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WATER CONSUMPTION OF EGGPLANT UNDER DIFFERENT MICROCLIMATES

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ABSTRACT

The experiment was conducted during two successive summer seasons of 2008 and 2009 at El-Bosaily farm El-Behira governorate in the North Coastal of Delta, Egypt to study the effect of different irrigation treatments and greenhouse cover on plant growth and yield of eggplant (*Solanum melongena* L*)* cv. Baladi. The experiments examined the effect of four irrigation levels (0.60, 0.80, 1.00 and 1.20 of the potential evapotranspiration estimated according to class A pan equation) applied by drip irrigation system and two greenhouse cover (white and 40% shade) in comparison with open field conditions . The experimental design was a split- plot with three replicates. The highest value of vegetative growth was recorded under black net greenhouse cover followed by the greenhouse covered with white net, while the lowest vegetative growth was recorded by open field treatments. The differences between irrigation treatments were significant; the highest plant growth characters, fruit weight and number of fruits per plant were recorded by 1.00 ET irrigation treatment. The results of total fruit weight under different greenhouse cover show that the highest total yield was recorded by white net treatment during the two summer seasons. The highest water use efficiency was obtained by 0.80 irrigation treatment in comparison with the other irrigation treatment with the white greenhouse net cover.

INTRODUCTION

Irrigation water is gradually becoming scarce not only in arid and semi-arid regions but also in the regions where rainfall is abundant. Therefore, the water saving and conservation is essential to support agricultural activities. On the other hand, sandy soils suffer due to water deficiency, while intensifying mineral fertilization with irrigation water supply endangers the environment. Therefore, there are needs to cultivate the sandy soils to fight against hunger in the world but with the least amount of irrigation (Saleh and Ozawa, 2006). Row covers are a flexible transparent covering which is installed over plants to reduce the water needs, increase air temperature around the crop. Furthermore, their usage has been associated with increased plant growth, higher yields and earliness of harvest (Teasdale and Abdul-Baki, 1995 and Ibarra *et al.*, 2001). Canopy development and management of some greenhouse horticultural crops is quite different than that of outdoors. Differences in plant spacing, crop height (use of vertical supports, pruning practices) and in aerodynamic properties may affect the Kc values. Moreover, the proportion of diffuse radiation in a greenhouse is higher than outdoors (Bonnano and Lamont. 1987). Thus, it is questionable whether the standard Kc values, determined experimentally outdoors, can be used directly to determine the ET of the greenhouse crops. Additionally, there is a need to determine the duration of the major growth stages for the major crops. For estimating the time from planting to effective full cover, simple models using thermal time regression equations or more sophisticated plant growth models has been proposed (Abou-Hadid and El-Beltagy, 1992).

Crops grown in open fields of a semi-dry climate are subjected to direct sunlight, high temperatures and wind resulting in high crop evapotranspiration (ETc) and therefore, demanding large amounts of water. In contrast, shade-houses favor plant growth since plants are less stressful: direct sunlight is avoided, temperature is lower, humidity is higher, wind is reduced, and ETc is low. Irrigation water requirement of 23% to 31% pan evaporation has been used for plants grown under 70% light reduction. In addition, water use efficiency increases under shady conditions (Jifon and Syvertsen, 2003).

In this work the growth and yield of eggplant, grown during the summer season under two types of screen net in comparison with open field was investigated.

MATERIALS AND METHODS

The experiments were carried out at El-Bosaily site of the protected cultivation, El-Behira governorate, Agricultural Research Center, located at the North Coast of Egypt during summer seasons of 2008 and 2009. The electrical conductivity (EC) of irrigation water was 0.80 mmhos/cm during the two cultivated seasons.

Plant materials

Eggplant (*Solanum melongena* L*)* cv. Baladi seeds were sown in the nursery at April, 25 and 22 at 2008 and 2009 summer seasons, respectively. The seedlings were transplanted on June, 9th, 2008 and June, 8th 2009, respectively. Soil was analyzed and the results are presented in Table (1). Eggplants were grown under three cover treatments (White net and black net (40% shade) and open field conditions).The width of greenhouse was 8.5 m, the length was 40m and the height was 3.25m. Two covered greenhouses with screen net (White and black net) were cultivated as well as open field conditions. The greenhouses were divided into 5 beds each bed was 1 m wide and 40m long; the same practices were implied at open field conditions. Fertilization and pests and diseases control ware carried out according to Anonymous (1996).

