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IRRIGATION AND FERTILIZATION MANAGEMENT FOR MAXIMIZING CROP-WATER EFFICIENCIES OF TOMATO

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ABSTRACT

A field experiment was carried out at El-Roba village, Baltim, Kafr El- Sheikh Governorate, Egypt during two consecutive growing seasons (Late winter seasons 2003/2004 and 2004/2005) to study the effect of irrigation regimes, organic manure and source and levels of nitrogen fertilizers on tomato yield and water efficiency.

The obtained results could be summarized as follows:

The highest values of tomato total fruit yields (34.782 and 32.733 ton fed.$^{-1}$) were obtained from tomato plants irrigated at 1.3 evaporation pan coefficient and fertilized with 10 m^3 chicken manure fed.$^{-1}$ and enciabeen (SRF) at 320 kg N fed.$^{-1}$ in the 1st season and at 240 kg N fed.$^{-1}$ in the 2nd season.

The highest values of N concentration in tomato plants at 70 days from transplanting (4.06 and 4.03 %), P% (0.340 and 0.346 %) and K concentration (3.63 and 3.67 %) were obtained from tomato plants irrigated at 1.3 evaporation pan coefficient with 10 m^3 chicken manure and fertilized with enciabeen at 320 kg N fed.$^{-1}$ in the both seasons.

Results indicated that the amounts of seasonal water consumptive use were (84.73, 71.01 and 58.96 cm) in the 1st season and (87.40, 73.09 and 60.54 cm) in the 2nd season from irrigation at 1.3, 1.0 and 0.7 evaporation pan coefficient, respectively. The highest values of water use efficiency (11.816 and 11.947 kg fruits m^{-3} water consumed by tomato plants) were obtained from tomato plants irrigated at 0.7 evaporation pan coefficient, fertilized with 10 m^3 chicken manure fed.$^{-1}$ and fertilized with enciabeen at 320 and 240 kg N fed.$^{-1}$ in the 1st and 2nd seasons, respectively.

Keywords: Irrigation, N fertilization, organic fertilization, nutrient contents, water use efficiency and tomato.

INTRODUCTION

Tomato is one of the most important vegetable crops grown in Egypt and North Delta for fresh consumption and processing. Optimum soil moisture content plays an important role in yield production. Plant growth and fruit yield will be reduced under high deficit of the available soil moisture especially in vegetative growth.

Nitrogen fertilization is very important for plant growth. El-Atawy (2003) found that the highest yield was recorded in the most irrigated treatment. Sharaf et al. (1999) and El-Atawy (2007) found that irrigation positively influenced tomato yield.

Application of cattle and compost materials increased total yield (Dawa et al., 2000 and Mousa, 2002). Increasing FYM rate up to 40 m3 fed.-1increased total yield and number of fruits plant-1(El-Nagaar, 2004 and El-Beheidi et al., 2006).

Increasing nitrogen fertilizer levels up to 200 kg N fed.$^{-1}$ increased total yield (Abd El-Rahman, 2001 and Mousa, 2002). While, El-Shobaky (2002) found that applied nitrogen fertilizer at the rate of 300 kg N fed.$^{-1}$ increased number of fruits plant^{-1} and fruit yield feddan^{-1}. The present study aims to maximizing crop-water efficiencies.

The effects of two sources of nitrogen fertilizer (urea and enciabeen-slow release fertilizer-) and their levels in relation to irrigation water applied at three different regimes, and organic applications as chicken manure , rice straw compost as well as the control treatment on tomato plants, were also observed.

MATERIALS AND METHODS

Experimental treatments :

The experimental design was split-split-split plot, where the two sources of nitrogen fertilizers (Urea and Enciabeen -slow release fertilizer-) were assigned in the main-plots, three irrigation regimes (1.3, 1.0 and 0.7 evaporation pan coefficient) were situated in the sub-plots, the organic manure was assigned in the sub-sub plots(Chicken manure at 10 m^3 fed.$^{-1}$, compost at 10 m^3 fed.$^{-1}$and non organic manure) and the five nitrogen fertilizer levels (0, 80, 160, 240 and 320 kg N fed.$^{-1}$) were situated in the sub-sub-sub plots. All the experimental treatments randomly distributed on the respective plots.

