IMPACT OF SOME PREPARED FOLIAR FERTILIZERS ON TOMATO YIELD AND FRUIT QUALITY

Mahmoud Abd El-Gawad*, Ahmed Abd El-Aziz and Ehab El-Sayad***
*Department of Soils and Water, Faculty of Agric. Fayoum University
**Samtrade (Eng. Samir Fahmy companies group)

ABSTRACT

Two field trials were carried out in the Fayoum Faculty of Agriculture Experimental Farms at Dar El-Ramad (clay alluvial soil) and Demo (loamy sand soil) in the early summer seasons of the years 2002 and 2003. The objective of this work was to evaluate the influence of some foliar compound fertilizers prepared by the authors in comparison with two commercial foliar fertilizers on two tomato cultivars (***Lycopersicon esculentum*** **Mill**) namely, Wadistar and Nema.1400. Yield and fruit content of total sugars, total acidity, total dissolved solids (TSS), and lycopene were estimated.

It was generally observed that the compound fertilizers prepared by the authors had better effect on tomato yield/feddan and most of the studied fruit quality characteristics in comparison with those of either the control (recommendation of the Ministry of Agriculture) or the two tested commercial fertilizers.

Results of the present investigation also indicated that the concentrations of Fe,Mn and Zn in plant leaves were considerably greater in Wadistar cv. than those of Nema.1400 cv. plants. This emphasized the differential varietal response of tomato genotypes to micronutrients cations which should be kept in consideration when planning the actual crop requirements of such nutrients. On the other hand, Nema 1400 cv. fruits contained greater concentrations of total sugars, Lycopene and total soluble solids, but less contents of total acidity than Wadistar cv. fruits. Statistical analysis of data showed highly significant positive correlation coefficient between Lycopene content and each of total sugars and TSS concentrations in tomato fruits.

Foliar application with the prepared compound"E" (consisted of N, P, K, Fe, Zn, Mn, citric acid, ascorbic acid and the amino acids cystene, lysine and mithionine, resulted in the greatest total yield per feddan and had the most desirable fruit quality characters followed by "D" which contained N, P, K, Fe, Zn, Mn, citric and ascorbic acids without amino acids.

According to the results of this investigation it could be generally concluded that the compound"E" prepared by the authors was the most effective among the studied foliar spray fertilizers., however further studies should be conducted on large experimental fields for final recommendation in this respect.

Key words: Foliar application – compound fertilizers- Ascorbic acid - citric acid - amino acids - tomato plants.

INTRODUCTION

Tomato is considered one of the most important vegetable crops for local consumption and exportation in Egypt

Based on the cultivated area, Egypt comes the sixth country in the world. Tomato can be grown as a winter, fall and summer crop in Egypt.

The production of several hybrids of tomato seeds in the recent few years increased the need to much research work on such hybrids in Egypt in order to improve yield and fruit quality

Balanced fertilization with both macro and micronutrients is one of the most important factors affecting crop yield and fruit quality.

As early as **1916, Johnson** found that foliar spray with ferrous sulfate ($FeSO_4 - 7H_2O$) at 2-8 per cent in aqueous solution gave temporary recovery from chlorosis. He added that young plants were more subjected to injury from the sprays than older ones, and hence were not safely sprayed at the higher concentration.

Studies of **Parker (1934)** showed that a single spray of one of several zinc compounds, applied at a concentration supplying 1.15 pound of metallic zinc or more per 100 gallons of solution gave complete recovery from mottle leaf for one to three years. Among the effective materials were zinc sulfate, zinc oxide, zinc carbonate, and zinc sulfide.

Parker and Southwick (1941) in California and **Camp and Fudge (1939)** in Florida have found that a single spray of manganese sulfate at 2 to 4 pounds per 100 gallons usually causes complete recovery of chlorotic citrus leaves.

Studies of **Tardea *et al.*, (1986)** on the foliar fertilizer f (4) (NPK + microclements), indicated that P and K are absorbed rapidly by all leaves of Vemone hybrid tomatoes.

The effect of foliar application of some micronutrients (Zn, Mn, Fe and /or B) after 30 and 60 days from transplanting on tomatoes cv. Pusa Ruby was studied by **Bose and Tripathi (1996)**. They indicated that the best growth is obtained as a result of the combined application of these micronutrients.

