POTENTIAL PRODUCTIVITY OF TOMATO AS AFFECTED BY IRRIGATION WATER AMOUNTS AND NITROGEN FERTILIZATION, UNDER DRIP IRRIGATION, AT NORTHWEST DELTA, EGYPT

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ABSTRACT

Two field experiments were carried out during 2008 and 2009 growing seasons at Wady Elnatroon, El-Behera governorate to investigate the effect of irrigation amounts and nitrogen rates on tomato yield, under drip irrigation method in Northwest Delta. The soil of the experimental fields was sandy loam. The electrical conductivity of irrigation water was 1.1 dSm^{-1}. The treatments were arranged in a split plot design with four replicates. Four amounts of irrigation water were daily applied on a bases of 100%, 90%, 80% and 70% of ETc with four nitrogen rates i.e. zero (control), 150, 225 and 300 kg N $fed.^{-1}$, (1 feddan = 0.42 hectar). Seasonal plant water consumption or evapotranspiration of irrigation treatments varied from 42.88 cm to 57.93 cm in both seasons. Irrigation treatments had significant effects on yield and water use efficiency. The tomato yield varied from 20.188 to 44.367 ton $fed.^{-1}$. The highest total yield (44.367 ton $fed.^{-1}$) was obtained from irrigation at 100% of water requirements and fertilized with 300 kg N $fed.^{-1}$ in both seasons. The highest mean values of NUE (101.19 kg fruits kg^{-1} applied N $fed.^{-1}$) was obtained from 100% of ETc and 150 kg N $fed.^{-1}$, while, the lowest value (60.39 kg fruits kg^{-1} applied N $fed.^{-1}$) was obtained from 70% of ETc and 300 kg N $fed.^{-1}$. The highest values of N, P and K concentrations in tomato plants and its fruits, were obtained from irrigation at 100% of ETc compared to 90, 80 and 70% of ETc. The highest values of water use efficiency and irrigation water use efficiency(21.15 kg fruits m^{-3} of water consumed and 18.60 kg fruits m^{-3} of water applied, respectively) obtained from tomato plants irrigated with 70 % of water requirement and fertilized with 300 Kg N $fed.^{-1}$. It could be concluded that for obtaining a good tomato yield and facing the irrigation water shortage, daily irrigation with 100% of ETc must be added with 300 kg N fed^{-1} under the sand loam soil texture in Wady Elnatron region and similar conditions.

Keywords: Tomato, drip irrigation, N fertilization, water consumptive use, water use efficiency.

INTRODUCTION

Tomato is one of the most important vegetable crops grown in Egypt and many other countries in the world wide 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.

Candido *et al*., (2000) found that the highest tomato yield was recorded in the most irrigated treatment. Colla *et al*. (2001) found that irrigation positively influenced tomato yield. El-Atawy (2007) and Meshref *et al*., (2008) indicated that the highest value of tomato total fruit yield was obtained from tomato plants irrigated at 1.3 evaporation pan coefficient compared to irrigated at 1.0 and 0.7 evaporation pan coefficient.

The highest values of N, P and K concentrations in tomato plants and fruits were obtained from tomato plants irrigated at 1.3 evaporation pan coefficient compared to irrigation at 1.0 and 0.7 evaporation pan coefficient (El-Hamady *et al*. ,2002, Feleafel and El-Araby, 2003 and El-Atawy, 2007).

Nitrogen fertilization is very important for plant growth. Increasing nitrogen fertilizer levels up to 200 kg N fed.$^{-1}$ increased tomato total yield (Abd El-Rahman, 2001 and Mousa, 2002). While, El-Shobaky (2002) found that nitrogen fertilizer applied at the rate of 300 kg N fed.$^{-1}$ increased number of fruits plant^{-1} and fruit yield feddan^{-1}

Meshref *et al*., (2008) indicated that the highest values of total fruit yield, water use efficiency and (NPK) concentrations were obtained from tomato plants fertilized with 320 kg N fed.$^{-1}$. Arafa *et al*., (2009) indicated that there was a positive proportional trend with the applied nutrient amounts and the NPK residues in the fruits under the investigated irrigation systems. Zhang *et al*., (2010) indicated that fertilizer N application affected biomass yield, total and marketable fruit yields and N use efficiency, also, they found that nitrogen use efficiency decreased with increases in fertilizer N rate.