In each of the two seasons, calcium super phosphate (15.5 % P_2O_5) was applied at the rate of 200 kg fed.$^{-1}$ during the field preparation, while potassium sulphate (48 % K_2O) was applied at the rate of 100 kg fed.$^{-1}$ 6 weeks after transplanting .

The soil was sandy loam, the mechanical and chemical analyses of experimental soil in both seasons are given in Table 1. The chemical analyses of the chicken manure and rice straw compost are shown in Table 2. The chemical analysis of the irrigation water is given in Table 3.

Every experimental unit area was 40 m^2, which contained five ridges of 8m length and 1m width. Tomato seedlings (c.v. Betopride- 2) were transplanted in hills (single plant) of 80 cm apart.

Plant samples: Two competitive tomato plants were randomly taken from the second ridge of each experimental plot after 70 days from transplanting, all samples were dried at 70^oC, ground and digested using wet ashing method by a mixture concentrated H_2SO_4+$HClO_4$ (10:1) according to Chpman and Pratt (1961) to determine the plant content of nitrogen, phosphorus and potassium.

Nitrogen concentration was determined using modified micro – kjeldahl method (Page et al.,1984). Phosphorus was calorimetrically determined by Murphy and Riley (1962) and potassium was determined using flamphotometer (Jackson, 1973).

All fruits harvested from the three center ridges from the remainder fife ridges from each plot allover the harvesting season were counted and weighed to calculate No. of fruits plant^{-1}and the total yield (ton fed.$^{-1}$).

Irrigation treatments :

Potential evapotranspiration by evaporation class A Pan was used .Prevailing weather data of the previous three years of Seedy Salem, Kafr El-Sheikh Governorate were used to estimate the potential evapotranspiration as daily average during the growing seasons of tomato plants. Irrigation was applied according to the daily record of the evaporation pan and the crop was irrigated when the water balance reached zero.

Application of irrigation regime treatments started after life watering.

Soil samples were taken at planting time, just before and after 24 hours from each irrigation and at harvest time for soil moisture determination. At each sampling date, duplicate soil samples were taken from 0-15 , 15- 30 , 30- 45 and 45- 60 cm depths and their moisture contents were determined gravimetrically .

Field capacity and bulk density were determined for the experimental site.

Water consumptive use in each irrigation was calculated according to (Hansin et al., 1979):

$$C.U. = \sum_{i=1}^{1-4} \frac{P_{w2} - P_{w1}}{100} \times D_{bi} \times D_i$$

Where: CU = water consumptive use in the effective root zone (0-60 cm).

i = number of soil layers (15 cm).

P_{w2} = soil moisture % 24 hours after irrigation (in sandy loam soil).

P_{w1} = soil moisture % before irrigation for the specified soil layer.

D_{bi} = bulk density of the specific soil layer.

D_i = soil depth (cm) = 15 cm.

Water use efficiency values were estimated for different treatments as follows (Doorenbos and Pruitt, 1975):

$$W.U.E. = \frac{\text{Total fruit yield (kg fed.}^{-1}\text{)}}{\text{Seasonal ETc (m}^{3}\text{ fed.}^{-1}\text{)}}$$

Table 1 : Mechanical and chemical analyses of soil during both seasons of experimentation :

Season	Physical properties				Chemical properties (soil paste)									
	Sand	Silt	Clay	Texture	EC dSm^{-1}	pH	Soluble cations ($meq\ L^{-1}$)				Soluble anions ($meq\ L^{-1}$)			
							Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}
2003/ 2004	72	15	13	Sandy loam	1.87	7.8	5.4	2.7	9.1	1.3	--	2.34	7.93	8.23
2004/ 2005	73	14	13	Sandy loam	1.92	7.7	5.8	3.1	8.6	1.7	--	2.53	8.17	8.50