Studies of **Kaya *et al.*, (2001a)** on three tomato cvs. Rio Grande, Monika F_1 and Morylin F_1, indicated that foliar applications of supplementary 5mM K and P as KH_2PO_4 increases the dry matter of all the studied cultivars, and the increases were greater in Monika F_1 and Marylin F_1 than Rio Grande.

Objective of the present work was to evaluate the influence of some compound fertilizers that were prepared by the authors during this work in the Department of Soil and Water, Faculty of Agriculture at Fayoum on tomato growth, yield and fruit quality

MATERIALS AND METHODS

3.1. Field Experiments:

Two field experiments were conducted in the Fayoum Faculty of Agriculture experimential farms at Dar El-Ramad (clay alluvial soil) and Demo (Loamy sand soil) during the two successive early summer seasons of 2002 on Wadistar cv.and 2003 on Nema.1400 cv. Some characteristics of the studied soils are given in **table 1**.

The influence of some compound fertilizers that were prepared by the authors during this work in the Department of Soil and Water, Faculty of Agriculture at Fayoum on tomato growth,yield and fruit quality was evaluated in comparison with two commercial fertilizers and the recommended rates by the Ministry of Agriculture.

Table 1. Some soil characteristics of experimental fields.

Soil property	Alluvial soil (Dar El-Ramad)		Loamy sand soil (Demo)	
	2002	2003	2002	2003
Particle size distribution				
Coarse sand %	5.2	4.9	58.3	58.3
Fine sand %	20.2	18.6	16.5	16.5
Silt %	30.9	29.9	14.2	14.2
Clay %	43.7	46.6	11.0	11.0
pH in soil paste	7.43	7.43	7.47	7.47
ECe (dSm^{-1}) in soil paste extract	3.29	4.31	4.29	4.29
Organic matter %	2.01	1.24	0.68	0.68
$CaCO_3$ %	4.94	6.13	6.65	6.65
Soluble ions mg /100 g soil				
CO_3^{--}	-	-	-	-
HCO_3^-	3.19	4.16	4.19	5.01
Cl^-	20.11	21.86	22.66	22.66
Ca^{++}	14.02	16.80	17.44	17.44
Mg^{++}	8.67	11.92	11.72	11.72
Na^+	10.46	13.21	12.76	13.85
K^+	0.62	0.93	0.86	0.86
SO_4^{--}	10.47	16.84	15.93	16.26
Total elements				
Total N%	0.46	0.48	0.20	0.20
$NaHCO_3$ Extractable-P	10.13	11.25	10.52	10.52
DTPA-Extractable micronutrients				
Fe, $mgkg^{-1}$	10.30	10.73	3.49	3.49
Mn, $mgkg^{-1}$	14.20	15.70	9.30	9.30
Zn, $mgkg^{-1}$	1.13	1.56	0.11	0.11

Fertilizers were prepared according to some basics among which are:

1- Scientific rules followed in compound fertilizers production.
2- Using local materials of low price, common in Egypt.
3- Free from heavy metal pollutions and / or hormones.

The composition and dose of the studied fertilizers applied in this work are given in **table 2.**

Two cultivar hybrids of tomato (***Lycopersicon esculentum*** **Mill**), namely Wadistar and Nema. 1400 (the most tolerant cultivars to Nemathoda) were chosen for this study.

Tomato seedlings (45 days old) were transplanted in 15th of April 2003. Each plot was fertilized with 30 m^3fed^{-1} organic manure before transplanting, 50Kg/fed. ammonium sulphate $(NH_4)_2SO_4$ (20.6%N), 300 Kg/fed superphosphate 15.5% P_2O_5 and 50 Kg Potassium sulphate (48-52% K_2O).

Foliar sprays were applied 3 times during the growing season 2,5 and 8 weeks after transplanting.

Sixty days after transplanting, ten plants were randomly collected. The area of the fourth leaf from the apex was measured in cm^2 by a Planimeter (Planix tomaya a digital, Model 2107).