The present study aims to maximizing crop-water efficiencies with studying the effect of nitrogen fertilizer levels in relation to irrigation water applied at four different amounts on tomato plants.

MATERIALS AND METHODS

Two field experiments were carried out during 2008 and 2009 growing seasons at Wady Elnatroon, (30° 25' N latitude and 30° 20' E longitude), El-Behera governorate to investigate the effect of irrigation amounts and nitrogen rates on tomato yield as well as water consumptive use, amount of irrigation water applied and irrigation water use efficiency. The experimental field was fertilized by 10 m^3 of chicken manure as well as 15 kg P_2O_5 fed.$^{-1}$ under tomatoes rows through soil preparation. The chicken manure contains 3.2% N, 2.1% P and 1.3% K.

Some physical and chemical properties of the experimental soils were determined according to the methods described by Page *et al*., (1984) and presented in Table 1.

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

Seasons	Sand %	Silt %	Clay %	Texture	EC dSm^{-1} 1:5 Soil : Water extract	pH 1: 2.5 Soil: Water suspension	Available nutrients Mg kg^{-1} soil		
							N	P	K
2007	74.4	13.65	11.95	Sandy loam	0.67	7.4	28	7.0	377
2008	74.5	13.70	11.80	sandy loam	0.69	7.6	27	6.0	380

Surface drip irrigation system used was consisted of normal polyethylene pipes of 16 mm diameter as laterals with line dripper of 4 L/h at 50 cm apart. The laterals were located 150 cm apart, one lateral for each plant row. Irrigation water was filtered through gravel filters and refiltered through screen filters. The electrical conductivity of irrigation water was 1.1 dSm^{-1}. The treatments were arranged in a split plot design with four replicates. The main plots were assigned with four irrigation water amounts and the sub plots were randomely assigned with four N-fertilizer rates. The experiment size was 0.91 feddan included 64 rows with 150 cm apart and 40 m long.

Irrigation treatments were dialy applied with amounts of water equal to 100%, 90%, 80% and 70% of the crop evapotranspiration (ET_c). Nitrogen was applied as ammonium nitrate (33.5%N) at the rate of 0.0 (control), 150, 225 and 300 kg N $fed.^{-1}$ through the irrigation water using venture injection in ten equal doses, the first dose after 5 days from transplanting, while the latter doses were applied on weekly basis.

Tomato seedlings (*Lycopersicon esculentum mill.* cv. *Petopride*) were transplanted in hills (single plant) of 50 cm apart at 11 and 18 of June during the two successive seasons 2008 and 2009. All field practices were done as usually recommended for tomato cultivation.

Harvesting was done after 90 days from transplanting. Central area of 45 m^2 in each plot was kept for determining tomato yield to eliminate any border effect. Fertilizer use efficiency by plants calculated as kg of total yield produced by each unit of fertilizers nutrients used.

Plant sample: Two imitative 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 digestion method by a mixture concentrated H_2SO_4 + $HClO_4$ (10:1) according to Chapman 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 colorimetrically determined according to Murphy and Riley (1962) and potassium was determined using flamphotometer (Jackson, 1973).

Soil water relations:

Soil moisture content was determined gravimetrically in soil samples taken at successive of 15 cm each to a depth of 60 cm from three locations, under the emitter and between the emitters and the laterals. Soil samples were also collected just before irrigation and 6 hours after every irrigation as well as at harvesting to estimate evapotranspiration rates. Field capacity and the bulk density were determined to a depth of 60 cm. The average values are presented in Table (2).

1- Water consumptive use (Cu):

Water consumptive use was calculated using the following equation (Hansen *et al*., 1979).

$$Cu = \sum_{i=1}^{n=4} Di \times Bd \times \theta_2 - \theta_1/100$$

Where:

- Cu = Water consumptive use (cm).
- Di = Soil layer depth = 15 cm.
- Bd = Soil bulk density, (kg m^{-3}) for this depth.
- θ_1 = Soil moisture % before irrigation.
- θ_2 = Soil moisture % 6 hours after irrigation.
- n = Number of soil layers.

