J. Agric. Sci. Mansoura Univ., 28(1):617- 628, 2003

THE EFFECT OF SOME MACRO AND MICRONUTRIENTS ON YIELD AND OIL YIELD OF SWEET BASIL GROWN IN SANDY SOILS

Madkour, H. A.;T. T. Mahgoub and R.A. Drar
Soil, water and Inviron. Research Institute, Agricultural Research Center, Giza, Egypt

ABSTRACT

A field experiments was conducted in sandy soil at South El-Tahrir province during two successive seasons to study the influence of macro and micronutrients on dry matter yield, oil content and nutrient contents and uptake of sweet basil plants (ocimum basilicum L.)

Results show that basil plant height was significantly affected by the applied fertilizer (NPK, Fe, Mn and Zn) either at the first or second cut.

*) Micronutrients fertilizers generally showed a beneficial influence on enhancing the dry matter yield of leaves and stems in the two seasons.

*) The best treatment in increasing oil % was the chelated Zn, Mn, Fe + NPK.

*) Application of NPK and the used micronutrients (Fe, Mn and Zn) remarkably increased N and P concentration either in the first and second cut of basil plants or in the first and the second season of planting. The same trend was found in nitrogen and phosphorus uptake.

*) Zn application in the form of EDTA showed the highest effect in augmenting K concentration and uptake.

*) Application of micronutrients and NPK pronouncedly augmented the iron content and uptake by basil plant leaves.

*) Zn and Mn application in chelated forms increase Zn and Mn concentration in plants.

Keywords : Macro and micronutrient, yield, concentration and uptake, oil yield sweet basil.

INTRODUCTION

Aromatic plants and their essential oils are considered one of the most important exports which support our national economy. The production acreage of such aromatic plants is annually increasing.

Sweet basil cocimum basilicum L.), is economically significant herb plant grown in Egypt for commercial export. Sweet basil, an annual herb, is grown far its highly aromatic leaves, which are dried and exported, or sufected to steam distillation far the extraction of essential oils. The oil is used in flavouring confectionery, food , condiments, dental creams and mouth washes.

Sweet basil grown in sandy soils has received little attention on the nutrition of macro and micro-nutrients. The growth of sweet basil grown in sandy soils suffer from moderate to severe deficiencies of nutrients.

Singh *et al.* (1989,b) found that N fertilizer at the rate 50-200 kg N/ha significantly effect on herbage yield. Harnok (1982) stated that NPK affect significantly on sweet basil yield.

Hassan (1988) mentioned that nitrogen and phosphorus pramated basil plant growth.

Misra and Sharma (1991) and El-Ghadban (1994) pointed out that micronutrients remarkably augmented plant growth and oil content of basil plants.

Ichimura *et al*, (1995) found that yield of sweet basil and P concentration in leaves and soil increased with increasing rate of P. Refaat and Saleh (1997) pointed out that plant growth was reduced by increasing intervals between irrigation treatment. Irrigation schedule also influenced essential oil yield and composition. The highest yields of essential oil/feddan were obtained from plants with the shortest irrigation intervals.

They also found that, the application of folifertile promoted growth and increased essential oil yield. Folifertile at 3000 ppm was the best treatment.

The aim of this study to find out the optimum application of NPK fertilizer and certain micronutrients for sweet basil in respect to both yield and oil content.

MATERIALS AND METHODS

A field experiments was conducted in sandy soil at South El-Tahrir province during two successive seasons to study the influence of macro and micronutrients on dry matter yield, oil yield and nutrient contents and uptake of sweet basil plants (ocimum basilicum L.). The soil of the experimental field is sandy, the main physical and chemical characteristics of the soil are presented in table (1).

