EFFECT OF PAINTING THE GREENHOUSE PLASTIC COVER ON DRIP IRRIGATION OF CUCUMBER

Aboamera [(1)], M. A.; Taha [(2)], A. T., Omar [(3)], M. N. and Dawood [(4)], A. E.

ABSTRACT

Painting the plastic cover of the greenhouse is an effective method to achieve a suitable environment for crop growth and to enhance crop productivity and quality in hot and sunny regions. The influence of painting with white plastic as shading material was studied in faculty of Agriculture, Shebin El Koum, Menoufia University, on cucumber crop. Drip irrigation water was applied at four levels which are: 70, 80, 90 and 100% of the potential evapotranspiration (ET_o) in two greenhouses. One was with painted cover and the other was without painting. The results showed that the painted cover greenhouse with white emulsion paint gave the highest yield of 15.5 Mg/fed at the water application rate of 80% of potential evapotranspiration. The highest rate of increasing cucumber length (6.69cm/day) was observed with unpainted plastic cover and occurred after 4 days at 70% of ET_o. The highest value of water use efficiency with painted plastic covers (10.23Kg/m^3) was achieved at 80% ET_o, while with unpainted plastic cover (9.42Kg/m^3) at 70% of ET_o.

Keywords: *Painted greenhouse; Cucumber; Drip irrigation, and Water use efficiency.*

1. INTRODUCTION

The important environmental factors affecting plant growth are temperature, relative humidity, light level and content percent of carbon dioxide (**Al-Ayedh and Al-Doghairi, 2004**). Transplant production in open fields faces many problems, especially in summer, due to the high radiation intensity along with high wind speed as well as high air temperature (**Abdel-Ghany et al., 2016**).

1) Professor, Agric. Eng. Dept., Faculty of Agric., Menoufia University.

(2) Assistant professor, Agric. Eng. Dept., Faculty of Agric., Menoufia University.

(3) Lecturer, Agric. Eng. Dept., Faculty of Agric., Menoufia University.

(4) Demonstrator, Agric. Eng. Dept., Faculty of Agric., Menoufia University.

Greenhouses allow producers to grow plants at time and location when it would be impossible to grow outside because of the adverse climate, pests and diseases (**Mutwiwa, 2007**). In warm areas, plant production in greenhouses is hampered by too high temperatures and too high relative humidity inside the greenhouse.

Cooling is considered as the basic necessity for greenhouse crop production to overcome the problems of high temperatures during summer months (**Sethi and Sharma, 2007a**). Shading method (e.g., whitewash or shade netting or screen) is one popular method for reducing excess solar heat radiation and high air temperatures in the greenhouse during the summer season. Using $CuSO_4$water solution as Liquid Radiation Filter (LRF) technique can offer an appropriate air temperature inside the house less than outside air temperature by around 8–10 °C in hot summer days (**Abdel-Ghany et al., 2016**). Shading greenhouse is an effective method to achieve a suitable environment for crop growth and to enhance crop productivity and quality in hot and sunny regions. Combining a shading method (e.g., whitewash or shade netting) with ventilation showed a significant effect on improving overall microclimate as well as the distribution of microclimatic parameters. This consequently reduces the energy and water consumptions and increases the crop productivity and its quality (**Ahemd et al., 2016**).The influence of whitening (about 8 kg CaO per 100 kg water) during summer in a greenhouse reduced the average glasshouse transmission coefficient for solar radiation from 0.62 to 0.31(**Baille et al., 2001**). whitening lime (8 kg CaO per 100 l water) reduced the transmission coefficients for Photosynthetic Active Radiation (PAR), total solar and thermal radiation of the greenhouse cover from 0.75 to 0.53; 0.74 to 0.55 and 0.45 to 0.43, respectively (**Mashonjowa et al., 2010**). Cucumber is one of the major vegetable crops cultivated in Egypt, under green-house conditions. The number of greenhouses reached about twenty thousand, when about 12000 (60%) are used for cucumber production (**El-Aidy et al., 2007**). Greenhouse shading may have a time-dependent effect on fruit production, water and nutrient uptake in plants and the impact of four shading treatments on cucumber growth and yield production. These treatments were Green Shadow 1 (GS1), Whitewash (Calcium Carbonate;