Table (2): Average values of field capacity and bulk density for the two growing seasons.

Soil depth (cm)	2008		2009	
	Field capacity %	Bulk density (kg m^{-3})	Field capacity %	Bulk density (kg m^{-3})
0-15	12.9	1370	12.9	1370
15-30	12.9	1370	12.9	1370
30-45	13.0	1380	13.0	1380
45-60	13.0	1380	13.0	1380

2- Irrigation water applied (IWA):

The amount of water applied at each irrigation was measured by flow meter and calculated according to Keller and Karmeli (1974) as follows:

$$IWA = \frac{ETo\,.\,Kc\,.Kr.II}{Ea} + LR$$

Where:

IWA = irrigation water applied (mm).
ETo = reference evapotranspiration (mm day^{-1}).
Kc = crop coefficient.
Kr = reduction factor (Keller and Karmeli, 1974).
II = irrigation intervals (days).
Ea = irrigation efficiency % = K_1 x K_2 = 0.85.
K_1 = emitter uniformity coefficient = 0.95.
K_2 = drip irrigation efficiency coefficient = 0.90.
LR = leaching requirements (10% of ETc).

3- Irrigation water use efficiency (IWUE):

It was calculated as follows :

$$IWUE = \frac{Y}{WR}$$

Where:

Y = Fruit yield (kg feddan^{-1}).
WR = Total amount of water applied in the field (cm).

4- Crop water use efficiency (CWUE):

It was calculated according to the following equation (Michael, 1978).

$$CWUE = \frac{Y}{ETc}$$

Where:

CWUE = crop water use efficiency (kg fruits cm^{-1} of water evapotranspiration).
Y = Fruit yield (kg fed.$^{-1}$).
ETc = evapotranspiration (cm).

5- Nitrogen use efficiency(NUE):

Nitrogen use efficiency by plants calculated as kg of the marketable yield produced by each unit of nitrogen fertilizers used.

Statistical analysis:

All the data were statistically analyzed following the procedure outlined by Snedecor and Cochran (1980). Combined analysis conducted for the data of the two growing seasons according to Cochran and Cox (1957). The differences between the mean values were compared by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

1. Total yield:

Combined analysis of variance over the two growing seasons indicate that, tomato yield was significantly affected by irrigation water amounts and nitrogen rates as shown in Table (3).

Table (3): Mean values of tomato fruit yield (ton fed.$^{-1}$) as influenced by irrigation water amounts and nitrogen rates under drip irrigation method in combined analysis of 2008 and 2009 seasons.

N-rates in Kg fed^{-1}	Irrigation treatments				Mean
	100% of ETc	90% of ETc	80% of ETc	70% of ETc	
Zero (control)	23.351 l	22.794 m	21.689 m	20.188 n	22.006 D
150	38.530 d	37.154 h	35.570 j	33.353 k	36.152 C
225	42.032 b	40.573 f	38.605 g	36.241 j	39.363 B
300	44.367 a	42.853 c	40.792 e	38.305 i	41.579 A
Mean	37.070 A	35.844 B	34.164 C	32.022 D	

*** Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.**

Exposing plants to water stress by watering every day with applied water equal 70% of Etc, significantly decreased tomato fruit yield by 13.62%, compared to daily watering with applied water equal 100% of ETc. This increasing in tomato fruit yield with increasing amount of applied water may be attributed to positive effect of more available moisture at vegetative growth processes. In this respect, Feleafel and El-Araby (2003) indicated that increasing available soil moisture increased vegetative growth, as well as, carbohydrates translocation process from the vegetative growth to fruits, thus, total fruit yield increased, such results are in harmony with those obtained by El-Atawy (2003), Mahajan and Singh (2006) and Arafa *et al*., (2009).