Estimation of water requirements

Climatic data were recorded during the two seasons at Elbosaily using thermohygrograph and the results are presented in Table (2). Water requirement estimations were calculated for the 1.00 of ET. According to Abou-Hadid *et al* (1988), other treatments (0.60, 0.80 and 1.20 of ET.) were derived form 1.00 of ET. Leaching requirements of 20% were added to modify different water requirements of 0.60, 0.80, 1.00 and 1.20 of ETo at Arish site. Water valve and flow-meter insulated for each irrigation treatment.

Treatments

The interaction of four irrigation levels namely 0.60, 0.80, 1.00 and 1.20 of ETo with three greenhouse cover treatments (White net, 40% shade net and open field conditions) were applied. This made the total number of experimental plots equals 4 * 3 = 12.

Measurements

Plant length (cm), number of leaves and total leaf area (cm2) were measured after 120 days form transplanting date. Fruits of eggplant were harvested and total fruit weight was measured during all the season. Relative humidity, soil and air temperature were recorded everyday under the different treatments at 12:00 pm.

Statistical design

Split-plot design was applied with three greenhouse covers as main factor and four irrigation levels as sub – main factor in three replicates. Each replicate consisted of 50 plants. L.S.D was statistically analyzed according to Snedecor and Cochran (1981).

Water use efficiency:

The water use efficiency (WUE) was calculated according to FAO (1982) as follows: The ratio of crop yield (Y) to the total amount of irrigation water use in the field for the growth season (IR); WUE (Kg/m^3) = Y (kg)/IR (m^3).

Chemical analysis:

Samples of five plants of each experimental plot were taken to determine growth parameters at the end of season (mid of May 2007 and 2008) For mineral analysis, the youngest mature leaves were dried and digested in the sulphuric acid and hydrogen peroxide mixture according to the method described by Allen (1974). Total nitrogen was determined by Kjeldahl method according to the procedure described by FAO (1980). Phosphorus content was determined using spectrophotometer according to Watanabe and Olsen (1965). Potassium content was determined photo-metrically using Flame photometer as described by Chapman and Pratt (1961). The permanent wilting point (PWP) and field capacity (FC) of the trial soil were determined according to Israelsen and Hansen (1962).

Table (1): Physical and chemical analysis of soil before cultivation

Physical properties							
Sand %	Clay%	Silt%	Texture	FC %	PWP %	Bulk density g/cm^3	
94.4	4.19	1.41	Sandy	12.77	5.45	1.25	
Chemical properties							
Ec m/moh	pH	Ca^{++} meq/l	Mg^{++} meq/l	Na^{+} meq/l	K+ meq/l	HCO_3- meq/l	Cl - meq/l
2.80	7.49	26.60	8.30	13.76	2.45	2.9	13.4

Table (2): Water requirements for eggplant during the 2008 and 2009 seasons for different irrigation treatments.

	Irrigation treatments				Irrigation treatments			
Week No.	60%	80%	100%	120%	60%	80%	100%	120%
	Liter/plant/day				Liter/plant/day			
week1	0.31	0.41	0.51	0.61	0.30	0.40	0.50	0.60
week2	0.44	0.58	0.73	0.87	0.43	0.57	0.71	0.85
week3	0.60	0.80	0.99	1.19	0.58	0.78	0.97	1.17
week4	0.74	0.99	1.23	1.48	0.72	0.97	1.21	1.45
week5	0.82	1.09	1.37	1.64	0.80	1.07	1.34	1.61
week6	0.89	1.18	1.48	1.78	0.87	1.16	1.45	1.74
week7	0.96	1.28	1.60	1.91	0.94	1.25	1.56	1.87
week8	1.03	1.37	1.72	2.06	1.09	1.46	1.82	2.18
week9	1.09	1.45	1.82	2.18	1.15	1.54	1.92	2.31
week10	1.11	1.48	1.85	2.22	1.17	1.57	1.96	2.35
week11	1.12	1.49	1.86	2.24	1.18	1.58	1.97	2.37
week12	1.13	1.50	1.88	2.25	1.19	1.59	1.99	2.39
week13	1.12	1.50	1.87	2.25	1.19	1.59	1.98	2.38
week14	1.05	1.40	1.75	2.10	1.04	1.38	1.73	2.07
week15	0.96	1.28	1.60	1.92	0.95	1.27	1.58	1.90
week16	0.86	1.15	1.44	1.72	0.85	1.14	1.42	1.70
week17	0.77	1.03	1.29	1.55	0.76	1.02	1.27	1.53
week18	0.72	0.96	1.20	1.44	0.71	0.95	1.18	1.42
week19	0.63	0.83	1.04	1.25	0.62	0.82	1.03	1.24
week20	0.54	0.73	0.91	1.09	0.58	0.77	0.96	1.15