1 kg/ 10 L water), Mud and Control (no shading)**.** Results showed that permeability was reduced by using (GS1) or whitewash as shading materials. The (GS1) treatment produced the highest vegetative growth, while whitewash produced the highest fruit yield (**Abu-Zahra and Ateyyat, 2016**). The effects of different drip irrigation regimes on yield and components of cucumber (cucumis- sativus l.) and to determine a threshold value for Crop Water Stress Index (CWSI) based on irrigation programming. Four irrigation treatments were tested as 50 (T-50), 75 (T-75), 100 (T-100) and 125% (T-125) of Irrigation Water (IW) applied per Cumulative Pan Evaporation (CPE) ratio with 3 days interval. In 50% (T-50) treatment it was observed a reduction in irrigation water resulted in 4.43% increase values in compared to those determined in (T-75) , (T-100) and (T-125) groups **(Simsek et al., 2005**). **Mohamed et al., (2012)** recommended open greenhouses using surface drip irrigation system with one lateral line per two rows of cucumber plant. Also they showed that, the pressure compensating emitter with a discharge of 8 lit/hour and one lateral /line per two plant rows has the highest cucumber yield (10.27Mg/fed)and water use efficiency of 55.91Kg/m^3 of water. The objective of this work was to study the effect of whitening on the greenhouse microclimate and both of cucumber yield and water use efficiency which irrigated by drip irrigation system. In addition to reduce the income solar radiation thus reduce the air temperature inside the greenhouse at the canopy scale, through the sensible heat flux and their evolution before and after application of the white paint.

2. MATERIALS AND METHODS

2.1. Primary experiment

A preliminary experiment was conducted to select the most effective characteristic parameters of painted coating materials on the models of the greenhouse which reserve the maximum amount of solar radiation. The tested paint materials were: (1) red oxide, (2) yellow oxide, (3) sodium sulphate, (4) ammonium chloride, and (5) lime and white plastic with different concentrations of each material. The effective parameters of the tested materials were selected after analyzing the obtained results from the primary experiment. The selected material was used in the field experiments and their characteristics were used in differentiation between the studied treatments. For each tested coated material, two levels of concentration were tested as follows:

1- Ammonium chloride **$AlCl_3$** (30 and 50%),
2- Sodium Sulphate **Na_2SO_4** (50 and 70%),
3- Red oxide **Fe_2O_3** (187.5 gm lime / 7.5gm oxide/ 0.75 liter of water) and (281.5gm lime / 7.5gm oxide/ 0.75 liter of water),
4- Yellow oxide **$FeHo_2$** (187.5 gm lime / 7.5gm oxide/ 0.75 liter of water) and (281.5gm lime / 7.5 gm oxide / 0.75 liter of water,
5- Lime **CaO** (150 gm lime / 0.75 liter of water), and (200 gm lime / 0.75 liter of water.

The concentration of white emulsion paint was 200 mm white plastic/ 1100 liter of water. Solar radiation was measured using the solar radiation powermeter TES 1333 Solarmeter in (W/m^2).

The measured climatic data inside the greenhouse were:

1. Air temperature (T, ºC) which was measured using IC (LM35) sensors. The data collection and recording frequency was 10 seconds, 60 minutes average of each measurement was recorded using a **Lab Jacks** data logger.
2. The incoming and out coming solar radiation (Rs_i and Rs_o, respectively, in W/m^2).

2.2. <u>Field experiment</u>

Two plastic covered greenhouses were constructed and oriented N-S in the farm. In each greenhouse, the geometrical dimensions were presented in fig.1.The frame of each greenhouse was covered with a single polyethylene sheet of 130-µm-thickness. The height of each greenhouse was 3m at the center and its width was 8.20m, with a length of 11m. Field experimental study focused upon the change of water application rate which where; 70, 80, 90 and 100% of potential evapotranspiration (ET_o).Cucumber vegetable crop was planted in each greenhouse at 16 /August /2016 with 50 cm spacing between plant rows and 30cm between plants. The used emitters are (orifice vortex emitter) with a nominal discharge rate of 4 l/h and 50 cm spacing between emitters. The crop evapotranspiration (mm/day) was estimated with the help of both potential evapotranspiration and crop coefficient using the following equation:

$$ETc = ETo * Kc \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where:

ETc: The crop evapotranspiration (mm/day).

ETo: The potential evapotranspiration (mm/day); and

Kc: Bazzle crop coefficient

Bazzle crop coefficient was taken from literature and was differed according to the cucumber growing stage. As for the irrigation event, it was conducted twice weekly, one was after 3days and the other was after 4 days.