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

a)Physical Properties

$CaCO_3$ %	W.H.C %	Partical size distribution %				Textural grade	Field Capacity
		Coarse sand	Fine sand	Silt	Clay		
4.5	14.9	54.2	34.3	8.3	3.2	Sandy	8.94

b) Chemical properties

PH in	E.C.	Soluble cations and anions meq/L.								Available nutrients					
1:2.5	DSm^{-1}	Cations				Anions				N	P	K	DTPA extratable		
In susp.		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$	%	ppm	Meq/100g	Fe ppm	Mn ppm	Zn ppm
7.9	1.5	6.4	2.8	5.7	0.1	0.8	6.4	6.0	1.8	0.01	0.4	9.5	4.1	1.3	0.9

The experiment consisted of 14 treatment of NPK and micronutrients as follows :

1)Control (without fertilization).
2)NPK at the rate of (61 kg N/fed, 20.3 kg P/fed and 59 kg K/fed).
3)NPK + Z1
4)NPK + Z2

5)NPK + Z3
6)NPK + Mn1
7)NPK + Mn2
8)NPK + Mn3
9)NPK + Fe1
10) NPK + Fe2
11) NPK + Fe3
12) NPK + (Zn1 + Mn1 + Fe1)
13) NPK + (Zn2 + Mn2 + Fe2)
14) NPK + (Zn3 + Mn3 + Fe3)
Zn, Mn, Fe 1 , 2 , 3 equal 100, 200, 300ppm

Phosphorous fertilizer was added during soil management before transplanting. Potassium fertilizer was added as potassium s ulphate in two doses, the first dose before transplanting and the second dose after the first cut.

Nitrogen fertilizer was added in three doses, the first dose was added after one month of planting, the second and third dose were added after the first and second cut respectively.

Three micronutrients, Iron, manganese and zinc were added as a foliar application as EDTA form. The chelated forms were EDTAFe(6%), EDTA-Mn (15%) and EDTA-zn (14%0. These micronutrients were sprayed in aqueous solution (400 liter/feddan) at a rate of (1) 100, (2) 200 , (3) 300 mg/L of each element. The foliar application were applied after one month of planting, after the first cut and finely after the second cut of plants. The experiments was designed in a complete randomized block design with four replications. The experimental plot area 2 O 2 m prepared containing rows of 50 cm a part the spacing between plants was 50 cms. Seed of sweet basil were sown and after 40 days from germination uniform seedlings were transplantied to experimental plants on one side of the ridge.

Two cuts were obtained from the growing plant during every season. The cutting was performed for vegetative parts of the sweet basil plants 10 cm alone soil surface. The following data were recorded.
1)Plant height.
2)Herb fresh weight/plant.

Dry matter was obtained by drying the fresh material in a drying oven at 70 °C to a constant weight.

Soil chemical analysis was determined using method reported by Jackson (1967), Particle size distribution was determined using international Pipett methods according Richards (1954). The essential oil content determined on freshly and dried cut of basil plants by hydrodistillation with modified clevengertrap according to the method described in ASTA (1985).

RESULTS AND DISCUSSION

1) Plant height :

Plant height (Table 2) was significantly affected by the application of fertilizer (NPK, Fe, Mn and Zn) either at the first or second cut. NPK application increased plant height by about 12.9 and 10.6% of the first and second cut respectively in comparison with control.

EDTA-zn fertilization at a rate 300 mg/L elongated plant heigh by 61.3 and 56.2% more than the control for the two cuts. Addition of chelated Mn fertilizer at a rate 100 mg/L resulted in a significant enhancement of plant height for the two cutting. The maximum plant height (55.1 cm) was obtained during the 2[nd] cut, where the minimum plant height was induced at the application of 300 ppm Mn. Concerning the affect of Fe fertilization, application of 200 ppm Fe gave the greatest increase in the plant height.

Table (4) demonstrated also that the three levels of combined fertilizer (Fe + Zn + Mn) significantly, enhanced the plant height.

Table (2) : Plant height, fresh weight of basil plants as affected by macro and micronutrients application.