Table 2: Chicken manure and rice straw compost analyses

Property	Rice straw compost		Chicken manure	
	1st year	2nd year	1st year	2nd year
Organic matter	32.71	32.62	58.80	60.00
Moisture content %	25.89	26.1	15.11	15.64
pH	7.43	7.49	8.13	8.21
EC (dS m^{-1})	8.12	8.61	4.65	4.78
Total N %	3.93	3.70	3.56	3.76
Total P %	0.91	0.90	2.11	2.23
Total K %	0.63	0.60	1.57	1.38
C/N Ratio	18.6	19.3	15	14

Table 3: Some characteristics of irrigation water

Cations meq L^{-1}				Anions meq L^{-1}				pH	EC dSm^{-1}	TSS	SAR
Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3	HCO^{-}	Cl^{-}	SO_4^{--}		dSm^{-1}		
2.87	4.43	6.7	0.23	---	4.3	4.6	5.23	7.5	1.4	910	3.51

RESULTS AND DISCUSSION

1:Yield and its components :

1-1 :No. of fruits plant^{-1} :

Results presented in Table 4 show that the number of fruits plant^{-1} was significantly affected by irrigation regimes. The highest values (61.5 and 63.2 fruits plant^{-1}) obtained from tomato plants irrigated at 1.3 evaporation pan coefficient in both seasons. It could be concluded that No. of fruits plant^{-1} was increased by increasing available soil water, which lead to increase in vegetative growth as well as carbohydrates and this in turn reduced the No. of fruits set. These results are supported with those obtained by El-Araby and Feleafel (2003), El-Atawy (2007) and El-Hamady et al. (2002).

The data recorded in Table 4 prove that the No. of fruits plant^{-1} of tomato plants was high significantly affected by the organic manure, nitrogen form and nitrogen fertilizer levels in both seasons. The highest values (85.6 and 89.3 fruits plant^{-1}) obtained from plants fertilized at 10 m^3 chicken manure fed.$^{-1}$ in the both seasons, respectively. Organic manure can improve soil content of organic matter, and this in turn led to improve soil conditions such as soil water content, and increase the availability of minerals. These results are in accordance with those reported by Dawa et al. (2000), Mousa (2002), and El-Beheidi et al. (2006).

Tomato plants which fertilized with enciabeen (SRNF) had the higher number of fruits plant^{-1} than those fertilized with urea.

These results are similar to those reported by Abbady-Khadra et al. (2003), they found that N leaching from a resin-coated urea was less than from comparable N rate.

The highest values (67.9 and 69.4 fruits plant^{-1}) obtained from tomato plants fertilized at 240 and 320 kg N fed.$^{-1}$ in the 1st and 2nd seasons, respectively. The enhancing effect of N fertilizers on fruit numbers plant^{-1}

could be attributed to the increment in vegetative growth, No. of branches and flower set. These results are in accordance with those reported by Abdel-Rahman (2001), El-Atawy (2007), El-Shobaky (2002) and Mousa (2002).

Table 4: Effect of irrigation regimes, organic manure, source of N fertilizer and its levels and their interactions on tomato yield and its components and NPK concentrations in tomato plants in 2003/2004 and 2004/2005 seasons.