RESULTS AND DISCUSSION

Climatic data:

Mean air temperatures for the black net, white net greenhouse and open field showed that the use of nets exerted a limited influence on temperature (Fig.1). Air temperatures tended to be lower under the nets (2 – 6 °C), due to the interception of radiation which is greater than the gain of temperature caused by the use of nets due to their role in the interception of air circulation or "greenhouse effect". Bigger differences were recorded in the growing seasons. Soil temperatures under black net tended to be lower than control by 1-3 °C (Fig. 2) because of the greenhouse effect and the low radiation at this time of the day. The black net recorded lower air and soil temperature in comparison with white net or open field. Open field recorded the highest air and soil temperature during the whole season. Similar results were reported by Abdrabbo (2001) and Salman *et al*. (1992), indicating that the influence of nets upon temperatures and their role in increasing minimum temperatures was not clearly demonstrated. Saleh and Ozawa, (2006) and Tarara, (2000) however, found a moderate decrease in temperatures associated with the use of nets at the summer season.

Average relative humidity increased by the use of black and white net by 4-8% as compared with open field (Fig. 2). These results were in line with those reported by Iglesias and Alegre, (2006), indicating a 2-6% increase in humidity associated with the use of nets. These authors also reported a decrease in evaporation associated with the use of nets and a significant reduction in wind speed. Campen and Bot (2003) pointed out that pressure difference over the openings was one of the driving forces for ventilation, which could be either due to the wind outside the greenhouse or due to the temperature difference over the openings. At lower wind speed, which was true under present conditions, mainly the buoyancy effect contributes in ventilation (Medany, et al., 2009).

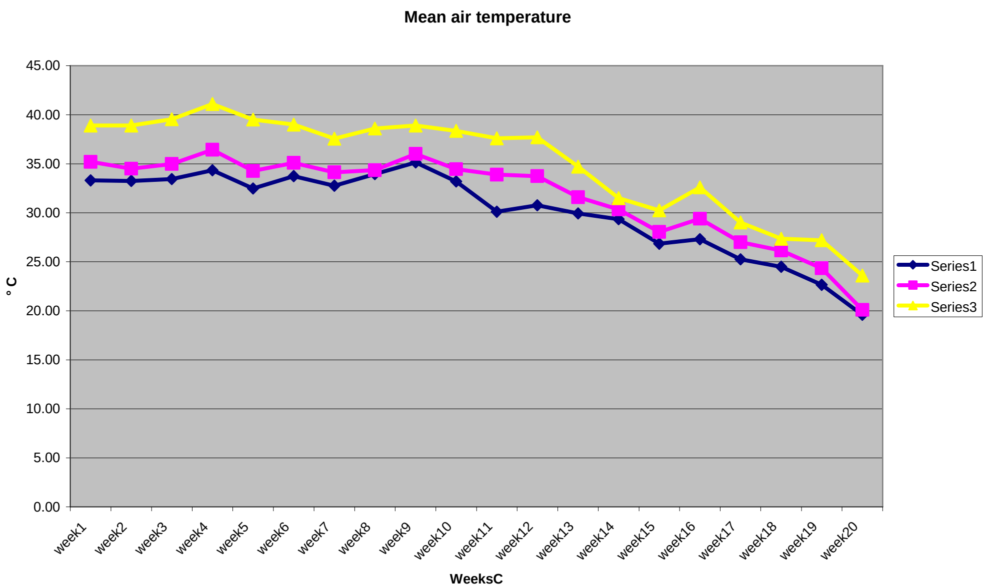

Fig 1. The average mean air temperatures under black net, white net and control (open field) of the 2008 and 2009 seasons.