Concerning nitrogen fertilization, data reveal that there was significant increase in tomato fruit yield with raising the adding nitrogen up to 300 kg N fed.$^{-1}$. The highest mean value of fruit yield (41.579 ton fed.$^{-1}$) was obtained by fertilization with 300 kg N fed.$^{-1}$. While, the lowest value of fruit yield (22.006 ton fed.$^{-1}$) was obtained from untreated plants with nitrogen. This result may explain that nitrogen plays a prominent role in building new merstimic cells, cell elongation, increasing photosynthesis activity and encouraging metabolic processes in tomato plants. These results are in harmony with those obtained by El-Beheidi *et al*. (2006), Mahajan and Singh (2006), El-Atawy (2007) and Zhang *et al*., (2010).

Interaction between irrigation treatments and nitrogen rates:

Data in Table 3 show that the average values of tomato fruit yield were significantly affected by the interaction between irrigations treatments and nitrogen application rates, over both seasons. The highest mean value of fruit yield (44.367 ton $fed.^{-1}$) was obtained by 100% of Etc and 300 kg N $fed.^{-1}$. While, the lowest value of fruit yield (20.188 ton $fed.^{-1}$) was obtained by 70% of ETc with untreated plants with nitrogen. These results are in harmony with those obtained by El-Atawy (2007), Arafa *et al*. (2009) and Zhang *et al*. (2010).

2: Nitrogen use efficiency:

Nitrogen use efficiency **(**NUE) is one of the principle factors for saving fertilizer. There are many factors affecting NUE. The data presented in Table (4) show the effect of irrigation water amounts, nitrogen fertilizer levels and their interactions on nitrogen use efficiency in kg tomato fruits kg^{-1} N fertilizer applied.

Table (4): Mean values of nitrogen use efficiency (NUE) in kg tomato fruits kg^{-1} applied N $fed.^{-1}$ as influenced by irrigation water amounts and nitrogen rates under drip irrigation in combined analysis of 2008 and 2009 seasons.

N-rates in Kg fed^{-1}	Irrigation treatments				Mean
	100% of ET_c	90% of ET_c	80% of ET_c	70% of ET_c	
Zero (control)	-----	--------	--------	--------	---------
150	101.19 a	95.73 b	92.54 c	87.77 d	94.31 A
225	83.03 e	79.02 f	75.18 g	71.35 h	76.88 B
300	70.05 i	66.86 j	63.68 k	60.39 l	65.24 C
Mean	84.76 A	80.54 B	77.13 C	73.17 D	

*** Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.**

Average values of nitrogen use efficiency were highly significantly affected by the interaction between irrigation treatments and nitrogen application rates, over both seasons. The highest mean values of NUE (101.19 kg fruits kg^{-1} applied N $fed.^{-1}$) was obtained by 100% of ETc under 150 kg N $fed.^{-1}$, while, the lowest value (60.39 kg fruits kg^{-1} applied N) was obtained by 70% of ETc under 300 kg N $fed.^{-1}$. This may be due to nitrogen fertilizer translocation in the soil profile by mass flow moisture distribution. High water amounts (100% of ETc) led to good root tomato system and right fertilizer distribution, which increased (FUE) in the less amount. On the contrary, high nitrogen fertilizer with low water quantities had the low (FUE) due to the limited root system, which related to less moist area. These results are in harmony with those obtained by El-Atawy (2007) and Zhang *et al*. (2010).

3- NPK concentration in tomato plants and fruits.

Data in Table 5 reveal that N, P and K concentrations in tomato plants were significantly affected by irrigation water amounts and highly significantly affected by nitrogen fertilizer levels in combined analysis of variance over the two growing seasons.

Table (5): Mean values of N, P and K concentration in tomato plants and fruits as influenced by irrigation water amounts and nitrogen rates under drip irrigation method in combined analysis of 2008 and 2009 seasons.

