone at any rates increased the oil content of caraway plants (*Carum carvi*, L.) compared to control.

Considering the economical and environmental impact of increasing rate of mineral N fertilization, this work was initiated to find out the best N fertilization program that include both organic and inorganic N source to reduce the amount of mineral N used in fertilization of some aromatic fruit crops.

Materials and Methods

A field experiment was carried out during the winter growth season of 2005/2006 at the Research Farm, Agricultural Research Station, El-Kharga, New Valley governorate, Egypt, to study the response of some aromatic fruit crops (cumin, coriander and caraway) to N fertilization programs that based upon partially substitution of mineral N fertilizer with organic

fertilizers. Farmyard manure (FYM) and Tacamoleia organo-mineral fertilizer (TOMF) are used in partially substitution of the amount of fertilizer N recommended for these crops. Tacamoleia fertilizer is an organo-mineral fertilizer prepared by mixing of some sugar cane industry wastes including filter mud cake and vinasse and supplemented with some inorganic fertilizers such as superphosphate, potassium sulfate and sulfurs each at rate of 50 kg of each ton. The physical and chemical analyses of experimental soil and organic fertilizers as well as irrigation water used during the course of experiment are presented in Tables 1, 2 and 3.

The recommended rate of 80 kg N fed^{-1} was used. The N fertilization programs were designed based on partially substitution of mineral N fertilizer by either FYM or TOMF. The eight tested N fertilization programs are summarized as follows: 1-P_1, control (without nitrogen fertilizer), 2- P_2, 80 kg N /fed (mineral only), 3- P_3, 1/3 N (FYM) +2/3 N (mineral), 4- P_4, 2/3 N (FYM) +1/3 N (mineral), 5- P_5, 100% FYM, 6- P_6, 1/3 N (TOMF) +2/3 N (mineral), 7- P_7, 2/3 N (TOMF) +1/3 N (mineral), 8- P_8, 100% TOMF. The amounts of inorganic and organic fertilizers used in each N fertilization program are shown in Table (4).

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

Soil Characteristics	Depth (cm)		
	0-15	15-30	30-45
Sand %	69.54	44.91	60.14
Silt %	11.58	13.95	8.83
Clay %	18.88	41.14	31.03
Soil texture	Sandy Loam	Clay Loam	Sandy Clay Loam
$CaCO_3$ %	2.80	2.40	2.00
OM%	0.11	0.09	0.07
Total N %	0.004	0.006	0.009
pH (1:1 suspension)	7.50	7.70	7.60
EC (1:1 extract) dS m^{-1}	0.53	0.57	0.46
$NaHCO_3$ – P (mg kg^{-1})	3.47	4.14	3.57
Exch. K (meq 100 g^{-1}soil)	0.21	0.24	0.29

*Each value represents the mean of three replicates.

Table(2): Chemical and nutritional analysis of the applied farmyard manure (FYM) and El-Tacamoleia organo-mineral fertilizer (TOMF).

Characteristics	fertilizer@	
	FYM	TOMF
Moisture%	23.30	13.67
Weigh of m^3 (kg m^{-3})	304	407
PH (1:10 suspension)	7.73	6.28
EC (1:10 extract) dS m^{-1}	6.45	6.37
N%	0.62	2.41
P%	0.35	3.84
K%	1.57	2.01
C%	22.66	42.14
C/N ratio	36.45	17.49
Fe ppm	752	1240
Mn ppm	325	450
Zn ppm	148	185
Cu ppm	62	180

@TOMF=Tacamoleia organo-mineral fertilizer FYM= Farmyard manure

*Each value represents the mean of three replicates.

The experimental site was irrigated using underground water. Drip irrigation system was used in this experiment. The drip irrigation system was consisted of the standard GR polyethylene hose of 16 mm diameter. The drippers of 4 L h^{-1} discharge were spaced at 50 cm apart. The laterals were located 60 cm apart; one lateral for each crop row was used.

The experimental design was complete randomized blocks design with four replicates. The experimental unit area was 4.8 m^2 (8 X 0.6 m). Each unit contained 56 plants. The organic fertilizers were thoroughly incorporated into the surface 20 cm soil layer under drip irrigation lines, 15 days before planting.

Table(3): Soluble cations and anions in irrigation water.

Character	EC dSm^{-1}	pH	Soluble cations meq l^{-1}				Soluble anions meq l^{-1}			SAR	Fe (ppm)	Mn (ppm)
			Ca^{+2}	Mg^{+2}	Na^{+1}	K^{+1}	$CO_3^{-2} + HCO_3^{-1}$	Cl^{-1}	SO_4^{-2}			
Values	0.31	6.70	0.72	0.69	1.03	0.64	1.57	1.15	0.34	1.23	1.15	0.10

*Each value represents the mean of three replicates.

Table(4): The amounts of inorganic and organic fertilizers used in the experiment.

Fertilization program	Mineral nitrogen (kg fed^{-1})	Organic nitrogen (kg fed^{-1})	Ammonium nitrate (kg fed^{-1})	FYM* (kg fed^{-1})	TOMF* (kg fed^{-1})
P1	0	0	0	0	0
P2	80.0	0	238.8	0	0
P3	53.3	26.7	159.2	5608	0
P4	26.7	53.3	79.6	11215	0
P5	0.0	80	0.0	16823	0
P6	53.3	26.7	159.2	0	1282
P7	26.7	53.3	79.6	0	2563
P8	0	80	0	0	3845

* based on fresh weight.

Assiut J. of Agric. Sci. 40 Special Issue (3rd Conference Of Young Scientists, Fac. of Agric. Assiut Univ. April ,28, 2009.)(179-207)

The cumin, coriander and caraway fruits were obtained from Medicinal and Aromatic Research Department, Horticulture Institute, ARC. The fruits were sown on November 12th. Fruits were sown in holes (5-6 fruits in each hole) at space of 25 cm in between, beside drip irrigation lines. Thinning to two plants per hole was performed 30 days after sowing. The recommended dose of 22.5 kg P_2O_5 fed^{-1} as phosphoric acid and 24 kg K_2O fed^{-1} as potassium sulfate were applied with irrigation water during the growing season. Each N level was splitted into 12 equal doses. Nitrogen dose was injected once a week through the irrigation water. Phosphorus and potassium fertilizers were fertigated with N fertilizer treatments through these 12 applications. The injection of N, P and K fertilizers through the irrigation water usually starts after 15 minutes from the beginning of the irrigation period and stops 15 minutes before the termination of irrigation to insure the washing of irrigation lines. All plants received normal agricultural practices as recommended.

The cumin, coriander and caraway plants were harvested before it was fully ripe. Cumin were harvested (15th of April) when plants turn yellowish brown, while, the coriander fruit were harvested (1st of April) when plants become greenish yellow in color or semidry. Caraway plants were harvested (1st of May) when approximately 75 per cent of the fruits have turned dark brown. Three plants from each plot of the studied plants were chosen randomly to measure the growth parameters. Plants were cut off immediately above the soil surface and left for about 10 days then, hammered for fruit separation. Generally, the following measurements were determined as follow:

Soil Analysis:

Composite soil samples at depth of 0-45 cm were collected after harvest from each plot, air dried, ground to pass through 2 mm sieve and then analyzed for electric conductivity ($EC_{1:1}$), organic matter, total nitrogen, available-P and available-K.

Plant Analysis:

At harvesting three plants from each plot of the studied plants were chosen randomly, washed first by tap water then by distilled water, air dried, oven dried at 70 C, ground finely and stored for chemical analysis later on.