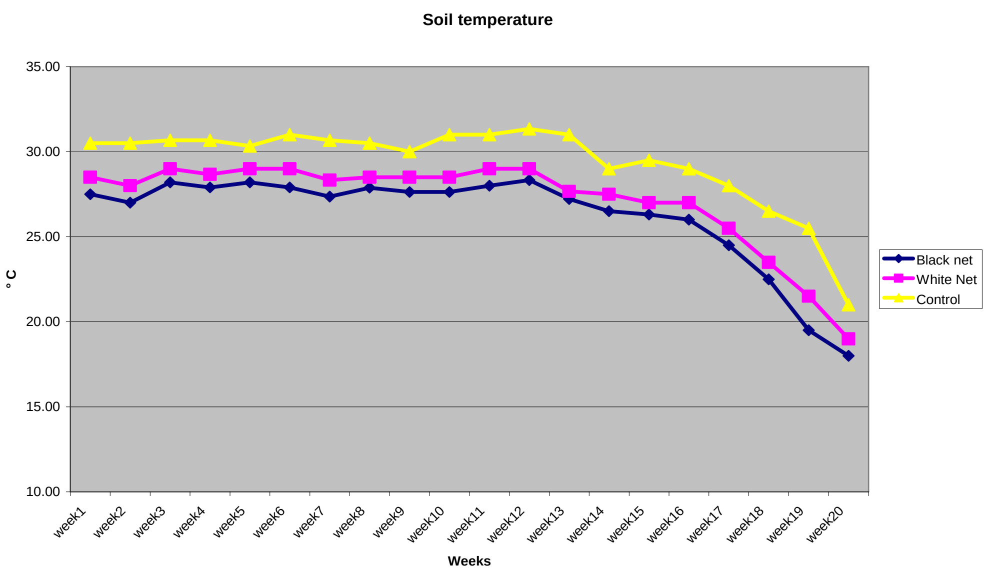

Fig 2. The average soil temperatures under black net, white net and control (open field) of the 2008 and 2009 seasons.

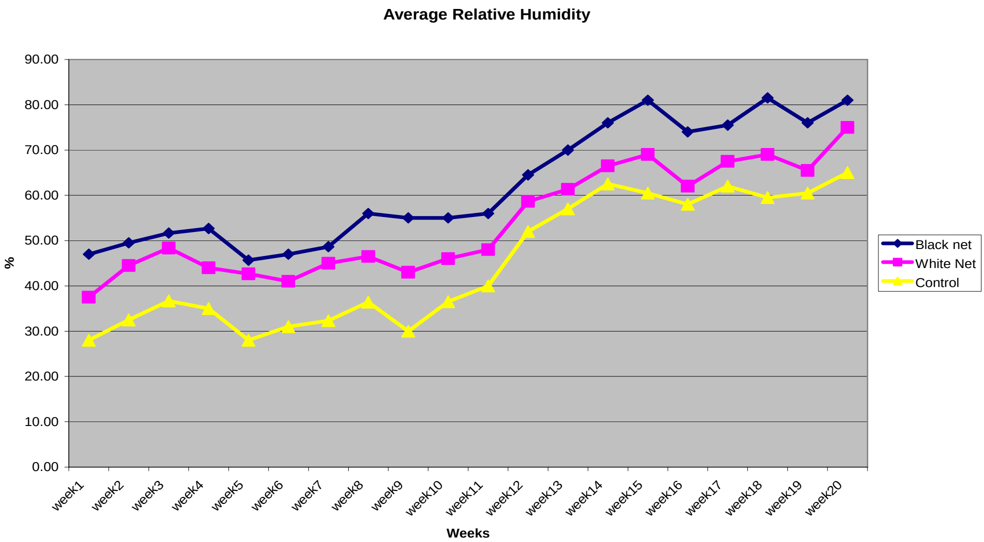

Fig 3. The average relative humidity under black net, white net and control (open field) of the 2008 and 2009 seasons.