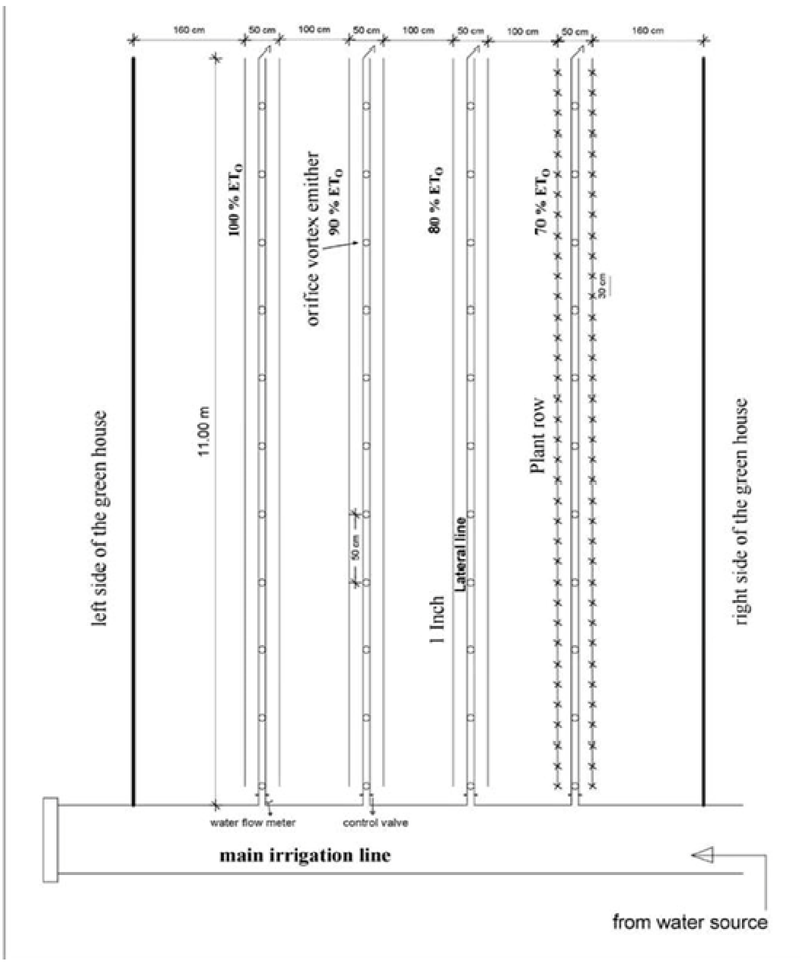

Fig. 1: Schematic diagram of surface drip irrigation system and the studied tested treatments for each greenhouse.

Water use efficiency (WUE) values for each treatment were calculated according to Jensen (1983), as follows:

$$\mathrm{WUE}\ (\mathrm{kg/m^3}) = \frac{\text{total fresh yields}\left(\frac{\mathrm{kg}}{\mathrm{fed}}\right)}{\text{total water applied}\left(\frac{m^3}{\mathrm{kg}}\right)}$$

3. RESULTS AND DISCUSSION

3.1. Water application rate

Table (1) represents the depth of irrigation water for all treatments along the growing season for both painted and unpainted cover greenhouses. For each treatment, the depth of water added each irrigation event depended on the growing stage of cucumber. At each growing stage, the depth of water applied depended on the level of the tested rate of application. The three known growing stages initial, development and harvesting stage consumed a different percent of total seasonal water application depth. For all the tested treatments initial, development and harvesting stage consumed 17%, 29% and 54%from the total seasonal water application depth respectively. These presents were the same for both painted and unpainted plastic cover greenhouses.

3.2. Cucumber plant length

Table (2) represents both of average plant length and rate of increasing the plant length for all the studied treatments. With unpainted plastic greenhouse the average plant length decreased when the rate of water application decreased. This was occurred after 37 days from planting. After this period the highest average length was 143.5 cm and observed at 100% of the potential evapotranspiration. But after this period and in case of using painted plastic the highest value of average plant length was 177.33 cm and also observed at 100% of the potential evapotranspiration. After 54 days from planting, the effect of level of water application rate appeared strongly with both painted and unpainted plastic cover. The highest average plant length (240.00cm) achieved in case of unpainted plastic and was recorded with 90% of the potential evapotranspiration. While in case of painted plastic cover, the highest average plant length (245.00cm) was recorded at 80% of the potential evapotranspiration. At the first period (after 37 days from planting) the lowest average length was occurred at the lowest level of water application rate (70% of ET_o). This was recorded for both painted and unpainted plastic covers.