Plant analysis was carried out for total N, P and K%. The analytical data was used to calculate the total uptake of N, P and K using the formula:

$$\text{N, P, K, uptake by plant (kg/fed).} = \frac{\left[\text{Nutrient \%} \times \text{Total biomass (kg fed}^{-1}\text{)}\right]}{100}$$

The apparent N recovery (ANR) and the N used efficiency (NUE) were calculated using the following equation:

$$\text{ANR} = \frac{\left[\text{N uptake of the treatment (kg fed}^{-1}\text{) - N uptake of the control (kg fed}^{-1}\text{)}\right]}{\text{N applied level (kg fed}^{-1}\text{)}}$$

$$\text{NUE} = \frac{\left[\text{Biomass of the treatment (kg fed}^{-1}\text{) - Biomass of the control (kg fed}^{-1}\text{)}\right]}{\text{Nitrogen applied level (kg fed}^{-1}\text{)}}$$

Oil extraction and measurement:

Oil content in fruits was extracted using the distillation method (Guenther, 1961). Then volatile oil percentage was calculated as ml of oil per 100 grams of fruits and the volatile oil yield per feddan was calculated.

Analytical methods:

Soil texture was determined according Piper (1950) while soil total nitrogen was determined by using the micro Kjeldahl method (Black, 1965). Soil pH, total calcium carbonate, organic matter content, total soluble salts, available phosphorus and potassium were measured according Jackson (1973).

Plant tissue analysis:

Samples of 0.5 g dried and ground plants were accurately weight and used for wet digestion in H_2SO_4-H_2O_2 mixture as described by Parkinson and Allen, (1975). Total nitrogen in plants was determined by using the micro Kjeldahl method (Black, 1965) while, total phosphorous and potassium in plant were determined as described by Jackson (1973).

Statistical analysis:

The obtained data of plant and soil characters were subjected to standard analysis of variance and the means of treatments were tested for significant differences using the least significant difference method (LSD) at $P = 0.05$. The MSTATC computer program written by Freed *et al.* (1987) was used to perform all the analysis of variance.

Results and discussion

1: Effects of N fertilization programs on soil properties:

The tested N fertilization programs contain mineral N fertilizers and two different types of organic fertilizers, farm yard manure (FYM) and Tacamoleia

organo-mineral fertilizer (TOMF). When added to the soils, the effects of each N fertilization program will depend to a great extent on the nature of the organic fertilizer it contained in one side, and the nature of minerals and organic compounds released into root zone during the decomposition of the organic manure, in the other side. Therefore, studying the effects of the tested N fertilization programs on the soil environment in the root zone would be of great importance to explore the effects of the N fertilization program on growth, fruits yield, oil content in the fruits, and oil yield of each of the studied aromatic fruit plants.

1-1: Total Soluble Salts (Electrical Conductivity, EC):

The effects of N fertilization programs on the values of $EC_{1:1}$ of the soil of the root zone depends on the type and the application rate of organic manure used in each program (Table 5). Comparing to control (soil with no addition of N fertilizers), all N fertilization programs that contained organic manure at either 1/3 or 2/3 of the N recommended rate, significantly ($p \leq 0.01$) increased the $EC_{1:1}$ of the root zone. However, there were no significant differences between any of the tested N fertilization programs that contained organic manure. The effects of N fertilization programs on $EC_{1:1}$ reached their maximum of 1.13, 1.20 and 1.14 dS m^{-1} in the root zone of cumin, coriander and caraway plants received all N recommended rates in the form of FYM (100% FYM).

As shown in Table (2) the EC values of 1:10 water extract of FYM and TOMF are 6.45 and 6.37dS m^{-1}, respectively. These high salinity levels of organic fertilizers used could be the reason behind increasing the EC values of the root zone soil. It should be remarkable that these increases of EC values did not reached the hazard levels of salinity to the tested aromatic fruit plants. However, continuous application of the same N fertilization programs may cause salt accumulation in the root zone. Therefore, monitoring the salinity level of the soils continuously treated with organic manure should be followed. Increasing salt content in the soil due to application of organic fertilizers such as cattle manure (Soliman, 2000), and palm waste compost (Bashandy, 2007) has been reported.

1-2: Organic matter:

At harvesting time, organic matter (OM) in the root zone significantly ($p \leq 0.01$) increased as a result of applying the N fertilization programs that contained organic fertilizers only (FYM or TOMF) or in combination with the mineral N fertilizer (Table 5). The maximum values of OM content was attained with the application of N

Table(5): Effects of N fertilization programs on soil electrical conductivity and soil organic matter in the root zone of the studied crops.

N Fertilization programs	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
	EC (dSm^{-1})			OM%		
Control (without nitrogen only)	0.92	0.98	0.75	0.19	0.09	0.09
80 kg N (mineral only)/fed	0.97	1.02	0.99	0.24	0.17	0.17
1/3 N (FYM) +2/3 N (mineral)	1.11	1.19	1.13	0.37	0.39	0.39
2/3 N (FYM) +1/3 N (mineral)	1.11	1.19	1.27	0.41	0.45	0.45
100% FYM	1.13	1.20	1.14	0.46	0.50	0.50
1/3 N (TOMF) +2/3 N (mineral)	1.11	1.14	1.07	0.37	0.38	0.38
2/3 N (TOMF) +1/3 N (mineral)	1.14	1.16	1.13	0.40	0.41	0.43
100% TOMF	1.12	1.14	1.09	0.43	0.47	0.47
$LSD_{0.05}$	0.03	0.10	0.14	0.06	0.08	0.04

fertilization programs that contained only FYM or TOMF. However, FYM was little bet more effective than TOMF in increasing OM content in soil. Comparing to application of TOMF only, the percentages of increase in OM caused by application of FYM only reached up to 6.98, 6.38 and 6.38% in the soils cultivated with cumin, coriander and caraway, respectively. This may be due to the high amount of FYM that applied to the soil, to satisfy the recommended N rate, compared to TOMF. Results obtained by Mahmoud (2000) emphasized that application of FYM resulted in increasing the OM content in soil.

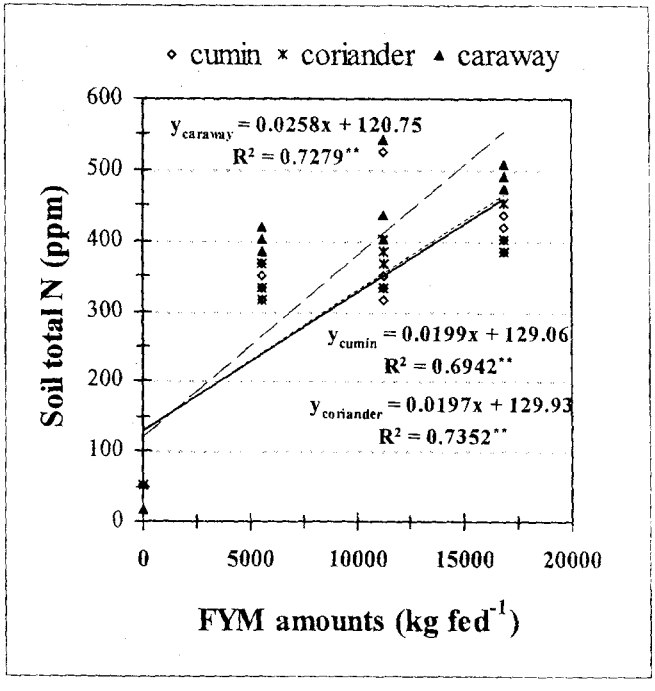
1-3: Total N Contents:

The changes in total N contents in the soil at harvesting time followed the same trend as the OM content. Comparing to control, all N fertilization programs significantly ($p \leq 0.01$) increased the total N content in soil (Table 6). The maximum increases in soil total N ranged between 400 to 485 ppm N were recorded after the application N fertilization programs that contained either FYM or TOMF only as a source of N. Comparing to the N fertilization program that contained only mineral source, including the organic fertilizers in the N fertilization program was more effective in enhancing the status of N in the root zone of the studied aromatic fruit crops. Application of N fertilization program that include 2/3 of the recommended N rate as FYM increased the total N up to 380.6, 371.9 and 446.3 ppm in the soil after harvesting of cumin, coriander and caraway, respectively. In the case of using TOMF to furnished 2/3 of the recommended N rate, the total N in the soil after harvesting cumin, coriander and caraway reached the values of 367.5, 376.3 and 441.9 ppm; respectively. The amount of total N in soil after harvesting could be direct results of many processes take place during the growth period of plants. Firstly, the decomposition of organic manure has a substantially effect on increasing the amount of N in soil (El-Etr *et al.*, 2004; Mohamed and Hussein, 2005). Secondly, but not least, the high amount of total N in soil treated with organic manure could be due to the enhancement of the activity of soil microorganisms that fix the atmospheric N (Elsharawy *et al.*, 2003). The amounts of total N in the soil after harvesting both cumin and coriander were little bet lower than that after harvesting caraway. These data reflect the differences between the grown plants in their N requirements and ability to absorb and acquire the N from the soil, caraway being required low amount of N than cumin and coriander.

Regression analysis was used to study the relationships between the amount of FYM and TOMF applied and total N in soil, Fig. 1 graphically represents the results

Table(6): Effects of N fertilization programs on soil total nitrogen, available phosphorus and potassium.

N Fertilization programs	Total nitrogen (ppm)			Available phosphorus (ppm)			Available potassium (ppm)		
	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
P1	52.5	52.5	17.5	4.2	5.0	4.3	110.4	95.0	137.3
P2	170.6	166.3	192.5	7.9	7.8	6.3	208.2	195.2	267.9
P3	341.3	345.6	402.5	17.5	15.1	10.4	238.9	227.2	304.1
P4	380.6	371.9	446.3	18.2	15.7	14.0	242.4	233.6	311.5
P5	411.3	411.3	465.0	20.1	17.0	15.0	251.4	240.3	318.2
P6	341.3	336.9	402.5	19.9	16.9	14.9	237.3	225.7	302.3
P7	367.5	376.3	441.9	22.1	18.7	15.9	242.1	230.7	308.4
P8	402.5	411.3	485.6	22.5	18.9	16.2	248.1	236.8	314.4
LSD 0.05	58.302	37.533	40.074	4.2	5.0	4.3	35.95	17.88	12.46



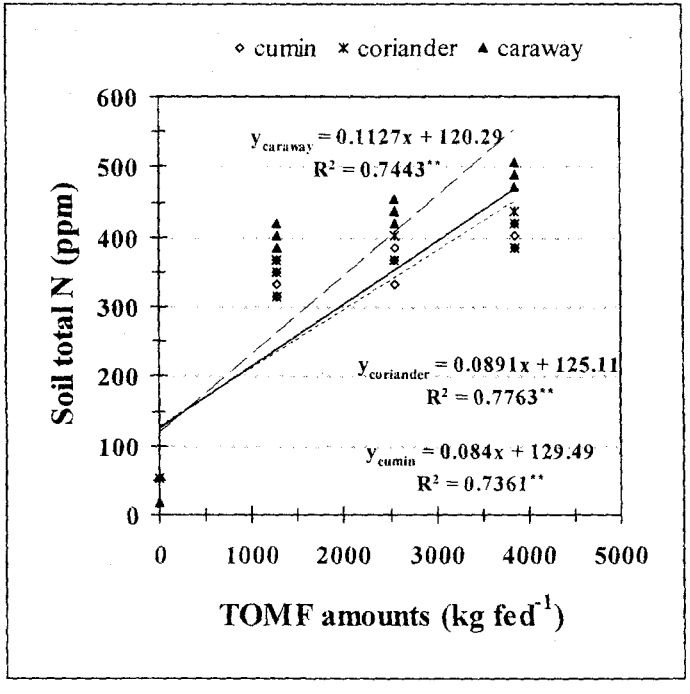


Fig. (1): Linear regression analysis of amount of organic fertilizers and total N content in soil.

of the regression analysis. Linear regression was the best model fitting the data with significant correlation coefficients of 0.6942, 0.7352 and 0.7279; and 0.7361, 0.7763 and 0.7443 for cumin, coriander and caraway fertilized with FYM and TOMF; respectively. The slops of the regressions lines were 0.0199, 0.0197 and 0.0258 for cumin, coriander and caraway plants fertilized with FYM, respectively; while they were 0.084, 0.0891 and 0.1127, respectively for TOMF. This means that the amounts of organic manure required to increase the total N in soil by one unit were drastically differ with both the type of organic manure and crop gown.

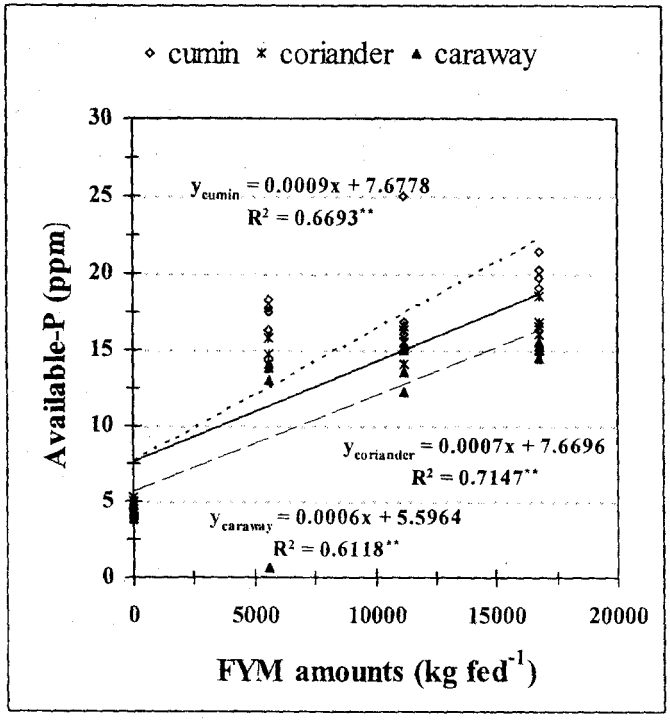
1-4: availability of P and K:

Comparing to the control (without N fertilization), all N fertilization programs significantly ($p \leq 0.01$) increased the available P and K in soil (Table 6). The presence of organic fertilizers in the N fertilization program has augmented effects on increasing the amount of available P and K in root zone of the tested aromatic fruit crops. These effects were markedly increased with increasing the substitution rate of mineral N in the N fertilization program. It should be remarkable also that TOMF surpasses the FYM in its effect on the availability of P, and have the same effect as FYM on the availability of K.

The highest values of available K were reported due to include the FYM in the N fertilization program. Comparing with the program that contain mineral N as a solely source of N, these increases reached 20.7, 23.1 and 18.8 % in the soils after harvesting of cumin, coriander and caraway, respectively. These increases could be attributed to the fact that FYM contained high amount of soluble K as reported by Arafat (1998) and shown in Table (2).

Increasing the availability of P due to the application of organic fertilizers might be a direct result of increasing the amount of organic acids and humic substances associated with the decomposition processes of organic manure. These released organic manure and humic substances may play an important role in dissolving the sparingly soluble phosphate carrying minerals. In the same time organic acids and humic substances may inhibit the fixation reactions of phosphate in soil (Ahmed and Osman, 2003). This inhibition of P fixation may account for the observation that P availability is frequently greater in manured soils.