Vegetative growth:

Data presented in Table (3) represent the effect of different irrigation regimes on vegetative growth of eggplant. The irrigation level 1.00 ET recorded significantly the highest vegetative growth followed by 1.20, 0.80 and 0.60 irrigation levels in both seasons. Vegetative growth under black net was significantly higher than that under black net in both seasons; the lowest plant length was recorded under open field conditions. The interaction between greenhouse cover and irrigation level showed that the highest significant value was for 1.00 irrigation levels, with significant difference between greenhouse cover, while the lowest value was obtained for 0.60 irrigation level under open field conditions in both seasons. Similar results were found by abdrabbo (2005) who found that vegetative growth of the cucumber plants under shade net cover was higher than that obtained under open field conditions. The improved vegetative growth evidenced as plant height, number of leaves, and total leaf area per plant under the different greenhouse shade levels may be due to the favorable weather conditions, i. e., increase in relative humidity, lower maximum temperature, light irradiance and finally lower wind speed in comparison with open field conditions (Iglesias and Alegre, 2006). Other possibility was increasing the plant uptake ability to water and nutrients which ultimately accelerated the rate of vegetative growth under greenhouse conditions (Marouelli *and Silva*, 2005). Increasing vegetative characteristics under 1.00 ET irrigation levels could be attributed to the suitable irrigation quantity especially in the early stage of crop growth which enhanced a deeper and more extensive root system (Abdrabbo *et al.,* 2009 and Ngouajio *et al*., 2007).

Table (3). Effect of different greenhouse cover and irrigation treatment on the eggplant length, number of leaves and total leaf area per plant during 2008 and 2009 seasons.

	first season					second season				
Plant height (cm)										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	101	123	145	128	126	97	118	139	123	119
Black net	112	146	157	136	136	109	138	145	136	132
Open field	86	115	125	123	112	89	118	120	118	111
Mean B	99.7	127.9	142.2	129.0		98.3	124.6	134.6	125.7	
LSD 0.05										
GC		4.99					3.47			
I		0.62					0.54			
GC x I		2.07					1.07			
No. of leaves										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	37.3	48.3	56.7	42.3	46	34.7	45.3	52.7	42.5	44
Black net	43.0	52.0	59.3	48.7	51	39.7	48.7	55.3	46.3	48
Open field	30.3	39.5	45.1	37.2	38	27.7	40.7	43.0	39.2	38
Mean B	36.9	46.6	53.7	42.7		34.0	44.9	50.3	42.7	
LSD 0.05										
GC		1.43					1.02			
I		0.67					0.62			
GC x I		1.35					1.28			
Leaf area (cm^2)										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	3857	4993	5857	4373	4770	3581	4683	5440	4390	4524
Black net	4445	5372	6126	5027	5242	4098	5027	5716	4786	4907
Open field	3133	4082	4656	3846	3929	2858	4201	4442	4044	3886
Mean B	3812	4816	5546	4415		3512	4637	5199	4407	
LSD 0.05										
GC		147.7					105.4			
I		61.6					66.0			
GC x I		126.5					132.1			

- GC = greenhouse cover treatments.
- I = irrigation treatments.

Yield:

The effect of covered greenhouse with black net and white net conditions on fruit weight of eggplant is shown in Table (4). The higher eggplant yield was associated with the use of the covered net in comparison with open field conditions. White net had the highest fruit weight and number of fruits per plant followed by the black net, while the lowest fruit weight and number of fruits per plant was recorded by the open field conditions during both seasons.

Table (4). Effect of different greenhouse cover and irrigation treatment on the eggplant fruit weight and number of fruits per plant during 2008 and 2009 seasons.

	first season					second season				
	Fruit weight (g)									
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	2043.3	3963.8	4618.3	2971.3	3399	2021.1	3785.0	4160.0	2617.7	3146
Black net	2256.3	3681.3	3263.1	2772.3	2993	2320.9	3485.0	3210.0	2768.6	2946
Open field	1818.8	2098.3	2280.7	2061.8	2065	1727.8	2043.7	2221.4	1820.0	1953
Mean B	2039.4	3247.8	3387.4	2601.8		2023.3	3104.6	3197.1	2402.1	

LSD 0.05

	first season	second season
GC	115.14	114.53
I	38.46	34.79
GC x I	77.84	71.16

	first season					second season				
	No. of fruits									
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	10.81	20.97	24.44	15.72	17.98	10.69	20.03	22.01	13.85	16.65
Black net	11.94	19.48	17.27	14.67	15.84	12.28	18.44	16.98	14.65	15.59
Open field	9.62	11.10	12.07	10.91	10.93	9.14	10.81	11.75	9.63	10.33
Mean B	10.79	17.18	17.92	13.77		10.71	16.43	16.92	12.71	

LSD 0.05

	first season	second season
GC	0.52	0.50
I	0.19	0.18
GC x I	0.36	0.32

- GC = greenhouse cover treatments.
- I = irrigation treatments.