At the beginning of flowering samples of ten plants were randomly collected from each plot in the early morning and immediately transferred to the laboratory. Leaf blades were separated, washed with distilled water and dried with paper towels ,then oven dried at 60-70°C for 48 hours, ground to pass a 0.5 mm sieve.

Plant materials were wet digested with sulphuric and perchloric acids mixture at the rate 3: 2 (V/V) respectively as described by **Jackson (1973).** Fe ,Mn and Zn were detemined in plant digests using Atomic Absorption Spectrometer.

At the fruiting stage, red ripe fruits were collected to estimate the total yield/feddan, total acidity,total soluble solids , total sugars and lycopene as descibed by **A.O.A.C (1990)**.

The obtained results were statistically analyzed according to **Snedecor and Cockron (1980).**

Table 2. Composition and dose of the tested chemical compounds in the different treatments.

Foliar spray treatment	Composition of fertilizer	Dose
A	454 ml of Nitric acid (HNO_3 68%)/L 47.4 ml of Orthophosphoric acid (H_3PO_4 85%)/L 474 gm of Potassium hydroxide (KOH)/L	250-500 cm^3fed^{-1}.
B	**A** + 300 g Fe (13.2%, EDTA) 200 g Mn (13 %, EDTA) 200 g Zn (14 %, EDTA)	250-500 cm^3fed^{-1}.
C	**B** + 60 g citric acid.	250-500 cm^3fed^{-1}.
D	**C** + 60g Ascorbic acid.	250-500 cm^3fed^{-1}.
E	**D** + 50 mgL^{-1} L-Methionine 25 mgL^{-1} L- Lysine 10 mgL^{-1} L- cystine.	250-500 cm^3fed^{-1}.
K Allgrow potassium	12%N,3P_2O_5,43%K,1%Mg,0.01%Zn,0.01%Fe, 0.01%Mn,0.10%Cu,0.015%B	250-500 cm^3fed^{-1}.
F Fertigreen	20% N, 20% P_2O_5, 20% K , 1%Zn, 0.025 % Fe, 0.01% Mn, 0.10% Cu, 0.015% B.	250-500 cm^3fed^{-1}.
Absolute control	No fertilizer,Just sprays with water.	
Control (Recommendation of the Ministry of Agriculture for tomato crop)	In the first week 50 kg ammonium sulphate $(NH_4)_2SO_4$ 20.6%N+ 500 Kg Calcium diphosphate $Ca(PO_4)_2$ 15.5% P_2O_5 + 250 Kg Potassium sulphate K_2SO_4 (48% - 52% K_2O)/fed. In the third week 300 Kg ammonium nitrate NH_4NO_3(33.5%N) + 50 Kg calcium diphosphate + 600 g potassium sulphate/fed.	

RESULTS AND DISCUSSION

4.1. Leaf area (LA) of tomato plants.

Results illustrated in **tables (3)** show the effect of foliar applications, soil type and their interactions on leaf area (LA) of tomato plants for Wadistar cv. and Nema.1400 cv.

The general trend of data indicated significant and/or highly significant influence for treatments on plant leaf area. The greatest values of leaf area of Wadistar cv. were observed with treatment "C" followed by "E". For Nema.1400 cultivar, treatment E resulted in the greatest values of leaf area followed by "D". The influence of soil type on plant leaf area was highly significant. Plants grown on the clay soil had greater leaf area than those of the loamy sand. The interaction between soil type and treatments was not significant for Wadistar cv. Plants, however highly significant interaction was found with Nema. 1400 cultivar.

4.2. Tomato fruit yield per feddan.

The mean values of tomato yield in tons per feddan as affected by foliar spray, type of soil and their interactions for both the studied cultivars are given in **table (4)**.