There were positive linear relationships between the application rate of organic fertilizers and available P in soil (Fig. 2) with significant ($p \geq 0.05$) correlation coefficients of 0.6693, 0.7147, and 0.6118 in the case of



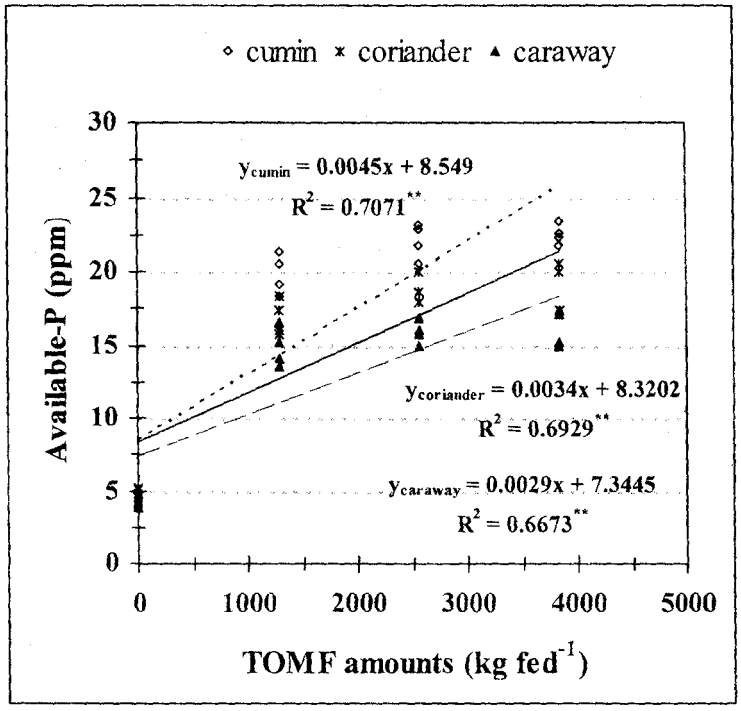


Fig.(2): Linear regression analysis of available P content in soil treated with organic fertilizers.

applying FYM and of 0.7071, 0.6929, and 0.6673 in the case of applying TOMF to cumin, coriander, and caraway, respectively. Available K in soil was also, increased linearly and significantly ($p \geq 0.05$) with increasing the application rate of organic fertilizers (Fig 3). The correlation coefficients for the relation between application rate of organic manure and available K were 0.5567, 0.6634, and 0.6585 using FYM, and 0.6408, 0.6522, and 0.6507 using TOMF for fertilizing cumin, coriander, and caraway; respectively.

2: Effects of N fertilization programs on N, P and K uptake:

Macronutrients N, P and K uptakes showed a great diversity as the N fertilization programs changed from application of all N recommended rate in mineral or organic forms to partially substitution of mineral N with either FYM or TOMF. Comparing to control (without addition of N fertilizer), all N fertilization programs highly significantly ($p \leq 0.01$) increased the amounts of N, P and K taken up by cumin, coriander and caraway (Table 7). The effects of both fully FYM and TOMF N fertilization programs on N uptake by the studied aromatic fruit crops were lower than that of mineral N fertilization program, and there is no significant difference between the two organic N fertilization programs (Table 7). The amounts of N taken up by cumin, coriander and caraway treated with mineral N fertilization program were 8.4, 25.2 and 31.7 kg N fed^{-1}; respectively. The amounts of N taken up by cumin, coriander and caraway treated solely with FYM were 6.2, 16.5 and 28.5 kg fed^{-1}, respectively; while in the case of TOMF they were 6.7, 17.7 and 30.5 kg N fed^{-1}, respectively. It seems that coriander and caraway plants removed much more N from the root zone than cumin plants did.

Partially substitution of mineral N with organic fertilizers enhanced the effects of N fertilization programs on N uptake by plants, however, the enhancement effects were varied depend upon both the type of organic fertilizers and the replacement rate of mineral N in the N fertilization programs. Replacement of 1/3 the N recommended rate with FYM significantly ($p \geq 0.05$) increased the amount of N taken up by cumin, coriander and caraway plants. However, further increases of the replacement rate to 2/3 and fully replacement resulted in gradually decreases in N uptake. On the other hand, maximum increases of N uptake were recorded with using the N fertilization program that includes 1/3 of N recommended rate as TOMF. Comparing to mineral N fertilization program these increases reached 76.2, 71.0 and 17.4% for cumin, coriander and caraway plants; respectively.

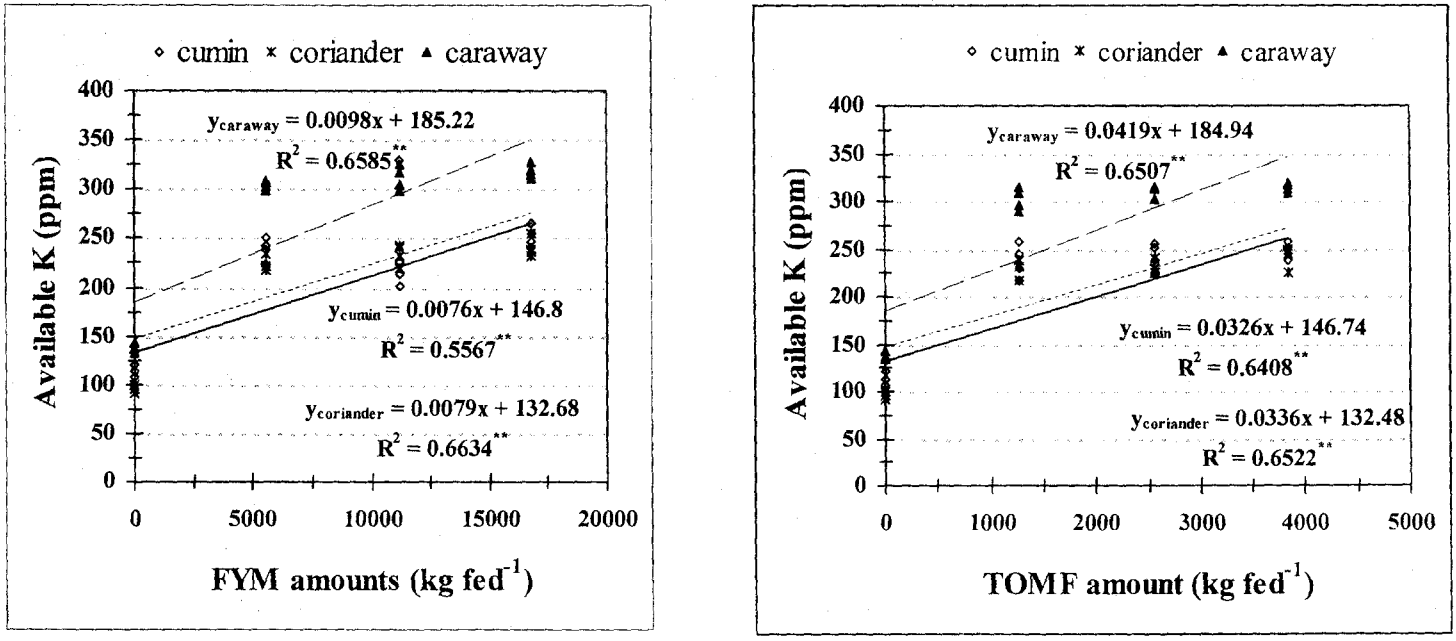


Fig. (3): Linear regression analysis of available K content in soil treated with organic fertilizers.