Table (1): Depth of irrigation water applied for all the studied treatments along the growing season with painted and unpainted cover greenhouses.

Growing stage	Time after planting (days)	Depth of water applied (mm/treatment) for both of painted and unpainted Plastic cover greenhouses			
		Studied treatment			
		100% ET_o	90% ET_o	80% ET_o	70% ET_o
Initial	9	23.70	21.48	19.26	16.30
	12	31.85	28.89	25.19	22.22
	16	20.74	19.26	17.04	14.81
Total	16	76.29	69.63	61.49	53.33
Development	19	28.89	25.93	22.96	20.00
	23	20.74	19.26	17.04	14.81
	26	28.89	25.93	22.96	20.00
	30	20.74	19.26	17.04	14.81
	33	28.89	25.93	22.96	20.00
Total	17	128.15	116.31	102.96	89.62
Harvesting	42	20.74	19.26	17.04	14.81
	45	28.89	25.93	22.96	20.00
	49	20.00	17.78	16.30	14.07
	53	14.81	13.33	11.85	10.37
	56	20.00	17.78	16.30	14.07
	60	14.81	13.33	11.85	10.37
	63	20.00	17.78	16.30	14.07
	67	14.81	13.33	11.85	10.37
	70	20.00	17.78	16.30	14.07
	74	14.81	13.33	11.85	10.37
	77	11.85	11.11	9.63	8.15
	81	8.89	8.15	7.41	6.67
	84	11.85	11.11	9.63	8.15
	88	8.89	8.15	7.41	6.67
	91	11.85	11.11	9.63	8.15
Total	58	242.2	219.26	196.31	170.36
Total seasonal water application depth (mm)		446.64	405.2	360.76	313.3
Total seasonal of water application rate (m^3/fed)		1875.89	1706.04	1515.19	1315.89

It was 125.00cm and 163.33cm for unpainted and painted plastic cover respectively. As for the rate of increasing the plant length, it also differed according to the level of water application rate. In case of unpainted plastic cover, the highest value was 6.69 cm/day with 70% of potential evapotranspiration after 54 days from planting. The lowest value was 3.97 cm/day and was observed at 100% ET_o of water application rate was also after 54 days from planting. With painted plastic cover, the highest rate was 4.31 cm/day recorded with 80% ET_o of water application rate, while the lowest rate (2.38 cm/day) was observed at 90% ET_o of water application rate after 54 days from planting. With the third period (75 days after planting), the rate took the same trend with unpainted plastic cover, where the length rate (4.25 cm/day) was observed at 70% ET_o of water application rate. In case of painted plastic cover, the highest rate (10.30 cm/day) achieved at 90% ET_o of water application rate and the lowest rate (1.70 cm/day) was at 70% ET_o of water application rate. The results showed that the painted plastic shared increasing the rate of increasing plant length comparing with the unpainted one. This was occurred at all the tested levels of water application rate. Both of plant length and its changing along the growing season for painted and unpainted plastic cover greenhouses represented in fig.2 and fig.3, respectively.

Table(2): Average plant length and rate of increasing the plant length along the growing season for both painted and unpainted plastic cover greenhouse.

Time after planting (days)	Average plant length (cm)							
	Unpainted plastic				Painted plastic			
	100% ET_O	90% ET_O	80% ET_O	70% ET_O	100% ET_O	90% ET_O	80% ET_O	70% ET_O
37	143.5	131	129	125	177.33	168.33	171.66	163.33
54	211	240	227.5	238.75	223	208.75	245	231.25
Rate of increasing plant length (cm/day)	3.97	6.44	5.79	6.69	2.69	2.38	4.31	4.00
75	287.5	274	262.5	328	306	425	400	260
Rate of increasing plant length (cm/day)	3.64	1.60	1.67	4.25	3.95	10.30	7.38	1.70

3.3. Total Cucumber yield

Total seasonal cucumber yield in Mg/fed for each treatment was computed and used in differentiation between treatments. Table (3) represents the total cucumber yield for both unpainted and painted plastic cover at all the four tested levels of water application rate. In case of using the unpainted plastic, the highest total yield (13.06 Mg/Fed) occurred with application rate of 80% of potential evapotranspiration.