Season	First season				Second season			
Treatments	Plant hight		Fresh weight Gm/plant		Plant hight		Fresh weight Gm/plant	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	37.2	39.0	160.5	171.9	38.3	40.1	163.5	174.8
NPK	42.0	43.2	217.5	222.9	42.7	42.9	220.6	225.7
Zn1 +NPK	51.6	53.0	239.3	271.6	52.6	53.4	241.5	273.7
Zn2 + NPK	58.3	59.8	269.0	334.3	58.7	60.7	271.4	335.1
Zn3 + NPK	60.0	60.9	278.3	447.0	61.1	61.1	281.1	448.0
Mn1 + NPK	53.0	53.2	278.0	308.3	54.0	54.0	281.4	310.1
Mn2 + NPK	43.3	42.0	248.0	220.6	44.4	43.0	250.1	223.9
Mn3 + NPK	40.6	39.6	174.0	160.7	41.7	40.5	176.1	163.8
Fe1 + NPK	51.0	53.0	220.0	245.0	52.0	54.0	223.1	248.0
Fe2 + NPK	57.0	59.0	270.0	370.0	58.1	60.0	272.3	373.0
Fe3 + NPK	45.0	44.3	130.0	303.3	46.0	45.3	132.0	306.3
Zn1+Mn1+Fe1+NPK	53.7	54.7	264.0	285.0	53.7	54.8	266.1	290.1
Zn2+Mn2+Fe2+NPK	55.1	58.0	312.0	401.7	55.0	58.2	3650	403.7
Zn3+Mn3+Fe3+NPK	51.1	59.0	266.0	171.6	52.0	50.6	271.0	173.8
L.S.D 0.05	3.77	2.6	13.05	14.75	2.39	2.7	13.07	14.84
0.01	3.16	-	17.38	19.69	3.17	-	14.49	19.66

2) Weight of the fresh herb :

Table (2) revealed that the fresh weight of two cutting was significantly affected by the applied fertilizers. NPK increased fresh weight of herb by 35.5 and 39.5% compared with the control in the first and second cut, respectively. Zn fertilization affect on fresh weight of herb was also significant. The greatest values were obtained at 300 ppm Zn application, Mn application Table (2) significantly enhanced the herb fresh weight foliar application of 100 ppm Mn increased fresh weight by 39.5% for the firest cutting and 19% for the second cutting. Iron fertilizer Table (2) considerably promoted herb fresh weight. The greatest increases over the control was 68.2 and 15.2% for the two cutting Table (2) demonstrated the three levels of combined fertilizer (Fe + Zn + Mn) on the herb heights. Data show that the heights increase was obtained at the applied, level 200 ppm; such increase was estimated by 94.4 and 133.7% for the two cuttings, respectively. This enhancing effect of applied micronutrients with NPK on the herb fresh weight attributed to its effe4ct on the enzymes activity which have a efrfective role on the process of the plant herb photosynthesis (Marschner, 1986). Similar results are in agreement with the finding.

3) Dry matter yield :

Table (3) showed no significant enhancement on dry matter yield of leaves in the both seasons of growth either in the first as the second cut with NPK application. Howevere, the dry matter of stems of the first cut significantly enhanced in both seasons of growth.

Table (3) : Leaves dry weight and oil content % of basil plants as affected by application of macro and micronutrients.