As regards the effect of foliar compound fertilizers on tomato yield per feddan, all treatments mostly recorded significant increases as compared to both the absoluate control and recommended fertilizer rates of the Ministry of Agriculture. Regardless soil type the average yields of Wadistar cv. ranged from (6.800 ton) for the absolute control to (11.600 ton) for tomato plants sprayed with the compound "E" For Nema. 1400 cv., the greatest mean yield was obtained by the use of compound E (10.200 ton) and the lowest was that of the absoluate control (7.680ton) with an average of (8.940 ton/feddan). Statistical analysis showed highly significant increases in tomato yield per feddan as a result of foliar fertilization for both cultivars in the clay and loamy sand soils. The differences between the yield of treatment "E" and those obtained with the two commercial fertilizers K and F were significant or highly significant. The superiority of compound "E" could be explained on basis that this fertilizer contains most of macro and micro nutrients in addition to citric and ascorbic acids, methionine, lysin and cystine. Results could also be due to the role of citric and ascorbic acids as chelating agents for nutrients in addion to the beneficial effects of the used amino acids.

Plants grown on the clay soil generally produced greater tomato yields than those of the loamy sand. This could be due to the differences between the two soils in their fertility and other characteristics **(table 1.)**.

It was also observed that Wadistar cv. plants produced greater tomato yield/feddan as the overall mean yield/feddan was 10.1 ton/feddan for Wadistar and 7.8 ton/feddan for Nema.1400 cv.

Statistical analysis of data showed significant possitive correlation coefficients between plant leaf area and total tomato yield /feddan ($r=0.349^*$ and 0.148 for Wadistar and Nema.1400 respectively). This could be expected since the absorpation of nutrients in case of foliar spray mainly depends upon plant leaf area.

Table 3. Influence of foliar spray applications on the leaf area of Wadistar and Nema.1400 tomato cultivars

Soil texture	Location	Leaf area(cm^2)									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	49.75	50.23	73.31	73.43	78.70	70.20	74.18	45.08	65.58	64.49
Loamy sand	Demo	27.60	30.13	43.83	35.03	52.43	48.93	56.05	30.93	33.95	39.87
Mean		38.68	40.18	58.57	54.23	65.56	59.56	65.11	38.00	49.76	52.18
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	49.73	97.20	87.33	98.23	73.25	108.53	103.75	92.85	81.08	87.51
Loamy sand	Demo	52.13	48.60	57.95	54.85	65.30	51.15	57.20	46.23	57.93	54.86
Mean		50.93	72.90	72.64	76.54	69.28	79.84	80.48	69.54	69.50	71.18

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	9.850	Soil type	5.834
Treatments	20.894	Treatments	13.683
Soils x treatments	n.s.	Soils x treatments	19.350

Table 4. Effect of foliar spray applications on tomato fruit yield per feddan.

Soil texture	Location	Yield (ton/fed.) Wadistar cv. Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	9.900	13.700	13.400	13.400	13.700	13.600	16.500	12.600	13.000	13.300
Loamy sand	Demo	3.700	4.400	5.600	4.900	6.100	6.700	6.800	5.100	4.100	5.300
Mean		6.800	9.000	9.500	9.100	9.900	10.100	11.600	8.900	8.500	9.300
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	9.000	9.720	8.280	12.120	9.240	10.800	11.520	9.240	8.880	9.720
Loamy sand	Demo	6.240	6.600	8.040	7.320	7.800	7.560	8.880	6.720	7.080	7.440
Mean		7.680	8.160	8.160	9.720	8.520	9.120	10.200	7.920	7.920	8.640

Each value represents the mean of 4 replications

Wadistar cv.

L.S.D at 5% level for
Soil type 0.4660
Treatments 0.9880
Soils x treatments n.s.

Nema.1400 cv.

L.S.D at 5% level for
Soil type 0.8184
Treatment 1.9188
Soils x treatments n.s.

The interaction between soil type and foliar spray treatments was not significant for both the studied cultivars.

It is worthy to mention that the obtained values of tomato yield/feddan were relatively low. This could be due to the fact that summer tomato plants generally produces low yield. According to records of the Directory of Agriculture
of Fayoum the average values of summer tomato yield ranged between 6.80 ton/fed. in the year 2002 and 6.89 ton/fed. in the year 2003.

4.3. Iron, zinc and manganese concentrations in plant leaves.

The average values of Fe, Zn and Mn concentrations in dry plant leaves as affected by foliar compounds are given in **Tables (5, 6 and 7)**.

The concentrations of all the three nutrients were generally greater in Wadistar cv. plants than those of Nema. 1400 cv.,this emphasizes the differential varietal response to micronutrients cations which should be kept in consideration when planning the actual crop requirements of such nutrients.

