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The Effect of Different Irrigation Systems, Discharge, and Irrigation Intervals on Green Onion Growth and Yields

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Abstract**—** *An experiment was conducted in the field of the University of Baghdad in spring season of 2015 In loamy sand soil to evaluate the effect of different irrigation systems, discharge and irrigation intervals on green onion growth and yield, using locally combine implement which used for installation subsurface irrigation pipes and surface drip irrigation. Subsurface drip irrigation system and surface drip irrigation system as main plot treatment, three levels of discharge included 2.5, 3.0 and3.5 L\hr represented subplot treatment and two levels of irrigation intervals included: 4 days and 8 days represented sub subplot treatment were used in this study. Root diameter, stem diameter, green weight, dry weight, and stem length were measured. Nested design under randomized complete block design (CRBD) with three replications was used in this experiment. Least significant differences (L.S.D) at 0.05 levels were used to compare the mean of treatments.*

The results were showed the following:

Subsurface irrigation was superior in getting higher 78.6 gm dry weight and 232.2 gm green weight and 31.8 mm stem diameter and root diameter stood 45.2 mm and stem length stood 55.3 cm comparing with other treatments. 3.5 L/h discharge was superior in getting the highest 81.8 gm dry weight, 249.4 gm green weight, stem length stood 70.8 cm, root diameter stood 45.4 mm and stem diameter stood 32.6 mm comparing with other treatments. 4 days irrigation interval was superior in getting higher 80.2 gm dry weight, 231.4 gm green weight, root diameter stood 46.3 mm, stem diameter stood 32.7 mm and stem length stood 55.3 cm comparing with other treatments. Triple interaction between subsurface irrigation system, 3.5 L / h discharge and4 days irrigation interval was superior in getting the highest dry weight stood 86.4 gm, green weight stood 252.3 gm, stem length stood 78 cm, root diameter stood 50.6 mm and stem diameter stood 35.3 mm comparing with other interactions treatments.

Keyword—root diameter, stem diameter, green weight, surface drip irrigation system, drip irrigation.

I. INTRODUCTION

Agricultural mechanization is defined as the performance of various agricultural processes such as plowing , sowing, fertilization, modification, settlement and operation of fixed irrigation pumps by agricultural machinery and implements. Tractors is the main source of the farms movement power which are used to pull various agricultural implements, (Kepner et al 1972). Mechanization is of great importance in carrying out agricultural operation, reducing manpower and production unit costs and increasing agricultural production of the land unit (Izat and Ali ,1986). Mechanization involves the identification or evaluation of various agricultural implements ,especially the combine implement , which are used to increase agricultural production and reducing the costs of agricultural operation in general (Frank, et al, 2012). Combine implement which is a group of important implements that have been published recently because they perform the work of one field by short passage of time and cost, creating good germination condition, reducing tillage and protecting the soil from compression (Camp, et al, 1988).The scarcity of irrigation water is an effective factor in reducing the cultivated areas in the world. Therefore, researchers and farmers resorted to the development and use of new systems to reduce waste in water , considering that the old irrigation systems are accompanied by large water losses with the current acute shortage of water supply in general and irrigation water especially .One of the most efficiency ways to conserve water is surface drip irrigation and subsurface drip irrigation . Kumar et al, (2007) and Enciso et al,(2009) where found that irrigation has a significant effect on onion and yield components. Drip irrigation is a slow and frequent addition of water to the soil through the picks of the picks drawn along the water delivery pipes (Al-Taie, 1999). The advantage of drip irrigation system are the efficiency of water use , as the evaporation is little ,especially in the subsurface drip irrigation system , these type of irrigation systems are also ways of reducing the growth of the bushes of the crops service operations as

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well as obtaining higher yield and quality of relatively low costs and can be add fertilizers with irrigation water (Al-taief and Alhadithi , 1988).Green onion is a winter vegetable crops of high nutritional value for its vitamins , carbohydrates and mineral salts and is used for medicinal purposes as well (Morsia and Nimet , 1973).

The purpose of this study is to evaluate the effect of subsurface drip and surface drip irrigation systems and different irrigation discharges and intervals on green onions growth and yields.

II. MATERIALS AND METHODS

The experiment was conducted to evaluate the effect of different irrigation systems, discharge and irrigation intervals on green onion growth and yield in the field of the University of Baghdad in spring season of 2015 In loamy sand soil (Tble,1). Locally combine implement (fig. 1) which used for installation subsurface irrigation pipes and surface drip irrigation was used this experiment. Subsurface drip irrigation system and surface drip irrigation system as main plot treatment, three levels of discharge included 2.5, 3.0 and3.5 L\hr represented subplot treatment and two levels of irrigation intervals included: 4 days and 8 days represented sub subplot treatment were used in this study. Root diameter, stem diameter, green weight, dry weight, and stem length were measured. Nested design under randomized complete block design (CRBD) with three replications was used in this experiment. Least significant differences (L.S.D) at 0.05 levels were used to compare the mean of treatments.

Table.1: Soil physical and chemical properties

Property	Values	Unites
Soil bulk density Soil EC PH Capron	1.3 1.1 **7.25** **619**	**Mg | m^3** **Ds| cm** **Mg | l**
Soil Texture	Loamy sand	
Soil analysis components	Sand Silt Clay	**77.6%** **12.5%** 9.9%

Fig.1: Combine implement used in instslation irrigation pipes

Studed properties

1- Root diameter (mm) -

Ten plants from the middle lines were selected and the root diameter for each plant was measured by vernier .

2- Stem daimeter (mm) -

The stem diameter of ten plants(top of the root and lower stem) was measured from the selected middle lines by vernier .