Table(7): Effects of N fertilization programs on macronutrients uptake of the studied crops.

N Fertilization programs	Nitrogen uptake (kg/fed)			Phosphorus uptake (kg/fed)			Potassium uptake (kg/fed)		
	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
P1	3.3	9.4	9.1	0.5	2.4	1.0	0.8	7.7	5.5
P2	8.4	25.2	31.7	1.2	5.3	4.7	12.1	23.2	42.8
P3	9.3	29.0	33.8	2.1	6.2	4.8	15.7	33.3	43.9
P4	7.8	18.9	30.8	1.9	5.6	5.0	14.3	23.4	41.7
P5	6.2	16.5	28.5	1.4	3.5	4.0	11.4	20.8	37.5
P6	14.8	43.1	37.2	3.3	10.1	5.3	24.1	45.2	47.5
P7	13.5	38.4	33.5	3.3	10.9	5.4	23.2	46.6	44.1
P8	6.7	17.7	30.5	1.8	5.6	5.5	11.8	22.0	39.9
LSD 0.05	0.87	2.71	2.08	0.18	0.87	0.66	1.56	4.77	6.07

These results could be explained in conjunction with the effects of N fertilization programs on N availability in root zone. As mentioned above carrying on the N fertilization programs that contained organic fertilizers, either FYM or TOMF, could increase the amount of available N in root zone, which is reflected on increasing the amount N taken up by growing plants. This effect of organic manures is mainly due to releasing of N during the course of decomposition of organic matter.

Regarding to P uptake, comparing to control (without application of N fertilizer), N fertilization programs significantly ($p \leq 0.01$) influenced the amount of P taken up by cumin, coriander and caraway plants (Table 7). Application of recommended N rate either as mineral N fertilizer or as organic fertilizers (FYM or TOMF) increased the amounts of P taken up by the three studied aromatic fruit crops. However, the response of P uptake to TOMF program was significantly higher than that of FYM.

Nitrogen fertilization programs that include 2/3 of the recommended N rate as TOMF exerted much more effects on P uptake, and the increases in the amounts of P taken up by cumin, coriander and caraway plants reached the maximum of 3.3, 10.9 and 5.4 kg P_2O_5 fed^{-1}; respectively. Comparing to mineral N fertilization program these increases in P uptake in cumin, coriander and caraway were equal to 170.5, 105.7 and 14.9%; respectively. However, the differences in the response of P uptake to N fertilization programs that contain 1/3 of recommended N rate as TOMF and 2/3 were not significant.

The fact that TOMF was prepared by mixing filter mud cake, vinasse, mineral sulfur and super phosphate could explain the enhanced effects of TOMF on P uptake by the studied aromatic fruit plants. On the other hand, during the decomposition of the organic constituents of TOMF lot of soluble organic acids and humic substances are released, which in facts enhanced the growth of roots and facilitate the turnover of unavailable P pools to more available ones, both factors resulted in increasing the P uptake by growing plants. The data obtained by Elgharably (2002) using the TOMF supported these results.

Nitrogen fertilization programs that solely contained mineral N fertilizers, FYM or TOMF significantly ($p \leq 0.01$) increased the amounts of K taken up by cumin, coriander and caraway, comparing to control (without N fertilization). However, there were no significant differences between these N fertilization programs in their effects on K uptake of the studied aromatic fruit plants. Remarkable amount of organic

acids released during the decomposition of both organic fertilizers may result in desorbing the mineral-bound insoluble potassium rendering it more available for plant uptake (Elsharawy *et al.*, 2003).

3: Effects of N fertilization programs on total biomass and fruits yield:

Results illustrated in Tables (8) show the responses of total biomass and fruit yields to mineral, organic and organo-mineral N fertilization programs. The response of total biomass and fruit yields to mineral nitrogen fertilization program was significantly ($p \leq 0.01$) higher than that to either FYM or TOMF. It is quite clear that both N fertilization programs that used organic fertilizers only, FYM and TOMF, could not furnished the grown plants with their N requirement immediately in the right time, and TOMF produced significantly higher biomasses and fruit yields comparing to the FYM. On the other hand, application of all N requirements via FYM produced minimum values of total biomass yield. These decreases may be due to the lake of immediately available N and other plant nutrients in FYM.

Partially substitution of mineral N fertilizers with organic fertilizers enhanced the response of aromatic fruit crops to the N fertilization programs. As reveled from the data presented in Tables (8) the response of total biomass and fruit yields of the studied aromatic fruit crops to the N fertilization programs was differed based upon both the kind of organic fertilizer used (FYM or TOMF) and the mixture rate with inorganic N fertilizer (1/3 or 2/3 of the N recommended rate). Fertilizing the cumin, coriander, and caraway plants with the N fertilization program that include 1/3 of the N rate as organic fertilizers (FYM or TOMF) produced highly significantly ($p \leq 0.01$) higher total biomasses and fruit yields compared to those programs that used only either mineral or organic N fertilizers. Using the TOMF in the N fertilization program gave much higher total biomasses and fruit yields of the three aromatic fruit crops. The percentages of increase in total biomasses of cumin, coriander and caraway produced by using the N fertilization program contained 1/3 of recommended N as TOMF were 66.9, 51.8, and 62.72%, respectively; and the percentages of increases in fruit yields were 71.5, 45.1 and 14%, respectively. The same trends were obtained for other herbal plants like basil plants (Massoud, 2007).

On the light of the previous results it can be stated that replacing one-third of N recommended rate for cumin, coriander and caraway by organic N in the form of TOMF improved the growth of plants and thus increased both the total biomass

and fruit yields. The positive effects of N fertilization program that contained 1/3 of N requirement as organic fertilizer TOMF may be due to the effects of organic fertilizer on the soil physical properties (Abd-El-Maboud, 2004; Zanouny, 2003; Mekail, 2006 and Mekail *et al.*, 2006). Providing the soil microorganisms with a suitable form of energy (carbohydrates and other hormones-like substances) could also be another explanation for the positive effects of organic fertilizers on the growth of aromatic fruit plants (El-Ghadban *et al.*, 2003). Releasing of most plant nutrients throughout the course of decomposition of organic fertilizer could increase the available pools of these nutrients and, therefore, enhanced the growth of root system and increased the efficiency of acquisition, absorption and translocation of plant nutrients (Desoki, 2004; Mohamed and Hussein, 2005).

Table(8): Effects of N fertilization programs on fruits yield and total biomass of the studied crops.

N fertilization programs	Fruits yield (kg/fed)			Total biomass (kg/fed)		
	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
P1	054.4	363.2	305.3	280.8	1291.4	757.4
P2	202.3	879.6	926.9	448.6	2143.9	1918.8
P3	220.4	917.7	939.5	498.8	2317.0	1955.8
P4	195.6	674.2	716.1	428.7	1616.6	1873.1
P5	153.7	625.9	530.8	351.3	1464.2	1778.4.
P6	347.0	1277.6	1057.1	748.7	3255.0	2065.0.
P7	336.4	1156.7	977.0	717.8.	3088.6	1945.2
P8	164.1	635.9	654.5	369.6	1515.3	1848.9
LSD 0.05	3.6	49.5	50.6	8.8.	135.8	80.02

Besides the other effects of organic fertilizers on soil and plant that were well documented (El-Etr, *et al.*, 2004), TOMF may enhanced the physiological processes, namely photosynthetic activity, utilization of carbohydrates, and absorption of essential nutrients. Tacamoleia organo-mineral fertilizer is prepared from some by-products of sugar industry that contained a lot of soluble carbohydrates, hormones and enzyme-like substances, and soluble K and other micronutrients. These constituents play an important role in increasing the activities of root systems and enhanced its ability to discover a large volume of root zone, and thus improved the efficiency of plant root system to