Regarding the irrigation treatments, the highest fruit yield was obtained by the 1.00 ET treatment followed by 0.80 ET. The lowest fruit weight and number of fruits per plant were obtained by the 0.60 ET during both tested seasons.

The interaction effect between the different cover of greenhouses and irrigation level revealed that the highest fruit weight and number of fruits per plant was obtained by 1.00 ET combined with white net cover followed by 0.80 ET combined with white net cover. The lowest fruit weight and number of fruits per plant was obtained by the 0.60ET combined with open field conditions. Similar results were obtained by El-Gizawy, *et al*., (1992). They found that increasing shade density in the summer season increased vegetative growth of plants under open field conditions while decreased fruit weight and number of fruits while decrease due to less photosynthesis machine associated with less radiation under shaded plants (Abdrabbo *et al*., 2009). Furthermore, the reduction of radiation is responsible for down-regulation of photosynthetic capacity of leaves and consequently a lower light saturated photosynthetic rate compared to the control (Abdrabbo *et al*, 2009). On the other hand, Ngouajio *et al*. (2007) reported that sustained moisture supply by using proper water quantity enhanced plant yield. The irrigation water supplied, irrespective of irrigation methods, retained in the soil and efficiently distributed for crop growth (Abdrabbo., 2009).

Plant elemental content:

The obtained results in Table (5) showed that the typ of greenhouse cover and irrigation treatment significantly affected the uptake of N.P.K. by eggplant during the two growing seasons.

Greenhouse covers significantly affected the NPK percentages. White net resulted in the highest average values of NPK uptake by eggplants followed by black net treatment. The lowest NPK percentage was obtained by the open field (control) treatment during the two seasons.

The 0.80 ET increased the uptake of NPK followed by 1.00 ET, while the lowest NPK content was obtained by 0.60 ET. Increasing the uptake of NPK by 0.80 ET may be due to the good soil water content under 0.80 ET condition (Saleh and Ozawa, 2006).

Regarding the interaction effect between greenhouse cover and irrigation, the highest NPK content was obtained by 0.80 ET combined with white net cover followed by 1.00 ET with white net cover. The lowest NPK content was obtained by open field (control) treatment with different irrigation levels during both seasons.

Table (5). Effect of different greenhouse cover and irrigation treatment on the eggplant NPK percentage during 2008 and 2009 seasons.

	first season					second season				
N %										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
Black net	3.08	3.34	3.13	3.01	3.14	3.04	3.29	3.09	2.97	3.10
White net	3.21	3.51	3.38	3.16	3.31	3.17	3.46	3.33	3.12	3.27
Open field	3.13	3.64	3.41	3.35	3.39	3.09	3.60	3.37	3.31	3.34
Mean B	3.14	3.50	3.31	3.18		3.10	3.45	3.26	3.13	
LSD 0.05										
GC		0.19					0.18			
I		0.09					0.09			
GC x I		0.14					0.14			
P %										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
Black net	0.62	0.70	0.65	0.61	0.65	0.61	0.70	0.64	0.60	0.64
White net	0.74	0.79	0.82	0.69	0.76	0.73	0.78	0.81	0.68	0.75
Open field	0.87	0.93	0.86	0.81	0.86	0.86	0.92	0.85	0.80	0.85
Mean B	0.74	0.81	0.78	0.70		0.73	0.80	0.77	0.69	
LSD 0.05										
GC		0.06					0.05			
I		0.03					0.02			
GC x I		0.05					0.04			
K %										
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	2.73	2.80	2.67	2.43	2.66	2.70	2.76	2.63	2.40	2.62
Black net	2.53	2.47	2.33	2.14	2.37	2.50	2.44	2.30	2.12	2.34
Open field	2.60	2.67	2.93	2.32	2.63	2.57	2.63	2.90	2.29	2.60
Mean B	2.62	2.65	2.65	2.30		2.59	2.61	2.61	2.27	
LSD 0.05										
GC		0.16					0.15			
I		0.08					0.07			
GC x I		0.11					0.10			

- GC = greenhouse cover treatments.
- I = irrigation treatments.