Treatments	First season						Second season					
	Leaves dry wt Gm/plant		Stems dry wt Gm/plant		Oil content %		Leaves dry wt Gm/plant		Stems dry wt Gm/plant		Oil content %	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	24.8	12.1	7.5	10.5	1.9	1.20	25.2	13.0	8.5	11.5	1.19	1.21
NPK	32.0	18.2	14.5	11.7	1.31	1.32	33.7	19.0	0.4	12.6	1.31	1.33
Zn1 +NPK	36.4	24.3	14.3	16.4	1.56	1.61	36.9	24.9	15.0	17.0	1.66	1.62
Zn2 + NPK	38.3	32.8	16.2	16.6	1.57	1.73	39.1	33.7	16.9	17.1	1.58	1.73
Zn3 + NPK	47.8	52.4	20.9	19.6	1.51	1.75	48.3	53.0	21.3	20.1	1.62	1.76
Mn1 + NPK	44.0	27.8	19.0	16.4	1.62	1.79	45.1	28.4	20.1	17.5	1.63	1.79
Mn2 + NPK	35.1	22.1	15.3	11.5	1.43	1.46	36.1	22.9	16.0	12.1	1.64	1.47
Mn3 + NPK	24.0	17.3	11.0	8.3	1.10	1.19	24.0	18.1	11.6	9.0	1.44	1.20
Fe1 + NPK	37.2	20.3	14.1	13.5	1.33	1.36	38.0	21.0	15.0	14.0	1.11	1.37
Fe2 + NPK	40.5	49.6	16.8	25.7	1.65	1.70	41.0	50.0	17.1	17.3	1.34	1.71
Fe3 + NPK	17.6	23.9	4.8	8.9	1.16	1.59	18.0	24.3	9.1	9.2	1.65	1.59
Zn1+Mn1+Fe1+NPK	44.4	26.4	18.6	24.8	1.40	1.54	45.3	27.1	19.2	24.3	1.61	1.55
Zn2+Mn2+Fe2+NPK	46.2	39.5	19.1	21.0	1.70	1.80	47.0	40.1	20.2	22.0	1.41	1.81
Zn3+Mn3+Fe3+NPK	35.5	19.4	17.5	8.3	1.31	1.40	34.1	20.4	18.3	9.1	1.71	1.40
L.S.D 0.05	11.17	8.75	4.04	5.3			11.18	8.58	4.13	5.4	0.149	0.089
0.01	14.87	-	5.38	-			14.91	-	5.39	-	0.199	0.118

Micronutrients, generally showed a beneficial influence on enhancing the dry matter yield of leaves and stems in the two seasons.

The foliar spray of Zn3 with NPK gave the highest increase of the leaves dry weight (333.3%) in the second cut at the first season compared to the control). The highest rate of Mn3 with NPK slightly reduced the dry matter of leaves. The data revealed that Zn3 was the most beneficial effect on the dry matter yield of plant in both season in the followed descendingly with Fe2 and Zn, Fe, Mn, application, except the treatment of Zn2, Mn2, Fe2 excelled the Zn1, Mn1, Fe1 treatments in enhancing the dry matter yield of leaves in the second season.

Effect of applied fertilizer on macronutrients content and uptake of basil plant :

1) Nitrogn :

The obtained results in table (4) revealed that the application of NPK and the used micronutrients remarkably increased nitrogen concentration, in the first and second cut of both season of growing. The highest level of applied Mn(Mn3 + NPK) showed the most effective role in augmenting N% compared with control and other treatments. Similar results for the effect of Fe, Zn and Mn on the N concentration in different plant, have been reported by Shoala (1992) on Lemon grass (Cymbopogon Citratus L.) and Morsi (1994) on Ocimum basilicum.

Table (4) : Effect at macro and micronutrients application on NPK % basil plants.