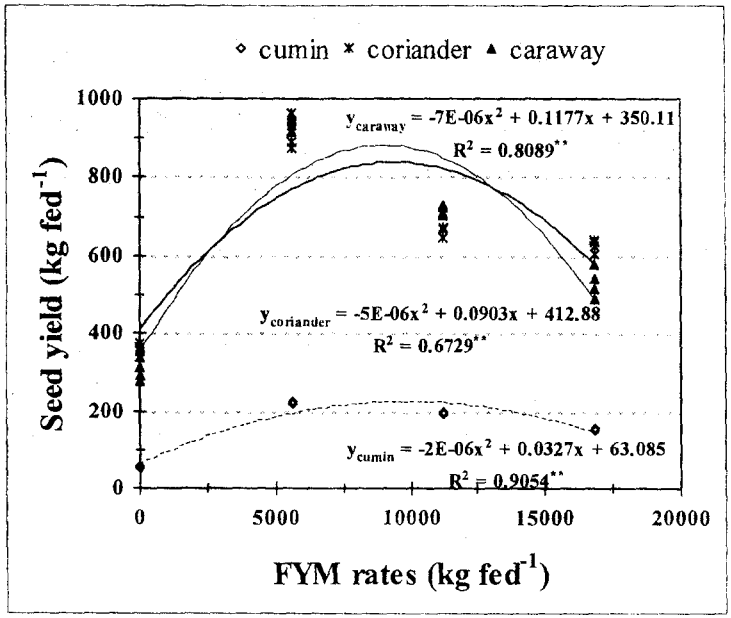
absorb and translocation of water and plant nutrients.

Analyzing the relationships between fruit yields of the studied aromatic fruit crops and the application rate of organic fertilizers using the regression analysis showed that quadratic equations best fitted the obtained results (Fig. 4). Inspection of these data revealed that under the condition of the New Valley and with using the drip irrigation system the application rates of 8175, 9030 and 8407 kg FYM fed^{-1} (equal to 50.7, 56.0 and 52.1 kg organic N as FYM, respectively) were required to produce the maximum yield of 196.75, 820.59 and 844.87 kg fed^{-1} for cumin, coriander and caraway, respectively.While, the application rates of 1959, 2442 and 2857 kg TOMF fed^{-1} (equal to 47.2, 58.9 and 68.9 kg organic N as TOMF, respectively) were required to produce the maximum fruits yield of the 376.23, 1394.23 and 954.25 kg fed^{-1} for cumin, coriander and caraway, respectively.

4: Oil contents and oil yields:

Comparing to control, high increases in oil contents and oil yield were obtained by the application of all recommended N rate as mineral fertilizer (Table 9). The oil contents and oil yield of cumin, coriander and caraway reached the values of 4.63, 0.32 and 2.78%, and 9.36, 2.82 and 25.7 kg fed^{-1}, respectively, with the application of all required N in mineral form. However, TOMF gave the second higher increases in oil content and oil yield, followed by FYM.

Partially substitution of mineral N fertilizers with organic fertilizers enhanced the response of aromatic fruit plants to the N fertilization programs. The percentages of increases of oil contents and oil yields depends on the kind of organic fertilizers used (FYM or TOMF) and the ratio between mineral and organic fertilizers used in the N fertilization program. Oil contents were, in general, increased with increasing the amount of organic fertilizers used in the N fertilization programs. Increasing the rate of organic fertilizers up to 2/3 of the recommended N rate significantly increased the oil contents in the fruits of the three studied aromatic fruit plants. These increases were held true for either the FYM or TOMF used in the N fertilization programs. The highest oil percentages in cumin fruits (5.03%), in coriander fruits (0.33%) and in caraway fruits (3.02%) were obtained by the application of the N fertilization program that contained 2/3 of N recommended rate as FYM. Comparing to mineral N fertilization program, these increased reached 8.64% for both cumin and caraway and 3.13% for coriander. Using the N fertilization program that contained 2/3 of N recommended rate as TOMF resulted in increasing the oil content in cumin and caraway fruits up to 4.83 and



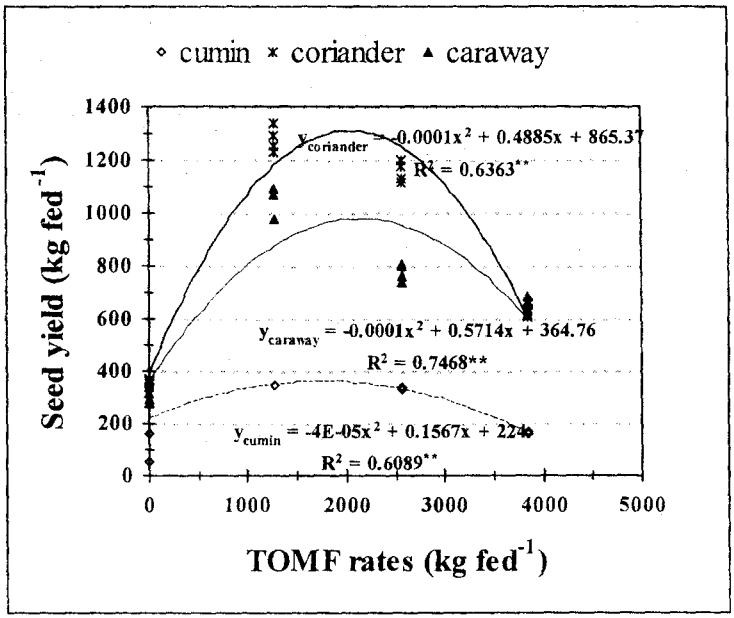


Fig.(4): Quadratic regression analysis of fruits yield of studied plants treated with organic fertilizers.

2.90%, respectively. On the other hand, the oil contents in coriander fruits showed no responses to the substitution of the recommended N rate with either of FYM or TOMF.

Nitrogen fertilization programs that contained either 1/3 or 2/3 of N recommended rate as TOMF produced the highest oil yields of cumin (14.7 and 16.2 kg fed^{-1}, respectively), coriander (3.8 and 3.6 kg fed^{-1}, respectively) and caraway (26.9 and 28.3 kg fed^{-1}, respectively). Comparing to the mineral N fertilization program, these increases were very highly significant ($p \geq 0.01$) only in the case of cumin and coriander. However, comparing to the mineral N fertilization program, the oil yield of cumin plants did show a significant response only to the N fertilization program that contained 1/3 of recommended N rate as FYM. Surprisingly enough, increasing the ratio of FYM in the N fertilization program more than 1/3 of the recommended N rate significantly reduced the oil yield of cumin, coriander and caraway plants to reach the lowest values of 6.04, 1.94 and 12.47 kg fed^{-1}, respectively, when only the FYM was used as a source of N. The values of oil yields (kg fed^{-1}) were calculated as the products of fruit yield (kg fed^{-1}) by oil content in fruits (%). Therefore, the effects of N fertilization programs on oil yields will be the net results of their effects on both fruit yields and oil contents in the fruits. As mentioned before, the fruit yields of the studied aromatic fruit corps were much more affected by the nitrogen programs, and, on the other hand, the oil contents in the fruits of these plants were less affected. Therefore, it is quite clear that the response of oil yields follows, to a great extent, the response of fruit yields to the N fertilization programs, and the highest increases in oil yields were obtained by the application of N fertilization program that contained 1/3 of the recommended N rate as TOMF. These results led to the general conclusion that using the TOMF in the N fertilization program at a rate up to 2/3 of the N recommended rate could be of great influence on oil contents and oil yield of the studied aromatic fruit plants.