Statistical analysis of data indicated nonsignificant differences between fertilizer treatments for plant leaf content of manganese., however the greatest leaf manganese content was associated with the foliar treatment "E" in wadistar cv. and "D" in Nema. 1400 cv. plants. The influence of fertilization treatments on iron content of plant leaves was significant with Wadistar cultivar and nonsignificant differences were observed with Nema. 1400 cv. plants. The greatest Fe content was associated with the foliar compound" E" followed by "D" for Wadistar and "D" followed by "E" for Nema. 1400 cv. The greatest leaf Zn contents were observed with treatment"K" for Wadistar cv. and "A" followed by "K" for Nema. 1400 cv.

Although the concentations of available Fe, Mn and Zn were more greater in the clay soil than the loamy sand **(Table 1.)**, the influence of soil type on micronutrients contents of plant leaves did not show any specific trend in both cultivars and the interaction between soil type and fertilizer treatments was statistically nonsignificant. These results could be expected since the vegetative growth and interaction between nutrients in plant are of the main factors which affect micronutrients concentrations in leaves. **Kirsch et al(1960)** showed that manganese absorption in tomato plants is influenced by the interactions between Fe and Mn. **Kohno and Foy (1983)** stated that high concentrations of iron decreases the absorption of Mn by some plants.

4.3.1. Tomato fruit quality.

4.3.1.1. Total acidity and lycopene in fresh fruits.

The concentrations of total acidity, total free amino acids in fresh fruits as affected by fertilizer treatments are given in **tables (8&9)**.

Data obtained indicated significant differences in fruit total acidity between treatments. The greatest values were mostly obtained with the control or the absolute control treatments for both cultivars except the case of Nema. 1400 cv. when grown on the loamy sand soil as the treatment "D" resulted in the greatest values. The lowest mean values which are desired for better quality were

Table 5. Effect of foliar spray applications on iron concentration in dry leaves of tomato plants.

Soil texture	Location	Fe concentration (mg kg^{-1})									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	322.00	430.50	432.00	499.50	518.00	548.50	567.50	550.50	566.50	492.78
Loamy sand	Demo	224.00	311.00	331.00	562.50	524.00	563.50	562.00	388.50	371.50	426.44
Mean		273.00	370.75	381.00	531.00	521.00	556.00	564.00	469.50	469.00	459.61
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	367.50	159.50	481.50	378.00	471.00	518.00	318.00	582.00	345.00	441.00
Loamy sand	Demo	395.00	362.50	228.00	516.50	368.00	563.00	683.00	205.50	193.00	410.14
Mean		381.25	261.00	354.75	447.25	419.50	540.50	500.50	393.75	269.00	425.57

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	11.325	Soil type	n.s.
Treatment	24.023	Treatments	n.s.
Soils x treatment	33.974	Soils x treatments	n.s.

Table 6. Effect of foliar spray application on zinc concentration in dry leaves of Wadistar and Nema.1400 tomato cultivars grown on a clay and a loamy sand soils (seasons 2002 and 2003).

Soil texture	Location	Zn concentration (mg kg^{-1})									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	225.00	126.50	134.50	180.00	127.50	256.00	132.50	175.25	220.00	175.25
Loamy sand	Demo	109.00	257.00	57.00	105.50	227.50	207.50	145.00	203.00	106.00	157.50
Mean		167.00	191.75	95.75	142.75	177.50	231.75	138.75	189.13	163.00	166.38
		Nema.1400 cv.									
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	38.50	63.00	39.00	65.50	46.50	106.50	52.50	41.00	25.00	53.06
Loamy sand	Demo	49.50	12.50	111.03	41.00	140.00	62.00	42.00	18.50	36.00	56.95
Mean		44.50	37.75	122.75	53.25	93.25	84.25	47.20	29.75	30.50	54.71

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	n.s.	Soil type	95.494
Treatments	n.s.	Treatment	223.953
Soils x treatments	n.s.	Soils x treatments	316.717

Table 7. Effect of foliar spray applications on Manganese concentration in dry leaves of tomato plants.