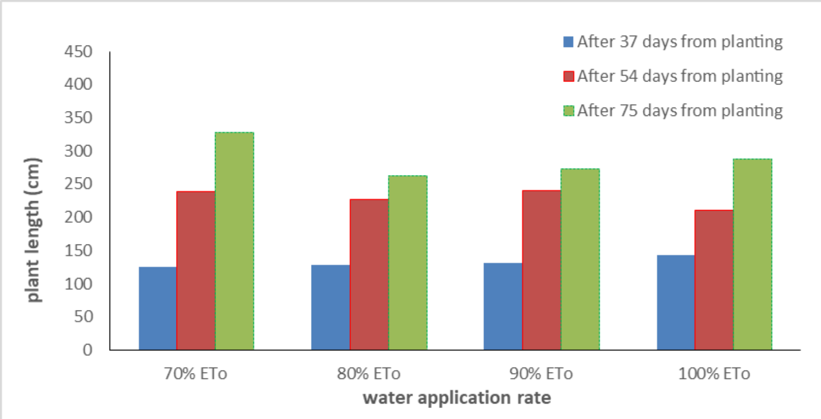

Fig. 2: Plant length and its changing along the growing season for all the studied treatment for unpainted plastic cover greenhouses.

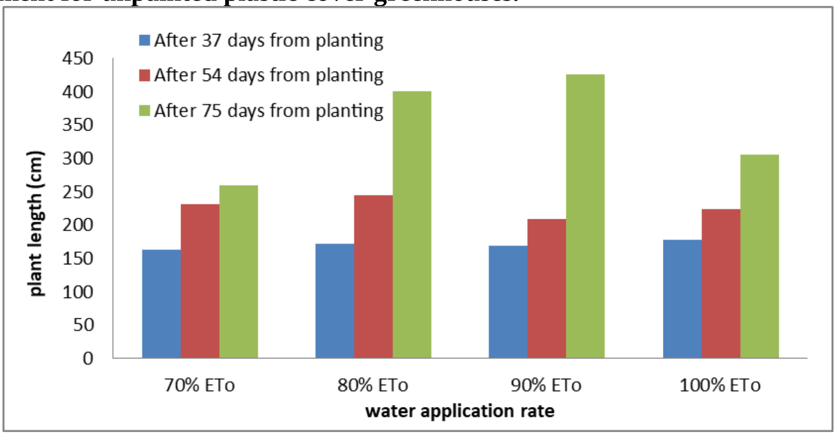

Fig. 3: Plant length and its changing along the growing season for all the studied treatment for painted plastic cover greenhouses.

The lowest total yield (9.8 Mg/Fed) was achieved at 100% of potential evapotranspiration. With painted plastic, the highest total yield (15.5 Mg/Fed) was observed at 80% of water application rate, while the lowest (10.69 Mg/Fed) was at 70% ET_o. At each level of water application rate, the total yield was greater when using painted plastic than with unpainted plastic except at 70% of potential evapotranspiration. The total yield increased by 22.04%, 16.94% and 18.68% with painted plastic at 100% ET_o , 90% ET_o and 80% ET_o respectively comparing with unpainted plastic. At 70% ET_O the total yield decreased by 13.79% when using the painted plastic comparing with the unpainted, considering the level of water application rate.

Table (3): Yield obtained per treatment during harvesting stage for both painted and unpainted plastic cover.