Table(9): Effects of N fertilization programs on oil percentage and oil yield of studied crops.

N fertilization programs	Oil%			Oil yield (kg/fed)		
	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
P1	3.53	0.27	2.12	1.92	1.00	6.49
P2	4.63	0.32	2.78	9.36	2.82	25.70
P3	4.60	0.30	2.76	10.13	2.74	25.93
P4	5.03	0.33	3.02	9.83	2.23	21.59
P5	3.93	0.31	2.36	6.04	1.94	12.47
P6	4.23	0.30	2.54	14.66	3.81	26.85
P7	4.83	0.31	2.90	16.23	3.59	28.33
P8	4.23	0.30	2.52	6.93	1.91	16.49
LSD 0.05	0.26	0.03	0.32	0.58	0.29	2.93

Having a high amount of soluble K and micronutrients (Table2) could be a good explanation for the enhancement effects of TOMF on oil contents and oil yields of the studied aromatic fruit crops. TOMF could also contain high proportions of hormones- and enzymes-like substances that could have great effects on the growth and the efficiencies of the metabolic processes that related to either the plant nutrients acquisition and uptake or nutrients utilizations and assimilations inside the plants. These points need more and deep research work to elucidate these effects.

5: Effects of N fertilization programs on apparent nitrogen recovery and nitrogen use efficiency:

Fertilizing without economical production means lowering farm profitability and missing of resources, all farmers aimed to increase productivity from each added fertilizer unit.

The ANR measured the amount of N taken up by plants due to the application of N fertilizer. While nitrogen uses efficiency, (NUE) reflects the ability of treated plants to assimilate N and accumulate dry matter. It was calculated as kg total biomass produced per each unit of fertilizer N applied. The nitrogen uses efficiency (NUE) was calculated according to Mekail *et al.* (2006).

The apparent nitrogen recovery and nitrogen use efficiency by cumin and coriander as well as caraway were decreased due to increasing the organic form in relation to mineral nitrogen form.

The data in Table (10) demonstrate the effects of mineral and organic fertilizers either alone or in combinations with different rates on the apparent nitrogen recovery and nitrogen use efficiency by cumin, coriander and caraway. The obtained data reveal the apparent nitrogen recovery and nitrogen use efficiency by cumin and corianders as well as caraway were decreased due to increasing the organic form in relation to mineral nitrogen form. The maximum values of ANR and NUE were obtained by using the N fertilization program that includes 1/3 of N recommended rate as TOMF. Meanwhile, the minimum values were obtained by application FYM only as an N fertilizer, followed by TOMF. Moreover, using the TOMF in N fertilization programs was superior in increasing ANR and NUE of all studied aromatic fruit crops compared to FYM at all rates of substitutions. These results explain the role of partially substitution of mineral N by organic N on increasing the efficiency of the N fertilization program applied to the aromatic fruit crops (Chung *et al.*, 2000). The effects of partial replacement of mineral-N by organic fertilizers on increasing ANR and NUE are well documented by Ashorabadi *et al.* (2003) on fennel and Salem, and Awad (2005) on coriander.

Table(10): Effects of N fertilization programs on apparent nitrogen recovery and nitrogen use efficiency of the studied aromatic fruit crops.

N fertilization programs	Apparent Nitrogen Recovery (ANR)			Nitrogen Use Efficiency (kg biomass /kg N) (NUE)		
	Cumin	Coriander	Caraway	Cumin	Coriander	Caraway
P2	0.064	0.197	0.282	2.10	10.66	14.52
P3	0.076	0.245	0.309	2.73	12.82	14.98
P4	0.056	0.119	0.271	1.85	4.06	13.95
P5	0.036	0.089	0.242	0.88	2.16	12.76
P6	0.144	0.421	0.350	5.85	24.55	16.35
P7	0.128	0.363	0.304	5.46	22.46	14.85
P8	0.043	0.104	0.266	1.11	2.80	13.64

References

Abd El-Latif, T.A. 2002. Effect of organic manure and biofertilizer on caraway plants (*Carum carvi*, L.). J. Agric. Sci. Mansoura Univ., 27 (5): 3459-3468.

Abd-El-Maboud, F.A. 2004. Improvement of soil properties through use of some amendments applications. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Ahmed, M.M.M, and E.B.A. Osman. 2003. Response of peanut plants grown a sandy calcareous soil to fertilization with farmyard manure and organo-mineral fertilizer prepared from some sugar cane wastes. Assiut. J. Agric. Sci., 34 (6): 337-347.

Aly, M.S. 2002. Effect of organic and mineral fertilization and their combination on *Coriandrum sativum*, L. plants. Minufiya J. Agric. Res. 27 (5): 1263-1274.

Aly, M.S. 2003. Effect of organic fertilizer (FYM) and/or some percentage of NPK fertilizer on fennel plants. Minufiya J. Agric. Res., 28 (4): 3215-3226.

Arafat, S.M. 1998. Evaluation of fertilizing efficiency of bagasse ash and its effect on faba bean growth. J. Agric. Sci. Mansoura Univ., 23 (2): 919-926.

Ashorabadi, E.S., A. Matin, and B. Abbaszadeh. 2003. Effects of manure and fertilizers in nitrogen efficiency in fennel (*Foeniculum vulgare* Mill.). Iranian Journal of Medicinal

and Aromatic Plants Research. 19 (3): 313-329.

Atia, N.A. 2007. Residual effect of organic and inorganic nitrogen fertilizers on wheat yield production and sandy soil fertility. J. Agric. Sci. Mansoura Univ., 32 (5): 4139-4154.

Bashandy, S.O. 2007. Recycling of date palm wastes as a source of organic fertilizer. M. Sc. Thesis, Fac. of Agric., Minia Univ., Egypt.

Bayoumi, N.A., T.T. Mahrous, and H.A. Madkour. 2003. Effect of mineral, organic and bio-fertilizer on growth and yield of fennel plants. J. Agric. Sci. Mansoura Univ., 28 (1): 603-616.

Black, C.A. 1965. Methods of Soil Analysis. Amer. Soc. of Agron., Madison, Wisconsin, USA.

Bokhtiar, S.M., and K. Sakurai. 2005. Effects of organic manure and chemical fertilizer on soil fertility and productivity of plant and ratoon crops of sugarcane. Archives of Agronomy and Soil Science. 51 (3): 325 – 334.

Chung, R., C. Wang, C. Wang, and Y. Wang. 2000. Influence of organic matter and inorganic fertilizer on the growth and nitrogen accumulation of corn plants. J. Plant nutrition, 23 (3): 297-311.

Desoki, A. H. 2004. Recycling of some Agricultural wastes and their utilization in bio-organic agriculture. Ph.Sc. Thesis, Fac. Agric., Ain Shams Univ., Egypt.

El-Etr, W.T., L.K.M, and E.I. El-Khatib. 2004. Comparative effects of bio-compost and compost on growth, yield and nutrients content of pea and wheat plants grown on sandy soils. Egypt. J. Agric. Res., 82 (2): 73-94.

El-Ghadban, E.A.E., A.M. Ghallab, and A.F. Abdel-Wahab 2003. Effect of organic fertilizer and bio-fertilization on growth, yield and chemical composition of marjoram plants under newly reclaimed soil conditions. J. Agric. Sci. Mansoura Univ., 28 (9): 6957-6973.

Elgharably, A.G. 2002. Response of corn and wheat to fertilization with mixtures of certain sugar industry wastes. M.Sc. Thesis, Faculty of Agric., Assiut University.