Soil texture	Location	Mn concentration (mg kg^{-1})									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	299.00	305.50	228.50	275.00	297.00	243.00	253.50	271.50	204.50	264.17
Loamy sand	Demo	249.50	274.00	221.00	278.00	248.00	200.00	330.50	198.00	248.50	249.72
Mean		274.25	289.75	224.75	276.50	272.00	221.50	292.00	234.75	226.50	256.94
		Nema.1400 cv.									
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	54.00	62.00	47.50	202.50	73.50	167.00	70.50	100.00	125.00	104.32
Loamy sand	Demo	249.50	54.50	215.00	150.50	177.50	241.50	79.00	171.00	115.00	152.64
Mean		151.75	58.25	131.25	176.50	125.50	204.25	74.75	135.50	120.00	128.48

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	n.s.	Soil type	n.s.
Treatments	n.s.	Treatments	n.s.
Soils x treatments	n.s.	Soils x treatments	n.s.

Table 8. Total acidity in fresh tomato fruits.

Soil texture	Location	Total acidity									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	6.87	5.80	3.14	3.22	3.44	3.31	4.79	3.72	4.44	4.30
Loamy sand	Demo	3.50	5.04	2.71	2.40	2.40	2.49	3.56	1.83	3.21	3.01
Mean		5.18	5.42	2.93	2.92	2.92	2.90	4.18	2.78	3.83	3.66
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	0.76	0.70	0.60	0.66	0.63	0.47	0.60	0.66	0.50	0.60
Loamy sand	Demo	1.01	0.98	1.23	1.23	1.11	1.45	0.95	0.95	1.07	1.15
Mean		0.89	0.84	0.91	0.95	0.87	0.96	0.77	0.81	0.79	0.87

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	0.563	Soil type	0.094
Treatments	1.195	Treatments	n.s.
Soils x treatments	1.690	Soils x treatments	n.s.

Table 9. Lycopene concentration in fresh fruits.

Soil texture	Location	Lycopene concentration(mg g^{-1} of fresh fruits)									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	0.02	0.03	0.05	0.09	0.05	0.08	0.01	0.05	0.01	0.04
Loamy sand	Demo	0.05	0.01	0.05	0.03	0.05	0.05	0.05	0.02	0.04	0.04
Mean		0.03	0.02	0.05	0.06	0.05	0.07	0.03	0.03	0.02	0.04
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	0.14	0.17	0.12	0.20	0.17	0.20	0.19	0.16	0.14	0.17
Loamy sand	Demo	0.13	0.18	0.19	0.14	0.18	0.12	0.18	0.18	0.18	0.16
Mean		0.13	0.17	0.15	0.17	0.17	0.16	0.19	0.17	0.16	0.16

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400 cv.	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	0.123	Soil type	n.s.
Treatment	0.260	Treatments	n.s.
Soils x treatment	0.368	Soils x treatments	n.s.

associated with the foliar treatment "E" for Nema. 1400 cv. and treatment "A" for Wadistar cv.

The increase of total acidity concentrations mostly in fruits of the control and absolute control treatments in comparison with other fertilization treatments could be due to the dilution effects of such constituents within fruits of plants fertilized with sufficient amounts of macro and micronutrients which resulted in greater tomato yield per feddan. Statistical analysis of the obtained data showed negative correlation between each of the total acidity and fruit yield per feddan (r = - 277*).

Concerning the influence of soil type, it was found that the interactions between soil type and fertilizer treatments were mostly nonsignificant.

With respect to lycopene content, data given in **table (9)** indicates that the greatest mean of lycopene content in fruits was associated with treatment "D" for

wadistar cv. and "E" for Nema.1400 cv. but the differences between treatments were nonsignificant in both cultivars

Data in **Tables (8&9)** also indicated that Wadistar cv. fruits generally contained greater concentrations of total acidity and lower contents of lycopene than Nema. 1400 cv. plants in both the clay and loamy sand soils.

4.3.2. Total soluble solids percent, total sugars and lycopene in fresh fruits.

Tomato fruit content of total soluble solids "TSS", total sugars and lycopene content are presented in **tables (9, 10 and 11)**.

Although the differences in TSS % between treatments were statistically nonsignificant, the foliar spray with compound "F" and "E" generally resulted in the greatest TSS concentration in fruits.