Time after planting (days)	Obtained yield per treatment (gm/treatment)							
	Unpainted plastic				**Painted plastic**			
	Water application rate				**Water application rate**			
	100% ETo	**90% ETo**	**80% ETo**	**70% ETo**	**100% ETo**	**90% ETo**	**80% ETo**	**70% ETo**
37	**………**	**385**	**325**	**675**	**790**	**1570**	**1735**	**1200**
39	**………**	**645**	**425**	**1120**	**2140**	**2955**	**3825**	**3170**
43	**2160**	**3225**	**1315**	**4420**	**5180**	**6530**	**8810**	**5440**
44	**295**	**350**	**1030**	**1650**	**910**	**925**	**1920**	**1100**
46	**235**	**1540**	**1905**	**1315**	**1050**	**1525**	**1605**	**1445**
49	**2790**	**4380**	**5580**	**6090**	**3970**	**7115**	**4725**	**3300**
53	**4370**	**5055**	**6995**	**5155**	**2430**	**4960**	**5970**	**4435**
55	**1515**	**3590**	**2340**	**1740**	**1850**	**2365**	**2350**	**1785**
57	**1750**	**3245**	**2620**	**2835**	**1390**	**1130**	**1310**	**940**
60	**3290**	**3635**	**4660**	**3465**	**1910**	**2785**	**2730**	**1950**
62	**1180**	**1660**	**2140**	**1700**	**1170**	**1185**	**1345**	**915**
64	**1260**	**1755**	**965**	**615**	**1235**	**1320**	**1060**	**1130**
67	**1265**	**2130**	**2375**	**1420**	**3535**	**2415**	**2900**	**3130**
69	**1325**	**1570**	**2530**	**910**	**1465**	**2310**	**2440**	**1335**
71	**1400**	**1205**	**1650**	**1665**	**3215**	**2720**	**2320**	**1385**
74	**2530**	**2055**	**1325**	**1775**	**4220**	**4875**	**4435**	**2170**
78	**150**	**1200**	**800**	**650**	**2700**	**2350**	**3700**	**1600**
82	**1750**	**1150**	**350**	**800**	**3650**	**2850**	**2455**	**2300**
86	**1230**	**1475**	**970**	**1130**	**1950**	**2685**	**3100**	**1630**
91	**1500**	**750**	**1500**	**950**	**1850**	**2500**	**2300**	**1400**
Total yield (Mg/Fed)	**9.8**	**12.4**	**13.06**	**12.4**	**11.96**	**14.5**	**15.5**	**10.69**

The higher values of the obtained yield with painted plastic may be returned to the orientation of the climatic parameters inside the greenhouse in this case. The difference in seasonal cucumber yield for painted and unpainted cover greenhouses presented in table (4).The difference in total yield in both painted and unpainted greenhouse due to climatic condition was presented in table (5). It clears that the painting material causes an effected role in improving the climatic condition inside the painted greenhouse. The value of solar radiation with painted inside greenhouse (334.63W/m^2) represents 44.21% from the outside solar radiation. While in case of unpainted, the solar radiation inside the greenhouse represents 74.79% from the outside solar radiation. Consequently the total yield increased with painted greenhouse. The same trend was observed with the value of air temperature inside the greenhouse either the maximum or the minimum values. Both maximum and minimum temperature decreased with painted greenhouse by about 9.83% and 11.65% respectively.

Table (4): Total cucumber yields for both unpainted and painted plastic at all the tested levels of water application rates.

state of the used plastic	Total cucumber yield (Mg/Fed)			
	Water application rate			
	100% ET_O	90% ET_O	80% ET_O	70% ET_O
Unpainted	9.8	12.40	13.06	12.40
Painted	11.96	14.50	15.50	10. 95
Changing percent (%)	22%	16.93	18.68	-13.79

Table (5): Total seasonal yield at the tested levels of water application rate for painted and unpainted plastic greenhouse with their climatic parameters

Climatic condition inside the greenhouse	Total cucumber yield (Mg/Fed)			
	Water application rate			
	100% ET_o	**90% ET_o**	**80% ET_o**	**70% ET_o**
Unpainted plastic Solar radiation (W/m$^{2)}$ R_I = 614.3 $R_{O=}$821.88 Air temperature (°C) T_{max} = 31.32 T_{mini} =17.6	**9.80**	**12.40**	**13.06**	**12.40**
painted plastic Solar radiation (W/m$^{2)}$ R_I =334.63 $R_{O=}$756.88 Air temperature (°C) T_{max} =28.24 T_{mini}=15.55	**11.96**	**14.50**	**15.50**	**10.95**

3.4. <u>Water use efficiency (W.U.E)</u>

Table (6) represents the computed values of the water use efficiency for all treatments either with unpainted or painted plastic. In general the calculated water use efficiency in case of painted plastic is greater than that calculated with unpainted plastic except at 70 % of ET_o. The highest value of W.U.E (10.23 kg/m^3) achieved with painted plastic cover at 80% of ET_o of water application rate.