Variables	N%		P%		K%	
	Plants	fruits	Plants	fruits	Plants	fruits
Irrigation treatments						
100% of ETc	2.41 a	1.91 a	0.092 a	0.441 a	1.64 a	2.37 a
90% of ETc	2.32 b	1.80 b	0.088 b	0.400 b	1.51 b	2.33 b
80%of ETc	2.25 c	1.71 c	0.084 c	0.368 c	1.43 c	2.27 c
70% of ETc	2.19 d	1.68d	0.076d	0.335 d	1.35 d	2.20 d
N-rates in Kg /fed.						
Zero N (control)	2.04 d	1.36d	0.074d	0.306 d	1.15 d	1.94 d
150 kg N fed.$^{-1}$	2.25 c	1.55 c	0.086 c	0.367 c	1.52 c	2.25 c
225 kg N fed.$^{-1}$	2.34 b	1.99 b	0.089 b	0.425 b	1.62 b	2.38 b
300 kg N fed.$^{-1}$	2.54 a	2.20 a	0.092 a	0.447 a	1.93 a	2.61 a

*** Mean designated by the same letter is not significantly different at the 5% level according to Duncan's multiple range tests.**

The highest values of N, P and K concentration in tomato plants and its fruits were obtained from irrigation at 100% of ETc.

Daily irrigation with applied water equal to 100% of ETc, significantly increased N, P and K concentrations in tomato plants by 10.1%, 21.1% and 21.5% respectively, compared to daily irrigation with applied water equal to 70% of ETc, while it increased N, P and K concentrations in tomato fruits by 13.7%, 31.6% and 7.7% respectively, compared to daily irrigation with applied water equal to 70% of ETc.

From the previous results, it could be mentioned that the increase of N,P and K% in tomato plants and its fruits may be attributed to increasing of soil moisture. Due to increasing the mobility of N, P and K in the soil, the rate of solubility increased with increasing soil moisture content. These results agreed with those obtained by El-Hamady *et al*., (2002).

Increasing N fertilization up to 300 kg N fed.$^{-1}$ increased N, P and K concentrations in tomato plants by 24.5%, 24.3% and 67.8%, respectively, while, N, P and K concentrations in tomato fruits increased by 61.8%, 46.1% and 34.5% respectively, compared to the control treatments. The increment of NPK concentrations in tomato plants and its fruits may be due to higher availability of the nutrients with increase in the N fertilizer levels, which resulted finally in better root growth and increased physiological activity of roots to absorb nutrients. These results are in accordance with those obtained by El-Hamady *et al*., (2002), El-Robae (2003) and El-Mansi *et al*., (2004).

II. Soil water relations:

1. Water consumptive use (Cu):

Evapotranspiration is the loss of water from plants and soil to the atmosphere. This process includes evaporation from the soil and plant surface plus transpiration of water from the plant. The values of water consumptive use as affected by irrigation treatments are presented in Table (6).

Table (6): Monthly and seasonal water consumptive use rates and water applied as affected by irrigation treatments and nitrogen rates for tomato over both growing seasons under drip irrigation.

Irrigation treatments	Nitrogen Rates kg fed.$^{-1}$	Monthly water consumptive use					Seasonal water consumption (cm)	Water Applied (cm)
		June	July	Aug.	Sept.	Oct.		
100% of ETc	Zero	2.19	12.25	21.53	17.12	4.57	57.66	65.27
	150 Kg N	2.19	12.40	21.56	17.14	4.60	57.89	
	225 Kg N	2.19	12.42	21.61	17.19	4.62	58.03	
	300 Kg N	2.19	12.44	21.64	17.22	4.64	58.13	
Mean		2.19	12.38	21.59	17.17	4.61	57.93	
90% of ETc	Zero	2.19	11.90	18.60	15.21	4.47	52.37	59.09
	150 Kg N	2.19	11.94	18.63	15.24	4.50	52.50	
	225 Kg N	2.19	12.01	18.74	15.28	4.51	52.73	
	300 Kg N	2.19	12.08	18.78	15.42	4.53	53.00	
Mean		2.19	11.98	18.69	15.29	4.50	52.65	
80% of ETc	Zero	2.19	10.02	17.18	13.62	3.99	47.00	53.41
	150 Kg N	2.19	10.03	17.21	13.74	4.12	47.29	
	225 Kg N	2.19	10.06	17.28	13.83	4.17	47.53	
	300 Kg N	2.19	10.08	17.31	13.98	4.19	47.75	
Mean		2.19	10.05	17.25	13.79	4.12	47.39	
70% of ETc	Zero	2.19	8.53	16.33	12.38	3.25	42.68	49.00
	150 Kg N	2.19	8.56	16.35	12.41	3.27	42.78	
	225 Kg N	2.19	8.58	16.40	12.47	3.29	42.93	
	300 Kg N	2.19	8.64	16.43	12.54	3.31	43.11	
Mean		**2.19**	**8.58**	**16.38**	**12.45**	**3.28**	**42.88**	