Elsharawy, M.A.O., M.A. Aziz, and L.K.M. Ali. 2003. Effect of the application of plant residues composts on some soil properties and yield of wheat and corn plants. Egypt. J. Soil. Sci. 43 (3): 421-434.

Freed, R.P., S.P. Eisensmith, S. Goelz, D. Reicozky, W.W. Smail and P. Woberg. 1987. MSTAT. A Softwar Program

for Design, Management and Analysis of Agronomic Research Experiments. Dep. Crop and Soil Sci; Michigan Stat University, USA.

Guenther, E. 1961. The Essential Oils. New York, London: D. Van Nostrand Co., III. 4th ed.

Jackson, M.L. 1973. Soil chemical analysis. Prentice-Hall, Inc. Englewood Cliffs, N.J. New Delhi.

Kaur, K., K.K. Kapoor, and A.P. Gupta. 2005. Impact of organic manures with and without mineral fertilizers on soil chemical and biological properties under tropical conditions. J. Plant Nutrition and Soil Sci. 168 (1): 117-122.

Mahmoud, M.R. 2000. The role of organic wastes and potassium fertilizer in soil fertility and product and nutrients content of barley crop in sandy soils. J. Agric. Sci. Mansoura Univ., 25 (9): 5941-5954.

Massoud, H.Y.A. 2007. Evaluation of some varieties of *Ocimum basilcum* L. and their response to some organic manures. J. Agric. Sci. Mansoura Univ., 32 (4): 2863-2880.

Mekail, M.M. 2006. Evaluation of some natural organic wastes as amendments for virgin coarse texture soils.4- Date palm trees wastes, composting and compost fertilizing value. Minia J. of Agric. Res. & Develop., 26 (1): 1-26.

Mekail, M.M.; H.A. Hassan and W.S. Mohamed. 2006. Integrated supply system of nitrogen for wheat grown in the newly reclaimed sandy soils of west El-Minia: Efficiency and economics of the system. Minia J. of Agric. Res. & Develop., 26 (1): 101-130.

Mohamed, W.H., and M.A. Hussein. 2005. Effect of some organic fertilizers and sulphur application on root yield and nutrient uptake of sugar beet in relation to some soil tests. J. Adv. Agric. Res (Fac. Agric. Saba Basha)., 25 (6): 3541-3558.

Morsy, M.A., and G.M. El-Dawwey. 1999. Evaluation of some amendments soil conditioners for sandy soils of Egypt. J. Agric. Sci. Mansoura Univ., 24 (9): 5129-5140.

Parkinson, J.A., and S.E. Allen. 1975. A wet oxidation procedure for the determination of nitrogen and mineral nutrients in biological material. Commun. Soil science and plant analysis 6: 1-11.

Patel, B. S.; A. U. Amin and K. P. Patel. 2004. Response of cumin (*Cuminum cyminum*) to integrated nutrient management. Indian Journal of Agronomy. 49 (3): 205-206.

Piper, C.J. 1950. Soils and plant analysis. Inter. Sci. Publishers, Inc. New York.

Salem, A.G., and A.M. Awad. 2005. Response of coriander plants to organic and mineral fertilizers fertigated in sandy soils. Egypt. J. Agric. Res., 83 (2): 829-858.

Soliman, W.S.A. 2000. Influence of organic matter addition to sandy soil on henna (*Lawsonia alba*, Lam.) yield and quality. M. Sc. Thesis, Fac. Agric., Assiut Univ., Egypt.

Zanouny, I. 2003. Cultivation of virgin desertic land of West Minia with integrated management system. 1- The direct effect on wheat yield and some properties of post-harvest soil. Minia J. of Agric. Res. & Develop., 23 (2): 271-284.

Assiut J. of Agric. Sci. 40 Special Issue (3 rd Conference Of Young Scientists.
Fac. of Agric. Assiut Univ. April .,28, 2009.)(179-207)

برنامج تسميد نتيروجيني لتقليل استخدام النيتروجين في انتاج محاصيل البذور العطرية

ايمن محمد احمد حسن***، حسانين جمعة حسانين*، حسين محمد علي راغب*
، محمد محمود محمد احمد**

* استاذ خصوبة التربة وتغذية النبات-قسم علوم الاراضي والمياه- جامعة اسيوط

** باحث اول- معهد بحوث الاراضي والمياه والبيئة- مركز البحوث الزراعية-الجيزة-مصر

*** مساعد باحث- معهد بحوث الاراضي والمياه والبيئة- مركز البحوث الزراعية-الجيزة-مصر

اجريت تجربة حقلية خلال الموسم الشتوي ٢٠٠٥/٢٠٠٦ بمحطة البحوث الزراعية بالخارجة-محافظة الوادي الجديد-مصر لدراسة تاثيرات ٨ برامج للتسميد النيتروجيني مصمم على اساس الاحلال الجزئي للسماد النيتروجيني المعدني بالسماد العضوي على النمو ومحصول الثمار ومحتواها من الزيت لثلاثة محاصيل ثمار عطرية وهى الكمون والكسبرة والكراوية. استخدم سمادان عضويان وهما السماد البلدي وسماد التكاملية العضوي المنتج من مخلفات صناعة السكر. في كل البرامج المجربة اضيف النيتروجين بمعدل ٨٠ كجم نيتروجين للفدان (المعدل الموصى به لهذه المحاصيل). وكانت برامج التسميد النيتروجيني كالتالي: ١-كنترول (بدون اضافة نيتروجين) ٢- ٨٠ كجم نيتروجين (سماد معدني فقط) ٣- ١/٣ سماد بلدي+ ٢/٣ نيتروجين معدني ٤- ٢/٣ سماد بلدي+ ١/٣ نيتروجين معدني ٥- ١٠٠% سماد بلدي ٦- ١/٣ سماد التكاملية+ ٢/٣ نيتروجين معدني ٧- ١/٣ سماد التكاملية+ ٢/٣ نيتروجين معدني ٨-١٠٠%سماد التكاملية. وقد تم خلط السماد العضوي في الطبقة السطحية (٢٠سم) تحت خطوط الري بالتنقيط وباقي الاحتياج النتيروجيني حقن مع ماء الري في ١٢ جرعة متساوية في صورة نترات امونيوم بفاصل اسبوع واحد. وقد حصدت النباتات قبل اكتمال النضج. تم تقدير الكمية الكلية للمادة الجافة ومحصول البذور والتحليل الكيماوي لكل من التربة والنبات واستخلاص الزيت من البذور. ايضا تم تقدير االنيتروجين والفوسفور والبوتاسيوم الممتص بواسطة النبات كذلك محتوى البذور من الزيت.

وقد ادى استخدام برنامج التسميد المحتوي على ١/٣ الاحتياج النيتروجيني الموصى به من السماد البلدي او سماد التكاملية الحصول على اعلى محصول للمادة الجافة و الثمار والزيت للمحاصيل الثلاث المدروسة. كان سماد التكاملية افضل من السماد البلدي في تأثيره على النمو ومحصول الثمار والزيت للمحاصيل الثلاثة. وقد كانت الاختلافات محدودة بين برامج االتسميد النيتروجيني المحتوية على ١/٣ او ٢/٣ النيتروجين الموصى به في صورة عضوية في تاثيرها على النمو ومحصول الثمار والزيت. لذلك تحت ظروف الخارجة بالوادي الجديد وباستخدام الري بالتنقيط يمكن التوصية باستخدام برنامج للتسميد النيتروجيني يحتوي على ٢/٣ من النيتروجين الموصي به في صورة سماد بلدي او سماد التكاملية لمحاصيل الكمون والكسبرة والكراوية لتقليل استخدام السماد النيتروجيني المعدني.