The lowest value of W.U.E (5.22 kg/m^3) observed with unpainted plastic cover at 100% of ET_o. The obtained results concluded using the painted plastic especially at 80% of ET_o of water application rate. Therefore, using the painted plastic cover is recommended especially at lower application rate than 100% of ET_o except at 70 % of ET_o. Although the total water application rate was the same, the water use efficiency with painted plastic supported using the painted plastic cover greenhouse with white plastic.

Table (6): Water use efficiency for all the tested treatments with both unpainted and painted plastic cover greenhouses.

State of the used plastic	Unpainted plastic				Painted plastic			
ET_O	**100 %**	**90 %**	**80 %**	**70 %**	**100 %**	**90 %**	**80 %**	**70 %**
Volume of water m^3/fed	**1875.89**	**1706.04**	**1515.19**	**1315.89**	**1875.89**	**1706.04**	**1515.19**	**1315.89**
Yield kg/fed	**9800**	**12400**	**13060**	**12400**	**11960**	**14500**	**15500**	**10690**
W.U.E kg/m^3	**5.22**	**7.27**	**8.62**	**9.42**	**6.38**	**8.50**	**10.23**	**8.12**

4. CONCLUSIONS

Painting the plastic cover with the white plastic will improved the lowest permeability of the income solar radiation in addition achieved the highest productivity of 15.5 Mg / fed and the highest efficiency of irrigation water use of 10.23 kg / m ^{3} and also gets the highest rate of increase the length of the cucumber plant, reaching 10.30 cm / day.

Using of drip irrigation system in greenhouses with orifice vortex emitter and a discharge of 4 liters per hour due to high rates of growth and high productivity compared to traditional methods of irrigation.

5. REFERENCES

Abdel-Ghany, A. M., Al-Helal, I. M., Alsadon, A. A., Ibrahim, A. A. and M. R. Shady, (2016) "Closed Solar House with Radiation Filtering Roof for Transplant Production in Arid Regions: Energy Consumption" Energies, 9(3), 136; doi: 10.3390/en9030136**.**

Abu-Zahra. R. and M. A. Ateyyat, (2016) "Effect of Various Shading Methods on Cucumber (Cucumis sativus L.) Growth and Yield Production", International Journal of Environment and Sustainability [IJES], Vol. 5 No. 1, pp. 10-17**.**

Ahemd, H. A., Al-Faraj, A. A. and A. M. Abdel-Ghany, (2016) "Shading greenhouses to improve the microclimate, energy and water saving in hot regions: A review" Scientia Horticulturae 20, 136–45.

Baille, A., Kittas, C. and N. Katssoulas, (2001) "Influence of whitening on greenhouse microclimate and crop energy partitioning" Agricultural and Forest Meteorology, 107, 293–306**.**

El –Ayedh, A. and M., Al-Doghairi, (2004) "Trapping efficiency of various colored traps for insects in cucumber crop under greenhouse conditions in Riyadh, Saudi Arabia" In: Inter. Symposium on greenhouses, Environmental controls and In- house Mechanization for crop production in the tropics and sub- tropics, Pahang, Malysia June 15-17.

El-Aidy, F., El-zawely, A., Hassan, N. and M. El-sawy (2007) "Effect of Plastic tunnel size on production of cucumber in delta of Egypt". Appl. Ecol. Environ. Res. 5 (2), 11–24.

Jensen, M. E. (1993) "Design and operating of farm irrigation system" ASAE, Michigan, USA.

Mashonjowa, E., Ronsse, F., Mhizha, T., Milford, J. R., Lemeur, R. and Pieters, J.G (2010) "The effects of whitening and dust accumulation on the microclimate and canopy behaviour of rose plants (Rosa hybrida) in greenhouse in Zimbabwe**"** Solar Energy 84, 10–23.

Mohamed, A. A., Mohamed, M. A., Gomaa, A. H., Aboamera, M. A and A.H. Taha, (2012). Cucumber growth and yield in plastic greenhouses under different emitter types and lateral line location. Misr journal of agricultural engineering, Vol. 29 No.(3).

Mutwiwa, U. N. (2007). Effects of Different Cooling Methods On Microclimate and Plant Growth in Greenhouses In The Tropics. Ph.D. Thesis, University of Hannover, Germany.

Sethi, V.P.; and S. K. Sharma. (2007a) " Experimental and economic study of a greenhouse thermal control system using aquifer water " Energy Conversion and Management, 48 (1): 306-319.