As for the total sugars content, the effects of treatments were mostly nonsignificant except the case of foliar sprayed plants of Nema.1400 cultivar as the differences between treatments were significant with the superiority of treatments "D" and "E" for Wadistar cv. and "K" and "E" for Nema. 1400 cv. Fruits.

It could be generally concluded from data that foliar spray with the prepared compound "E" and "D" resulted in the greatest mean concentrations of TSS% and total sugars in fruits.

With regard to the influence of soil type on fruit TSS% and total sugars contents, data in **table 10** indicated that plants of the studied cultivars grown on the loamy sand soil contained greater concentrations of TSS in comparison with the control. The effects of soil type on total sugars contents in tomato fruits were of no specific trend and differed according to cultivar.

The interactions between soil type and treatments on fruit contents of TSS, and total sugars were nonsignificant with both tomato cultivars.

Data obtained also indicated that Nema. 1400 cultivar fruits generally contained greater concentrations of total soluble solids, lycopene and total sugars in comparison with Wadistar cv.

Statistical analysis of data showed highly negative correlation coefficients between total acidity and each of TSS %, total sugars and fruit lycopene contents (r = - 0.330**, -0.552** and – 0.729** respectively).

Table 10. Influence of foliar spray applications on the percent of total soluble solids(TSS) in fresh tomato fruits

Soil texture	Location	Total soluble solids(TSS)									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	4.13	4.38	4.75	4.25	3.50	4.25	4.38	4.38	3.88	4.21
Loamy sand	Demo	3.38	5.75	4.75	4.63	5.00	5.00	6.13	5.38	6.75	5.42
Mean		4.75	5.06	4.75	4.44	4.25	4.63	5.25	4.88	5.31	4.81
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	4.88	5.50	5.50	5.63	5.25	4.75	6.00	4.75	4.38	5.24
Loamy sand	Demo	5.25	5.25	6.25	5.25	5.63	6.00	6.38	5.25	5.00	5.63
Mean		5.06	5.38	5.88	5.44	5.44	5.38	6.19	5.00	4.69	5.43

Each value represents the mean of 4 replications

Wadistar cv.		Nema.1400	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	0.569	Soil type	0.357
Treatments	n.s.	Treatments	n.s.
Soils x treatments	n.s.	Soils x treatments	n.s.

Table 11. Effect of foliar spray applications on the total sugar content in fresh tomato fruit.

Soil texture	Location	Total sugars									Mean
		Wadistar cv.									
		Absolute control	Control	A	B	C	D	E	K	F	
Clay	Dar El-Ramad	10.30	14.16	8.75	16.12	8.12	16.35	13.14	11.91	7.04	11.76
Loamy sand	Demo	4.60	4.93	4.43	4.38	5.03	4.28	5.05	4.95	4.65	4.70
Mean		7.45	9.54	6.59	10.25	6.57	10.31	9.09	8.43	5.84	8.23
Nema.1400 cv.											
Soil texture	Location	Absolute control	Control	A	B	C	D	E	K	F	Mean
Clay	Dar El-Ramad	26.96	34.41	5.57	35.98	31.84	24.09	40.66	48.23	20.24	29.37
Loamy sand	Demo	26.56	37.10	34.09	22.29	37.98	30.24	32.18	24.65	31.94	32.87
Mean		26.76	35.75	19.83	29.13	34.91	27.16	36.42	36.44	26.09	31.12

Each value represents the mean of 4 replications

Wadistar		Nema.1400	
L.S.D at 5% level for		L.S.D at 5% level for	
Soil type	2.305	Soil type	n.s.
Treatments	n.s.	Treatments	12.286
Soils x treatments	n.s.	Soils x treatment	n.s.

Highly significant positive corrolations were recorded between fruit lycopene content and each of total sugars (r = 0.328** and TSS% (r = 0.326**).

With regard to the overall influence of the different studied compounds in both the studied soils on both tomato cultivars as based on the greatest values of fruit yield/fed., total sugars, total soluble solids %, lycopene content as well as the values of total acidity, it could be concluded that the compound "E" is the most suitable among all the studied compounds followed by "D". However, one may determine the more suitable compounds from the stand point of economics on basis of costs and benefits. So,further studies on large experimental fields shoud be conducted on such compounds before a final recommendition in order to meet the main purpose of tomato production.