Data in Table (6) show that the highest mean water consumptive use by tomato plants (57.93 cm) was found with 100% ETc, and the lowest mean value (42.88 cm) with 70% of ETc. This trend show that the increment in water consumptive use depends on the availability of soil moisture in the root zone.

Monthly values of water consumptive use by tomato plants were lower at the beginning of the growing season, then increased as the plants grow up till it reached its peak in August. At the end of the season, the rates declined as the crop matured. These results indicated that the increase in evapotranspiration rates goes parallel to the increase in the vegetative growth of tomato plants. These findings are in agreement with those obtained by El-Atawy (2003), Mahajan and Singh (2006).

From Table (6), it can be noticed that there was small increase in water consumption with adding nitrogen up to 300 kg N fed.$^{-1}$. The increments were 0.78, 0.65, 1.6 and 1.01% as compared to the control treatments with irrigation at 100, 90, 80 and 70 % ETc, respectively. This could be attributed to that nitrogen promotes tomato plants growth and accelerates the rate of transpiration. These findings are in agreement with those of El-Atawy (2003), Mahajan and Singh (2006) and El-Atawy (2007).

2. Irrigation water applied (IWA):

Amounts of irrigation water applied throughout the two growing seasons under drip irrigation are presented in Table (6). Data reveal that the total amount of water applied under drip irrigation were 65.27, 59.09, 53.41 and 49.00 cm, for 100%, 90%, 80% and 70% of ETc, respectively.

3. Water use efficiency (WUE):

The mean values of water use efficiency (WUE) as affected by irrigation treatments are tabulated in Table (7).

Table (7):Water use efficiency (WUE) (kg fruit yield m^{-1} of ETc) and irrigation water use efficiency (IWUE) (kg fruit yield m^{-1} of water applied) for tomato under drip irrigation method (average of the two growing seasons).

N-rates in Kg /fed.	Irrigation treatments								Mean	
	100% of ETc		90% of ETc		80% of ETc		70% of ETc			
	WUE	IWUE	WUE	IWUE	WUE	IWUE	WUE	IWUE	WUE	IWUE
0 (control)	9.64	8.52	10.30	9.19	10.99	9.68	11.26	9.80	10.48	9.30
150	15.85	14.06	16.79	14.98	17.91	15.88	18.56	16.19	17.16	15.12
225	17.25	15.34	18.38	16.36	19.34	17.23	20.10	17.59	18.65	16.63
300	18.18	16.19	19.30	17.28	20.34	18.21	21.15	18.60	19.61	17.57
Mean	15.24	13.53	16.21	14.45	17.17	15.25	17.78	15.55		

Results indicate that the highest value of field and crop water use efficiency were recorded by the daily irrigation with 70% of ETc, whereas, the lowest one was obtained by daily irrigation with 100% of ETc. These results could be attributed to the significant differences among tomato fruit yield, evapotranspiration and water applied values.

These findings are in agreement with those obtained by El-Atawy (2003), Mahajan and Singh (2006).

Conclusion

Irrigation water and nitrogen had positive effect on growth and yield of tomato as it enhanced tomato production. The present study recommends under irrigation water shortage, daily irrigation with 100% of ETc and fertilization with 300 kg N per feddan for high tomato fruit yield in sandy loam soils of Wady Elnatroon region, Egypt and the similar conditions.