Sethi, V.P.; and S. K. Sharma. (2008) "Survey and evaluation of heating technologies for worldwide agricultural greenhouse applications" Energy Conversion and Management, 82, 832-859.

Simsek, M., T.Toukas , M, Kacria ,N.Comlekciogla and Z.Dogan (2005). The effect of different irrigation regimes on cucumber (cucumis sauius L,) yield and yield characteristics under field conditions. Agric. Water management 73,173-191.

الملخص العربي

تأثير دهان الغطاء البلاستيكي للصوبات الزراعية علي الري بالتنقيط لمحصول الخيار

أ.د / محمد علي ابوعميره [١] ، د/احمد توفيق طـه [٢]،
د/محمد نبيه عمر[٣] و م/اميرة عماد داود[٤]

أجري هذا البحث بمزرعة كلية الزراعة بشبين الكوم جامعة المنوفية ، واستهدف دراسة تأثير دهان الغطاء البلاستيكي للصوبات الزراعية بمادة البلاستيك الابيض علي إنتاجية ومعدل نمو وكفاءة استخدام مياه الري لمحصول الخيار تحت نظام الري بالتنقيط . وأستخدم لذلك اربعة مستويات لمعدل إضافة مياه الري هي (١٠٠%-٩٠%- ٨٠%-٧٠%) من البخر نتح الموضعي ، وتم زراعة نبات الخيار علي مسافة ٥٠ سم بين الخطوط ومسافة ٣٠ سم بين النباتات داخل الخط، وأستخدمت النقاطات ذات الفتحة بمعدل تصرف للنقاط مقداره ٤ لتر/س وأستخدمت قيم معامل المحصول عند مراحل النمو المختلفة لنبات الخيار من الدراسات المرجعية ، وتم إختيار مادة البلاستيك الابيض لدهان الغطاء البلاستيكي للصوبات الزراعية بعد دراسة أولية لعدد ستة مواد هي : (١) الأكسيد الأحمر،(٢) الأكسيد الأصفر، (٣) كبريتات الصوديوم ،(٤) كلوريد الامونيوم ،(٥) الجير،(٦) البلاستيك الأبيض . وأجريت بقسم الهندسة الزراعية بكلية الزراعة جامعة المنوفية بهدف قياس تأثير هذه المواد علي البارامترات المناخية داخل الصوب الزراعية وهي درجة الحرارة وقيمة الإشعاع الشمسي داخل الصوبة وتوصلت الدراسة الي النتائج الاتية :

١. نسبة الاستهلاك المائي للمرحلة الاولية ومرحلة النمو ومرحلة الحصاد لمحصول الخيار كانت ١٧% - ٢٩% - ٥٤% من العمق الكلي الموسمي لمياة الري علي الترتيب لكل معاملات الدراسة.
٢. تحقق أعلي معدل لزيادة طول النبات ومقداره ٦,٦٩ سم/يوم عند معدل إضافة مياه الري مقداره ٧٠% من البخر نتح الموضعي بعد ٥٤ يوم من الزراعة للصوبة الغير مدهونة
٣. تحقق أعلي معدل لزيادة طول النبات ومقداره ٤,٣١ سم/يوم للصوبة الزراعية المدهون غطائها بمادة البلاستيك الابيض عند معدل ري مقداره ٨٠% من البخر نتح الموضعي بعد ٥٤ يوم من الزراعة.
٤. تحقق أعلي إنتاج لمحصول الخيار ومقداره ١٥,٥ طن/فدان للصوبة الزراعية المدهون غطائها بمادة البلاستيك الابيض عند معدل ري مقداره ٨٠% من البخر نتح الموضعي.
٥. تحققت أعلي كفاءة لإستخدام مياه الري ومقدارها ١٠,٢٣ كجم/متر^{٣} عند استخدام الصوبة الزراعية المدهون غطائها بمادة البلاستيك الأبيض عند معدل ري مقداره ٨٠% من البخر نتح الموضعي.

---

١) - أستاذ بقسم الهندسة الزراعية - كلية الزراعة – جامعة المنوفية
٢) - أستاذ مساعد بقسم الهندسة الزراعية - كلية الزراعة – جامعة المنوفية
٣) - مدرس بقسم الهندسة الزراعية - كلية الزراعة – جامعة المنوفية
٤) - معيدة بقسم الهندسة الزراعية - كلية الزراعة – جامعة المنوفية