Treatments	No. of fruits plant^{-1}		Fruit yield (ton fed.$^{-1}$)		N %		P %			
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A: Source of N Fertilizer:										
1- Urea	57.3	57.9	17.74	17.97	2.44	2.46	0.225	0.231	2.64	2.67
2- Enciabeen	61.7	63.7	19.31	19.63	2.62	2.62	0.232	0.237	2.76	2.78
F. test	**	**	**	**	**	**	**	**	**	**
B : Irrigation regimes :										
1-I_1 : 1.3 ETp	61.5	63.2	19.85	19.93	2.60	2.62	0.239	0.245	2.76	2.79
2-I_2: 1.0 ETp	59.5	59.3	1865	18.45	2.53	2.54	0.227	0.234	2.70	2.73
3-I_3: 0.7 ETp	60.0	59.9	17.07	17.72	2.46	2.46	0.219	0.225	2.64	2.67
F. test	*	*	**	**	**	**	**	**	**	**
L.S.D. at 5 %	0.412	0.508	0.615	0.578	0.064	0.074	0.006	0.008	0.034	0.041
C : Organic manure(O. M.) :										
1- Chicken M.	85.6	89.3	24.49	25.21	3.25	3.26	0.257	0.264	3.06	3.10
2- Rice straw C.	64.9	66.7	20.76	24.34	2.42	2.43	0.229	0.235	2.64	2.66
3-Non O. M.	28.1	26.4	10.32	9.797	1.93	1.93	0.198	0.204	2.39	2.43
F. test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 5 %	4.31	4.685	0.197	0.318	0.181	0.164	0.014	0.019	0.108	0.148
D: Nitrogen fertilizer levels:										
1- 0 N (control)	47.3	48.6	13.92	14.25	2.11	2.12	0.179	0.184	2.28	2.31
2-80 kg N fed.$^{-1}$	54.7	55.8	16.45	16.78	2.31	2.32	0.204	0.209	2.49	2.51
3-160 kg N fed.$^{-1}$	61.4	62.0	19.36	19.46	2.53	2.55	0.231	0.238	2.72	2.74
4-240 kg N fed.$^{-1}$	66.3	69.4	21.72	21.79	2.79	2.80	0.262	0.268	2.97	3.01
5-320 kg N fed.$^{-1}$	67.6	68.2	21.64	21.79	2.91	2.91	0.266	0.273	3.04	3.07
F. test	**	**	**	**	**	**	**	**	**	*
L.S.D. at 5 %	0.31	0.214	0.075	0.548	0.076	0.064	0.003	0.004	0.025	0.037
Sig. Interaction :										
A x B	**	**	**	**	**	**	**	**	**	**
A x C	**	**	**	**	**	**	**	**	**	**
A x D	**	**	**	**	**	**	**	**	**	**
B x C	**	**	**	**	**	**	**	**	**	**
B x D	**	**	**	**	**	**	**	**	**	**
C x D	**	**	**	**	**	**	**	**	**	**
A x B x C x D	**	**	**	**	**	**	**	**	**	**

1-2 : Total fruit yield (ton fed.$^{-1}$) :

Table 4 shows that the total fruit yield (ton fed.$^{-1}$) was high significantly affected by irrigation regimes, organic manure, nitrogen form and nitrogen fertilizer levels in both seasons. The highest values (19.85 and 19.93 ton fed.$^{-1}$) obtained from irrigation at 1.3 evaporation pan coefficient in the 1st and 2nd seasons, respectively. It could concluded that fruit yield was increased by increasing available soil water. This increase can be attributed to the significant role of available water in affecting No. of fruits plant^{-1} and average fruit weight. These results supported with those obtained by El-Atawy (2003 and 2007).

The highest values as affected by organic manure (24.49 and 25.21 ton fed.$^{-1}$) obtained from application of 10 m^3 chicken manure fed.$^{-1}$ in the 1st and 2nd seasons, respectively. Plant growth and total fruit yield of tomatoes were found to be increased by application of organic manure and this increase may be due to improving soil organic matter contents at the experimental site, which in turn improves soil physical and chemical properties through providing the soil with macro and micronutrients as well as improving soil structure. The present results agree with those obtained by Ouda (2000) and El-Nagaar (2004) .

The highest yield as affected by N fertilizer sources (19.31 and 19.63 ton fed.$^{-1}$) obtained from fertilization with SRNF (enciabeen). These results stood in a good agreement with those obtained by Abbady-Khadra et al.(2003) and El-Atawy (2007).

The highest values of total yield as affected by N fertilizer levels (21.72 and 21.79 ton fed.$^{-1}$) resulted from tomato plants fertilized with 240 kg N fed.$^{-1}$ in both seasons. Total fruit yield of tomatoes increased by (61 and 48.1%) with increasing N fertilizer rates from 0 to 240 kg N fed.$^{-1}$ in the 1st and 2nd seasons, respectively.