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القدرة الإنتاجية لمحصول الطماطم تحت تأثير كميات الري بالتنقيط والتسميد النيتروجينى في شمال غرب الدلتا ـ مصر

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معهد بحوث الأراضي والمياه والبيئة ـ مركز البحوث الزراعية ـ الجيزة ـ مصر

أجريت هذه الدراسة بمنطقة وادي النطرون، محافظة البحيرة خلال موسمي الزراعة ٢٠٠٨ و٢٠٠٩ م بهدف دراسة أثر كميات مياه الري المضافة بالتنقيط والتسميد النيتروجيني على محصول الطماطم وبعض العلاقات المائية. واستخدم تصميم القطع المنشقة حيث كانت معاملات الري بالقطع الرئيسية والتسميد النيتروجينى بالقطع المنشقة في أربع مكررات وكانت المعاملات تحت الدراسة:

* أولاً: معاملات الري:

أ : تروى يومياً وبكمية مياهٍ تعادل ١٠٠% من جهد البخر نتح اليومي للمحصول.

ب: تروى يومياً وبكمية مياهٍ تعادل ٩٠ % من جهد البخر نتح اليومي للمحصول.

ج: تروى يومياً وبكمية مياهٍ تعادل ٨٠ % من جهد البخر نتح اليومي للمحصول.

د : تروى يومياً وبكمية مياهٍ تعادل ٧٠ % من جهد البخر نتح اليومي للمحصول.

* ثانياً: معاملات التسميد:

المعاملة القياسية (بدون تسميد) ، ١٥٠ ، ٢٢٥ و ٣٠٠ كيلو جرام نيتروجين للفدان.

تم إضافة ١٠م^{٣} سماد دواجن + ١٥ كجم فو$_{٢}$ اه للفدان في خطوط الطماطم قبل الزراعة.

وكانت أهم النتائج كما يلي:

١- أدى الري يومياً وبكمية مياهٍ تعادل ١٠٠% من جهد البخر نتح اليومي للمحصول إلى زيادةٍ معنويةٍ لصفة محصول الثمار.

٢- أدت إضافة النيتروجين حتى ٣٠٠ كيلو جرام نيتروجين للفدان إلى الحصول على أعلى القيم للمحصول (٤١.٥٧٩ طن للفدان)، كما زاد الاستهلاك المائي للطماطم في جميع معاملات الري.

٣- زاد الاستهلاك المائي بزيادة المحتوى الرطوبي بمنطقة الجذور حيث سجل ٥٧.٩٣، ٥٢.٦٥، ٤٧.٣٩ ، ٤٢.٨٨ سم لمعاملات الري (أ ، ب ، جـ ، د) على الترتيب، حيث كانت كميات مياه الري المضافة لتلك المعاملات هي:٦٥.٢٧ و ٥٩.٠٩ و ٥٣.٤١ و٤٩.٠٠ سم لنفس المعاملات على الترتيب.

٤- أدى الري وبكمية مياه تعادل ٧٠% من جهد البخر نتح اليومي إلى زيادة كفاءة استخدام الماء (١٥.٥٥ كجم ثمار لكل م^{٣} ماء مضاف و١٧.٧٨كجم ثمار لكل م^{٣} ماء مستهلك) بالمقارنة بالري بكمية مياهٍ تعادل ١٠٠%، ٩٠% و٨٠ % من جهد البخر نتح اليومي للمحصول.

٥- كانت أعلى كفاءة لوحدة السماد الأزوتي 101.19كجم ثمار لكل وحدة نيتروجين مضاف نتجت من الري بكمية مياهٍ تعادل ١٠٠% من جهد البخر نتح اليومي مع التسميد الأزوتي بمعدل ١٥٠ كجم نيتروجين للفدان، بينما كانت أقل قيمة لكفاءة السماد الأزوتي ٦٠.٣٩ كجم ثمار لكل وحدة نيتروجين مضاف نتجت من الري بكمية مياهٍ تعادل ٧٠% من جهد البخر نتح اليومي للمحصول مع التسميد الأزوتي بمعدل ٣٠٠ كجم نيتروجين للفدان.

قام بتحكيم البحث

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