Increased yield could be largely attributed to proper soil temperature due to application of the greenhouse cover, which resulted in enhancement of soil environment around roots of eggplants, which led to increasing plant growth, and hence increasing nutrient absorption and uptake. These results were in line with those obtained by Abdrabbo *et al.* (2009), Call and Courter (1989) and Fonsecal *et al.* (2003). Optimal root zone temperature conditions allow for adequate root function including proper uptake of water and nutrients (Cooper, 1973). Using proper water quantity allows plants to use water and nutrients from deeper soil, thus increases water and nutrients use efficiency, and reduce nitrogen leaching. Excess irrigation not only reduces crop yield, but also increases nutrient leaching (Zegbe-Dominguez *et al*., 2006).

Water Use Efficiency

Data in Table (6) showed that increasing irrigation quantity over 0.80 (ET) led to decrease water use efficiency for all irrigation treatments. The highest WUE was obtained by 0.80 (ET). Regarding the effect of different greenhouse cover treatments on WUE, data showed no significant difference among treatments, using white net led to increasing WUE during the two tested seasons. There was a significant interaction between irrigation treatment and mulch for WUE. The highest WUE was obtained by 0.80 (ET) combined with white net. The 1.20 (ET) combined with control treatment had the lowest WUE during the two studied seasons. These results were in line with those obtained by Saleh and Ozawa (2006) and Abdrabbo *et al.,* (2009).

Table (6). Effect of different greenhouse cover and irrigation treatment on water use efficiency (WUE) during 2008 and 2009 seasons.

	first season					second season				
	WUE (Kg/m^3)									
GC \ I	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A	0.60 ET	0.80 ET	1.00 ET	1.20 ET	Mean A
White net	13.31	19.36	18.05	9.68	15.10	12.96	18.20	16.00	8.39	13.89
Black net	14.70	17.98	12.75	9.03	13.62	14.88	16.76	12.35	8.87	13.21
Open field	11.85	10.25	8.91	6.72	9.43	11.08	9.83	8.54	5.83	8.82
Mean B	13.28	15.87	13.24	8.47		12.97	14.93	12.30	7.70	

LSD 0.05		
GC	0.90	0.88
I	0.17	0.18
GC x I	0.83	0.78

- GC = greenhouse cover treatments.
- I = irrigation treatments.

Conclusion

This study recommended the use of 0.80 ET from measured evapotranspiration with white net to grow the eggplant during the summer season.

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الاستهلاك المائي لنبات الباذنجان تحت ظروف مختلفة من المناخ الدقيق

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تمت التجربة في موقع البوصيلى للزراعات المحمية التابع لمركز البحوث الزراعية بمحافظة البحيرة في العروة الصيفي خلال موسمين 2008 و 2009 على التوالي، لدراسة تأثير الاحتياجات المائية والألوان المختلفة لغطاء الصوبة على نمو ومحصول نبات الباذنجان الصنف البلدي . وكان الهدف من هذه التجارب دراسة تأثير مستويات الري الأربعة (60% ، 80% ، 100% ، 120% من البخر نتح المحسوب من خلال حلة البخر) وتم تطبيق المقنن المائي من خلال شبكة الري بالتنقيط واثنين من أغطية الصوبة (ثيران ابيض وثيران اسود (40% تظليل)) مقارنة بظروف الحقل المفتوح. تم تصميم التجربة في قطع منشقة مره واحدة في ثلاثة مكررات. تم قياس النمو الخضري (طول النبات وعدد الأوراق و الوزن الطازج و الجاف للنبات) والمحصول المبكر والكلى. سجلت اعلي قيم من النمو الخضري تحت معاملة الثيران الأبيض يليها معاملة الثيران الأسود، في حين سجلت أدنى معدلات النمو الخضري في الحقل المفتوح. وكانت الاختلافات معنوية في معاملات الري، وسجل أعلى وزن ثمار وعدد ثمار للنبات مع معاملة الري 100% مع الأغطية المختلفة، أما بالنسبة للتفاعل بين المعاملات فكانت أحسن معاملة هي 100% مع الغطاء الأبيض للصوبة وذلك في كلا الموسمين.