The increment in total yield could be due to N rate increments which may increase plant vegetative growth and dry matter content. Also, increasing nitrogen fertilizer rates might be attributed to the stimulating effect of the macronutrients on photosynthesis process which in turn resulted in flower production and fruit set.

These results supported with those obtained by Abdel-Rahman (2001), El-Shobaky (2002) and Mousa (2002).

2-Chemical content of tomato plants:

Data in Table 4 indicate that N, P and K concentration in tomato plants at 70 days from transplanting were high significantly affected by irrigation regimes, organic manure, the source of N fertilizer and its levels in the both seasons. The highest values of N, P and K concentration in tomato plants as affected by irrigation regimes obtained from tomato plants irrigated at 1.3 evaporation pan coefficient in both seasons. From the previous results it can be mentioned that the increase of N, P and K % in tomato plants may be attributed to root zone which might have increased the mineralization lead to increasing the availability of NPK in a sandy loam soil.

These results accordance with those obtained by El-Hamady et al. (2002) and El-Araby and Feleafel (2003).

The highest values of N, P and K concentration in tomato plants as affected by organic manure obtained from tomato plants fertilized at 10 m^3 chicken manure fed.$^{-1}$ in both seasons. These results are in harmony with those obtained by Abd El-Mageed et al. (2000), Dawa et al.(2000), Mousa (2002) and El-Araby and Feleafel (2003) .

In tomato plants which fertilized with enciabeen (SRNF), N concentration increased by (7.38 and 6.5 %) compared the fertilization at urea in the 1st and 2nd seasons, respectively. These increments of NPK concentration with applying of enciabeen (SRNF) compared urea may be due to that enciabeen applying may available regular source for nitrogen supply. Also, may be referred to that nitrogen leaching from enciabeen was less than urea. These results could be supported with those obtained by and Abbady-Khadra et al. (2003) and El-Atawy (2007).

The highest values of N, P and K concentration as affected by nitrogen fertilizer levels obtained from tomato plants fertilized at 320 kg N fed.$^{-1}$ in both seasons.

These increments of N, P and K content in tomato plants at 70 days from transplanting may be due to higher availability of the nutrients with increase in the N fertilizer levels which final resulted in better root growth and increased physiological activity of roots to absorb the nutrients.These results are agreeable with those obtained by El-Robae (2003).

3-1: Water consumptive use (WCU) for tomato plants:

Data presented in Table 5 show the amount of water consumptive use during entire seasons. The results prove that the highest amount of seasonal water consumptive use (84.73 and 87.40 cm) obtained from irrigation at 1.3 evaporation pan coefficient, in the 1st and 2nd seasons, respectively, whereas, the lowest values (58.96 and 60.54 cm) resulted from irrigation at 0.7 evaporation pan coefficient, in both seasons.

Such increase in seasonal water consumptive use by increasing the level of available soil moisture may be attributed to the considerable increase in leaf area, which resulted in greater transpiration and in turn water requirement. These results could be enhanced with those obtained by Sharaf et al. (1999) and El-Atawy (2003).

Table 5: Water consumptive use (WCU) in cm by tomato plants during 2003/2004 and 2004/2005 growth seasons.

Irrigation regimes	Months / Season	Dec. cm fed.$^{-1}$	Jan. cm fed.$^{-1}$	Feb. cm fed.$^{-1}$	Mar. cm fed.$^{-1}$	Apr. cm fed.$^{-1}$	May cm fed.$^{-1}$	Total (WCU) Cm fed.$^{-1}$
1.3 ETp	Season 1	9.25	9.81	10.86	14.21	20.40	20.20	**84.73**
	Season 2	9.31	9.82	11.10	14.81	21.10	21.26	**87.40**
1.0 ETp	Season 1	8.35	7.91	8.62	11.81	16.91	16.41	**71.01**
	Season 2	10.41	8.11	8.80	12.45	17.41	16.91	**73.09**
0.7 ETp	Season 1	7.53	6.91	7.00	10.71	13.90	13.31	**58.96**
	Season 2	7.60	7.00	7.11	10.90	14.31	13.71	**60.54**