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تأثير بعض الأسمدة الورقية المركبة على محصول وجودة ثمار الطماطم

***محمود عبد الجواد، **أحمد عبد العزيز، *ايهاب الصياد**
* قسم الاراضي والمياه كلية الزراعه جامعة الفيوم
** شركة سامتريد (مجموعة شركات م/سمير فهمى وشركاه)

أجريت هذه الدراسة خلال الموسم الصيفي لعامى ٢٠٠٢، ٢٠٠٣ وذلك بهدف تقييم تأثير بعض أنواع الأسمدة المركبة الورقيه المعده بواسطة القائمين بهذا البحث فى قسم الاراضى بكلية الزراعة جامعة الفيوم على صنفين من أصناف الطماطم الهجين هما صنف وادي ستار ونيماتودا ١٤٠٠ (نيما ١٤٠٠)، وقد تضمنت الدراسة تجربتين حقليتين أجريتا فى المزارع التجريبية بكلية الزراعة بالفيوم وهما مزرعة دارالرماد (تربة طينية) ومزرعة دمو (تربة رملية طميية).
وقد أضيفت المركبات رشا على الأجزاء الخضريه (تسميد ورقى) وإشتملت الأسمدة المستخدمة على سمادين تجاريين لمقارنة تأثيرهما بتأثير الاسمده المعده بواسطة الباحثين
وعلى أساس نتائج المحصول الكلى للثمار/ فدان ومكوناته ومحتوى الاوراق من العناصر الغذائيه وتركيب الثمار وصفاتها تبين من هذه الدراسه أن مركبات الاسمده الورقيه المحضره بواسطة الباحثين قد أدت بشكل عام الى محصول أعلى وصفات جوده أفضل مقارنة بمعاملة الكنترول (توصية وزارة الزراعه المصريه) ومقارنة بالسمادين التجاريين المستخدمين وقد بينت النتائج المتحصل عليها ان تركيزات عناصر المنجنيز والزنك والحديد فى اوراق النبات كانت اكبر فى الصنف وادى ستار مقارنة بالصنف نيما ١٤٠٠ وكانت الفروق كبيره بين الصنفين فى امتصاصهما لهذه العناصر مما يستدعى ضرورة وضع ذلك فى الاعتبار عند حساب الاحتياجات الغذائيه الفعليه لكلا الصنفين من تلك العناصر، ومن ناحيه اخرى وجد ان ثمار الصنف نيما ١٤٠٠ تحتوى تركيزات اعلى من الليكوبين ومن السكريات الكليه والمواد الصلبه الذائبه مقارنة بالصنف وادى ستار، وقد بينت نتائج التحليل الاحصائى وجود ارتباط موجب عالى المعنويه بين محتوى ثمار الطماطم من الليكوبين وكلا من تركيزات السكريات الكليه والمواد الصلبه الذائبه بها.

* تبين أفضلية المركب المحضر E الذى يحتوى على (عناصر النيتروجين والفوسفور والبوتاسيوم والحديد والزنك والمنجنيز وحامضى الستريك والاسكوربيك والاحماض الامينيه المثيونين والليسين والسستين) وتلاه المركب D (الذى يحتوى على نفس المكونات ماعدى الاحماض الامينيه) مقارنة ببقية المركبات الاخرى المستخدمه فى تأثيرهما على المحصول الكلى للثمار /فدان وعلى معظم الصفات الاخرى للاوراق والثمار.

* بالرغم من أن نتائج هذه الدراسه قد بينت أفضلية السماد الورقى E المعد من قبل الباحثين فانه قد يكون من الضرورى ان يوضع فى الاعتبار التكاليف الفعليه والعائد المادى الناتج ونوع التربه، لذلك فانه يلزم أن تجرى تجارب على نطاق أوسع وفى حقول واسعه على هذا المركب قبل اعطاء توصيه نهائيه مناسبه تفى بالغرض الاساسى الذى يرغب فيه منتج محصول الطماطم.