Season Treatments	First season						Second season					
	N%		P%		K%		N%		P%		K%	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	2.13	2.31	0.135	0.211	2.71	2.30	2.14	2.32	0.136	0.222	2.72	2.4
NPK	2.31	2.41	0.166	0.231	3.12	2.90	2.33	2.42	0.167	0.233	3.14	2.93
Zn1 +NPK	3.26	3.06	0.247	0.251	3.13	2.61	3.27	3.07	0.248	0.253	3.12	3.62
Zn2 + NPK	3.13	2.94	0.248	0.281	3.49	2.28	3.14	3.0	0.286	0.282	3.50	3.8
Zn3 + NPK	2.68	2.84	0.224	0.294	4.01	2.87	2.69	2.86	0.225	0.296	4.0	2.8
Mn1 + NPK	2.66	2.43	0.305	0.247	5.15	2.63	2.67	2.41	0.302	0.246	4.1	2.7
Mn2 + NPK	3.24	2.46	0.221	0.242	3.86	2.44	3.25	2.49	0.222	0.243	4.0	2.5
Mn3 + NPK	3.35	2.57	0.201	0.215	3.15	1.31	3.36	2.58	0.201	0.215	3.2	1.3
Fe1 + NPK	2.94	2.85	0.231	0.252	3.39	2.59	3.10	2.9	0.232	0.253	3.4	2.6
Fe2 + NPK	2.94	2.39	0.226	0.263	3.96	2.83	3.2	2.4	0.227	0.264	4.0	2.80
Fe3 + NPK	3.40	3.12	0.226	0.242	3.51	1.60	3.5	2.12	0.226	0.243	3.55	1.61
Zn1+Mn1+Fe1+NPK	2.66	3.26	0.226	0.252	3.51	1.60	2.7	3.13	0.227	0.252	3.61	2.87
Zn2+Mn2+Fe2+NPK	2.11	2.68	0.200	0.110	3.60	2.86	3.13	2.69	0.210	0.110	3.90	2.4
Zn3+Mn3+Fe3+NPK	2.20	3.83	0.205	0.110	3.33	2.80	2.21	3.9	0.206	0.12	3.34	2.9

The combined fertilizer (Fe, Mn and Zn) application showed a beneficial effect on N content of basil plants. Its effect on the second cut excelled that in the first one.

Nitrogen uptake in Table (5) elucidated the same trend of N concentration as affected by the applied micronutrients. However the Zn3 passesed the highest effect on increasing the uptake of N by plants.

Similar result were obtained by El-Ghadban (1994) who found that the N content in the dry herb was generally increased by NPK fertilization with or without the addition of trace elements.

2) Phosphorus :

The effect of NPK and applied micronutrients on P concentration Table (4) displayed the beneficial effect of these fertilizers on p romoting P concentration o f b asil plants. The combined fertilizer in the mineral form at the lowest level (Zn1, Mn1, Fe1) showed the highest effect on increasing P in both seasons. However the higher levels of the combined fertilizer induced a depressive effect on P concentration in the second cut. On contrary many investiator reported the antaganistics effect between Zn and P. Loneragan *et al.* (1979) found that under condition of Zn deficiency and ample supply of phosphorus, the phosphorus uptake increase and toxic concentration of phosphorus may accumulate applied Zn at all levels here in considerably phosphorus concentrations. Wherever, that there is substantial evidence that zinc affects phosphorus metabolism in the roots of plants (Loughman *et al.* 1982) and increases the permeability of the plasma memberanes of root cells to phosphorus (Welch *et al.*, 1982).

Table (5) : Effect of macro and micronutrients application on NPK uptake g/fed.

Season Treatments	First season						Second season					
	N		P		K		N		P		K	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	12.4	6.7	0.79	0.6	15.8	6.7	12.2	6.79	0.79	1.61	16.5	7.7
NPK	18.2	10.5	1.3	1.0	24.6	12.7	18.3	10.56	1.30	1.10	24.4	13.4
Zn1 +NPK	28.8	17.5	2.2	1.5	26.8	14.4	29.0	18.3	0.89	1.00	27.6	15.7
Zn2 + NPK	26.9	23.1	2.6	2.2	26.9	17.6	29.5	24.3	1.20	1.20	32.8	22.6
Zn3 + NPK	26.4	35.7	2.6	3.7	26.4	26.5	31.2	36.7	1.10	1.40	46.3	32.6
Mn1 + NPK	29.6	16.3	3.2	1.6	29.6	16.2	28.9	16.8	1.50	1.00	44.4	18.4
Mn2 + NPK	25.8	13.2	1.9	1.3	25.8	10.1	28.2	13.2	0.9	0.70	34.6	13.7
Mn3 + NPK	15.7	10.7	1.2	0.9	15.7	4.2	20.0	11.0	0.6	0.50	19.2	5.6
Fe1 + NPK	28.4	13.9	2.1	1.2	19.0	17.2	28.0	14.6	0.8	0.90	31.0	13.1
Fe2 + NPK	25.7	28.5	2.2	3.1	25.7	19.1	31.5	28.8	0.90	1.10	39.4	34.8
Fe3 + NPK	15.0	17.9	1.0	1.4	14.9	16.8	15.1	12.4	0.50	0.50	15.3	9.4
Zn1+Mn1+Fe1+NPK	25.5	20.7	2.4	1.6	25.4	20.8	29.3	21.5	1.00	1.50	39.2	18.7
Zn2+Mn2+Fe2+NPK	18.4	25.4	2.2	1.1	18.4	12.4	24.0	26.9	1.00	0.60	43.9	32.7
Zn3+Mn3+Fe3+NPK	17.3	17.8	1.6	0.5	17.3	10.0	18.1	19.1	0.9	0.30	27.3	14.1