3-2 Water use efficiency (WUE):

Data illustrated in Table 6 prove that the water use efficiency (WUE) was significantly affected by irrigation regimes, organic manure, the source of N fertilizer and its levels in both seasons. The highest values of WUE (6.895 and 6.935 kg tomato fruits m^{-3} WC) as affected by irrigation regimes obtained from irrigation at 0.7 evaporation pan coefficient. The decrease of WUE as affected of increasing of irrigation water might be due to that the increase in tomato yield as water amount increase was not proportional to the increase of water added. These results are in harmony with those reported by Sharaf et al. (1999) and El-Atawy (2003 and 2007) .

The highest values of WUE as affected by organic manure (8.232 and 8.213 kg tomato fruits m^{-3} WC) obtained from tomato plants fertilized with 10 m^3 chicken manure $fed.^{-1}$ in the 1st and 2nd seasons, respectively.

These increments of WUE with the application of organic manure may be due to the increasing in total fruit yield with applying organic manure (Table 4), which increased as a result to improving soil properties and nutrients in the root zone which enhance plant growth. These results are in supported by El-Atawy (2003 and 2007).

Table 6 : Water use efficiency (WUE) in kg fruits m^{-3} of water consumed by tomato plants as affect by irrigation regimes , organic manure , source of N fertilizer and its levels in 2003/2004 and 2004/2005 seasons.

Treatments	(WUE)in kg fruits m^{-3} of (WCU)	
	2003/2004	2004/2005
A :Source of N fertilizer		
1:Urea	5.959	5.879
2-Enciabeen (SRNF)	6.639	6.381
B : Irrigation regimes :		
1-1.3 Pan evaporation	5.577	5.372
2-1.0 Pan evaporation	6.276	6.083
3-0.7 Pan evaporation	6.895	6.935
C : Organic manure :		
1-Chicken manure	8.232	8.213
2-Straw rice compost	7.016	6.982
3-Non organic manure	3.500	3.195
D: Nitrogen fertilizer levels:		
1-0 kg N $fed.^{-1}$(control)	4.698	4.690
2-80 kg N $fed.^{-1}$	5.553	5.515
3-160 kg N $fed.^{-1}$	6.525	6.392
4-240 kg N $fed.^{-1}$	7.190	7.143
5-320 kg N $fed.^{-1}$	7.280	6.910

The highest values of WUE as affected by the source of N fertilizers (6.539 and 6.381 kg fruits m^{-3} WC) obtained from fertilization with enciabeen (SRNF) in the 1st and 2nd seasons, respectively. The increment of WUE with application enciabeen could be due to that it may an available regular source for nitrogen supply, which increased vegetative growth and total fruit yield. These results could be enhanced with those obtained by Abbady-Khadra et al. (2003) and El-Atawy (2007).

The highest value of water use efficiency as affected by N fertilizer levels (7.280 kg fruits m^{-3} WC) obtained from tomato plants fertilized with 320 kg N $fed.^{-1}$ in the 1st season, while the highest value in the 2nd season (7.143 kg fruits m^{-3} WC) resulted from fertilization at 240 kg N $fed.^{-1}$. Increasing of WUE as affected of increasing N fertilizer levels may be attributed to the effect of available nitrogen which increased vegetative growth and photosynthesis process in tomato plants which in turn resulted in total fruit yield (Table 4). These results supported with those obtained by El-Atawy (2003 and 2007).