The uptake of phosphorus Table (5) illustrated that applied Zn1, Mn1 and Fe1 achieved the highest increase in the P uptake in both seasons. These increases were more than 393% and 115% in the first and second season respectively, in comparison with the control. Also the applied Zn with NPK showed the most beneficial effect in enhancing the uptake of P by basil plants. The high dose of micronutrients (Fe3, Zn3, Mn3) led to decrease the P uptake. This may be attributed to depressive effect of the higher dose of (Zn3, Mn3, Fe3) on the dry matter of plant leaves.

The enhancing effect of micronutrients on the uptake of P are in agreement with El-Chadban (1994) who found that the P contents increased in the middle of each growing season as a result of fertilization with NPK + Zn.

3) Potassium :

Potassium concentration Table (4) demonstrated that application of NPK alon or with Zn and Mn markedly increased K concentration in plant. However, a slight decrease in K contents was occurred with the addition of Fe and (Zn + Mn + Fe). Mn application showed the highest increments in K concentration wherever Mn, enhanced K% by more than 50% in the first cut of both season compared to the control. On the other hand the application of mineral iron on combined nutrients (Zn , Mn, Fe) decreased K% in plants, particularly in the first cut of both season.

The *applied Zn in* the form of EDTA showed the highest effect in augmenting K concentration where the EDTA-Zn3 augmented K% by more than 47% comparison with the control.

The uptake of K (Table 5) showed the same trend, wherever Zn application conciderably promcted K uptake.

4) Iron :

The obtained results in Table (6) elucidated that application of micronutrient and NPK pronouncedly augmented the iron content of plant leaves. Though the higher levels of applied Mn showed its drastic effect on the iron concentration and uptake by plant leaves compared to the other treatments. The dramatical influence of Mn on iron content was report by Marschner (1986). Application of iron tremendously increased iron content of plant leaves.

Table (6) : Fe, Mn and Zn concentration (ppm) of basil plants as affected by macro and micronutrients application.