CONCLUSION

The obtained results , in sandy loam soils, prove the possibility of producing high fruit yield of tomatoes from hybrid tomato variety by the irrigation at 1.3 evaporation pan coefficient, applying 10 m^3 chicken manure $fed.^{-1}$ and fertilized with the slow release nitrogen fertilizers (enciabeen) at 320 kg N $fed.^{-1}$ or fertilization with urea at 240 kg N $fed.^{-1}$. On the other hand, with infrequency of water irrigation, the irrigation of tomato performable at 0.7 evaporation pan coefficient with increasing organic and mineral fertilization, where, that realized the highest water use efficiency m^{-3} of water consumed.

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إحكام الري و التسميد لتعظيم كفاءة المحصول ومياة الري في الطماطم

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أجريت تجربة حقلية بقرية الربع ـ بلطيم ـ محافظة كفر الشيخ .خلال موسمي الزراعة المتعاقبين ٢٠٠٣ / ٢٠٠٤ , ٢٠٠٤ / ٢٠٠٥ لدراسة تأثير مستويات الري (١,٣ , ١, ٠,٧ من معامل وعاء البخر) والتسميد العضوي (سماد دواجن ـ كمبوست قش أرز ـ بدون سماد عضوي) ومصدرين للسماد النيتروجيني (اليوريا و الانسيابين ـ سماد بطئ الذوبان-) ومستويات الإضافة لكل منهما (صفر ـ ٨٠ ـ ١٦٠ ـ ٢٤٠ ـ ٣٢٠ كجم ن للفدان) على محصول الطماطم. وكانت أهم النتائج كما يلي :

كان أعلى محصول للفدان (٣٤,٧٨٢ , ٣٢,٧٣٣ طن ثمار للفدان) من نباتات طماطم رويت عند مستوى ١,٣ من معامل وعاء البخر وسمدت بسماد الدواجن بمعدل ١٠م^{3} للفدان و بسماد الانسيابين بطئ الذوبان بمعدل ٣٢٠كجم ن للفدان في الموسم الأول و معدل ٢٤٠كجم ن للفدان في الموسم الثاني .

كانت أعلى القيم لتركيز النيتروجين في نباتات الطماطم بعد ٧٠ يوم من الشتل (٤,٠٦ , ٤,٠٣ %) و الفسفور (٠,٣٤ , ٠,٣٤٦ %) والبوتاسيوم (٣,٦٣ , ٣,٦٧ %) في موسمي الزراعة الأول والثاني على التوالي قد نتجت من نباتات طماطم رويت عند مستوى ١,٣ من معامل وعاء البخر وسمدت بسماد الدواجن بمعدل ١٠م٣ للفدان .كما سمدت بسماد الانسيابين بطئ الذوبان بمعدل ٣٢٠كجم ن للفدان .

كانت كمية الاستهلاك المائي الموسمي لنباتات الطماطم في الموسم الأول (٨٤,٧٣ , ٧١,٠١ , ٥٨,٩٦ سم) وفي الموسم الثاني (٨٧,٤ , ٧٣,٠٩ , ٦٠,٥٤ سم) عند مستويات الري ١,٣ , ١ , ٠,٧ من معامل وعاء البخر على الترتيب .

كانت أعلى كفاءة لاستهلاك المياه ١١,٨١٦ , ١١,٩٤٧ كجم ثمار طماطم لكل متر مكعب من الماء المستهلك نتجت من نباتات طماطم رويت عند مستوى ٠,٧ من معامل وعاء البخر وسمدت بسماد الدواجن بمعدل ١٠م٣ للفدان .كما سمدت بسماد الانسيابين بطئ الذوبان بمعدل ٣٢٠كجم ن للفدان في الموسم الأول و معدل ٢٤٠كجم ن للفدان في الموسم الثاني .

من النتائج السابقة يمكننا أن نوصي للحصول على محصول أعلى من الطماطم بأن تروى الطماطم عند مستوى ١,٣ من معامل وعاء البخر مع التسميد العضوي بسماد الدواجن بمعدل ١٠م٣ للفدان مع التسميد بسماد الانسيابين بطئ الذوبان بمعدل من ٢٤٠ حتى ٣٢٠ كجم ن للفدان وذلك في أراضي شمال الدلتا .