Season Treatments	First season						Second season					
	Fe		Zn		Mn		Fe		Zn		Mn	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	130.4	133.7	7.5	8.9	65.7	80.6	130.6	134.2	7.7	2.8	66.7	81.0
NPK	169.8	172.9	9.9	11.1	90.3	102.8	171.1	172.0	8.1	5.2	90.5	103.0
Zn1 +NPK	185.1	195.7	27.0	28.9	81.9	116.2	185.0	195.0	24.8	17.4	81.7	117.0
Zn2 + NPK	182.2	194.8	29.1	3.2	77.5	107.6	182.0	193.0	28.2	24.5	78.0	107.7
Zn3 + NPK	180.0	193.1	33.3	34.4	51.7	77.5	182.0	192.0	39.4	44.5	56.0	78.0
Mn1 + NPK	171.1	173.3	17.6	21.1	111.3	124.9	170.0	171.0	19.5	14.7	112.1	125.0
Mn2 + NPK	170.1	171.4	14.3	18.2	129.2	129.1	169.0	170.0	13.0	10.4	130.1	130.0
Mn3 + NPK	166.2	170.5	12.3	14.3	133.5	116.4	166.0	170.0	7.2	6.4	133.7	117.0
Fe1 + NPK	234.2	266.7	11.0	13.1	107.6	120.6	233.0	266.0	10.9	7.1	107.6	121.0
Fe2 + NPK	253.3	283.3	10.6	12.8	86.6	116.2	251.0	282.0	10.8	15.6	87.0	117.0
Fe3 + NPK	274.0	300.0	10.4	12.5	81.6	99.0	273.0	301.0	4.8	7.4	81.2	98.0
Zn1+Mn1+Fe1+NPK	190.0	233.0	12.4	15.3	107.6	120.6	192.0	230.0	14.1	10.1	107.1	120.0
Zn2+Mn2+Fe2+NPK	240.0	266.0	11.3	14.4	116.2	116.2	241.0	267.0	13.5	13.8	115.1	114.0
Zn3+Mn3+Fe3+NPK	260.0	283.0	11.1	14.5	110.1	103.3	261.0	284.0	7.7	7.2	110.1	111.2

Data in Table (6) likewise painted out that the increase in the applied Zn slightly decreased the iron concentration. This may be attributed to the competition between iron and zinc on the uptake sites of the plant leaves. This results are in coincidence with finding of Rosell and Ulrich (1964). The enhancing of iron effect t on iron content was reported by Shalaby and Mashaly (1992).

5) Zinc :

Data in Table (6) displaced that zn concentration was enhanced ascendingly with increasing Zn levels. The same trend was occurred in the case of Zn uptake. The highest level of Zn addition increased the uptake of Zn by more than seven fold in the first cut and fourteen fold in the second cut respectively, in both seasons. Similar results were found by El-Sayed *et al.*, (1988a) and Abo El-Nour (1987) , Mazrou (1991).

Although the application of different fertilizer showed an enhancement for Zn content of basil plant, the higher doses of added Fe and Mn slightly decreased those increments of Zn contents. This may be ascribed to the slightly antagonistic effect between Mn, Fe and Zn, which reported by Mengel and Kinkby (1987).

Likewise the added combined fertilizer (Mn, Zn, Fe) increased the Zn concentration and uptake by plants. However the amount of increases, slightly decreased with the higher level of applied (Mn, Fe, Zn).

These results are in agreement with the findings of Mousa and El-Lakany (1984) and El-Gadban (1994).

6) Manganese :

The obtained results in Table (6) demonstrated that Manganese content increased with raising the levels of manganese fertilizer. These increases were more than 150% in comparison with the control in both seasons, either in the first and the second cut. The same trend for influence of applied fertilizer on Mn concentration by plants were accurred with Mn uptake. Similar results were rerouted by Subrahmanyan *et al* (1991), El-Gadban (1994) and Morsi (1994).

The competition between iron, zinc and manganese also obviously appeared with Mn concentration and uptake. Wherever the concentration of manganese were decreased with increasing the levels of applied Zn and Fe.

Oil Content :

Data in Table (3) elucidated that NPK application significa tly increased the oil percent in the second cut only, by 10% compared to the control.

Micronutrients except Mn3, remarkably augmented oil content in both season either in the first or second cuts. These data are agreement with the data reported by Misra and Sharma (1991) and El-Ghadban (1994).
The best treatment in increasing oil content was the Zn2, Mn2, Fe2 + NPK, where the increased oil % by more than 42% in the two cuts of both seasons, compared to the control.

Table (7) : Fe, Zn and Mn uptake g/feddan by basil plants as affected by macro and micronutrients fertilization.

Season Treatments	First season						Second season					
	Fe		Zn		Mn		Fe		Zn		Mn	
	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
Control	130.4	13.4	4.37	2.58	38.3	23.4	134.0	41.6	4.7	2.8	40.3	25.3
NPK	169.8	172.9	7.82	4.35	71.3	44.9	131.4	78.4	8.1	5.2	73.2	52.1
Zn1 +NPK	161.7	114.0	23.6	16.9	71.5	67.8	163.8	116.4	24.8	17.4	72.0	7.0
Zn2 + NPK	167.3	153.0	26.7	23.8	84.7	98.9	170.8	156.0	28.2	24.5	73.2	87.0
Zn3 + NPK	206.5	242.8	38.2	43.2	59.3	97.4	210.0	244.2	39.4	44.5	66.0	99.0
Mn1 + NPK	180.7	115.6	18.6	14.1	118.2	83.3	184.0	116.5	19.5	14.7	121.0	86.0
Mn2 + NPK	143.2	90.9	12.0	9.7	108.8	68.5	146.4	93.4	13.0	10.4	112.0	71.0
Mn3 + NPK	95.7	70.8	7.1	5.9	76.9	48.3	99.6	73.8	7.2	6.4	80.0	50.8
Fe1 + NPK	209.4	130.0	9.9	6.4	96.0	58.8	212.5	134.0	10.9	7.1	98.0	61.0
Fe2 + NPK	246.2	337.2	10.3	15.2	84.2	138.8	247.0	33.8	10.8	15.6	85.0	140.4
Fe3 + NPK	115.7	172.1	4.4	7.2	34.2	56.8	118.0	68.8	4.8	7.4	35.0	57.2
Zn1+Mn1+Fe1+NPK	202.5	148.6	13.2	3.7	114.7	76.4	208.0	135.7	14.1	10.1	116.0	78.6
Zn2+Mn2+Fe2+NPK	266.1	252.8	12.5	13.7	128.8	110.2	271.0	261.5	13.5	13.8	139.0	109.0
Zn3+Mn3+Fe3+NPK	209.0	132.0	8.9	6.8	90.0	48.1	232.0	104.5	9.7	7.2	90.0	54.4

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تأثير بعض العناصر الكبرى والصغرى على النمو ومحتوى الزيت لنباتات الريحان النامية في أراضي رملية

حسب النبي أحمد مدكور، طه طه محجوب، رشاد عبد المنعم دراز
معهد بحوث الاراضي والمياه والبيئة – مركز البحوث الزراعية

تهدف هذه الدراسة إلى معرفة تأثير إضافة بعض العناصر الغذائية الكبرى NPK والصغرى Zn, Mn, Fe على محصول نبات الريحان ومحصول الزيت ومحتوى النبات من العناصر الغذائية.

أجريت تجربة حقلية بالقطاع الجنوبي لمديرية التحرير لمدة موسمين :

*) بينت النتائج أن أطوال نباتات الريحان تأثرت تأثيراً معنوياً بالتسميد بالعناصر الكبرى أو الصغرى في الموسم الأول أو الثاني.

*) أثر إضافة العناصر الغذائية الصغرى على محصول المادة الجافة للأوراق والسيقان في موسمي النمو.

*) كانت إضافة العناصر الغذائية الصغرى على محصول المادة الجافة للأوراق والسيقان في موسمي النمو.

*) كانت أفضل معاملة لزيادة النسبة المئوية للزيت هي إضافة العناصر الصغرى في صورة مخلبية علاوة على NPK.

*) إضافة العناصر الصغرى والكبرى زاد من تركيز النتروجين والفوسفور في النبات سواء في الحشة الأولى أو الثانية أو في موسم النمو الأول أو الثاني كما وجد نفس الاتجاه في امتصاص النتروجين أو الفوسفور.

*) إضافة الزنك في صورة مخلبية EDTA أظهر أعلى تأثير على زيادة تركيز البوتاسيوم في النبات وكذا امتصاصه.

*) إضافة العناصر الصغرى مع الكبرى NPK زادت من محتوى الحديد وامتصاصه بواسطة نباتات الريحان.

*) إضافة الزنك والمنجنيز في صورة مخلبية زاد من تركيز الزنك والمنجنيز في النبات.