3- Stem length (cm) -

The length of the stem was measured from the previously selected plants .

4- Green weight (gm) -

The green weight of the plant was measured from the intermediate lines of the previously selected plants by the sensitive balance of each plant including the total of green onions .

5- Dry weight (gm) -

The dry weight of the plant was measured from the intermediate lines of the previously selected plants and placed in perforated bags for each plant and placed in the oven for 24 hours at a temperature of 105 CO. The measurment was taken for more than once and after the weight was established the final measurements were taken by sensitive balance for each plant

III. RESULTS AND DISCUSSION

Root diameter (mm):

Table (2) shows the effect of irrigation systems and different discharges and irrigation intervals on the root diameter of the green onion plant. Subsurface drip irrigation system was superior in getting higher root diameter stood 45.2 mm while root diameter in the surface drip irrigation system got 43.4 mm. 3.5 L / h discharge got the highest value of root diameter amounted 45.4 mm and the 4 days irrigation interval got higher root diameter amounted 46.3 mm comparing with other treatments. The triple interaction between subsurface drip

irrigation system and 3.5 L / h discharge and the 4 days Irrigation interval got the highest root diameter amounted 50.6 mm compared with the interaction between surface drip irrigation system 2.5 L / h discharge and 8 days irrigation interval reached 38.7 mm. The reason may be retention soil moisture in the subsurface irrigation system compared to the evaporation of irrigation water from the soil of the surface drip irrigation system. These results are consistent with the results reached by Khalil, (2013).

Table.2: Effect irrigation systems and different irrigation discharge and interval in root diameter (mm)

Indicators	Root Diameter (mm)			
	Interaction between Irrigation Systems and Discharge and Irrigation Intervals			
Irrigation Systems	Discharge	Irrigation Intervals		Interaction between Irrigation systems and Discharge
		4 days	8 days	
Subsurface Drip Irrigation	2.5	44.2	42.6	42.4
	3.0	48.1	42.9	45.5
	3.5	50.6	43.4	47
Surface Drip irrigation	2.5	44.3	38.7	41.5
	3.0	44.6	44.3	44.4
	3.5	46.5	41.2	43.8
Lsd = 0.05	0.86			
Irrigation Interval Medium	46.3		42.1	
Lsd =0.05	0.44			
Discharge	Interaction between Irrigation Discharge and Intervals			Discharge Medium
2.5	44.3		40.6	42.4
3.0	46.3		43.6	44.9
3.5	48.5		42.3	45.4
Lsd = 0.05	0.42			
Irrigation systems	Interaction between Irrigation Systems and Intervals			Irrigation Systems Medium
Subsurface Drip Irrigation	47.6		42.9	45.2
Surface Drip Irrigation	45.5		41.4	43.4
Lsd = 0.05	0.53			

Stem diameter (mm):

Table (3) shows the effect of irrigation systems and different discharges and irrigation intervals on the stem diameter of the green onion plant. Subsurface drip irrigation system was superior in getting higher stem diameter stood 31.8 mm while root diameter in the surface drip irrigation system got 31.2 mm. 3.5 L / h discharge got the highest value of stem diameter amounted 32.6 mm and the 4 days irrigation interval got higher stem diameter amounted 32.7 mm comparing with other treatments. The triple interaction between subsurface drip irrigation system and 3.5 L / h discharge and the 4 days Irrigation interval got the highest stem diameter amounted 35.3 mm compared with the interaction between surface drip irrigation system 3.0 L / h discharge and 8 days irrigation interval which reached 29.1 mm. The reason may be small number of days between irrigation intervals which caused increase in soil water storage. These results are consistent with the results which reached by Ati, (2014).

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Table.3: The effect of irrigation systems and different irrigation discharge and interval on stem diameter, mm.

Indicators	Stem diameter, (mm)			
Irrigation Systems	Interaction between Irrigation Systems and Irrigation Discharge and Intervals			Interaction between Irrigation Systems and Discharge
	Discharge	Irrigation Intervals		
		4 days	8 days	
Subsurface Drip irrigation	2.5	30.9	29.3	30.1
	3.0	33.4	31.1	32.2
	3.5	35.3	30.8	33.05
Surface Drip irrigation	2.5	31.7	30.5	31.1
	3.0	32.2	29.1	30.6
	3.5	32.7	31.6	32.1
Lsd = 0.05	0.094			
Medium Irrigation Intervals	32.7		30.4	
Lsd =0.05	0.73			
Discharge	Interaction between Irrigation Discharge and Intervals			Medium Discharge
2.5	31.5		29.9	30.7
3.0	32.8		30.1	31.4
3.5	34.0		31.2	32.6
Lsd = 0.05	0.78			
Irrigation Systems	Interaction between Irrigation Systems and Intervals			Medium Irrigation Systems
Subsurface Drip irrigation	33.2		30.4	31.8
Surface Drip Irrigation	32.2		30.3	31.2
Lsd = 0.05	0.26			

Stem length (cm):

Table (3) shows the effect of irrigation systems and different discharges and irrigation intervals on the stem length of the green onion plant. Subsurface drip irrigation system was superior in getting higher stem length stood 64.7 cm while stem length in the surface drip irrigation system got 60.0 cm. 3.5 L / h discharge got the highest value of stem length amounted 70.8 cm and the 4 days irrigation interval got higher stem length amounted 55.3 cm comparing with other treatments. The triple interaction between subsurface drip irrigation system and 3.5 L / h discharge and the 4 days Irrigation interval got the highest stem length amounted 78.0 cm compared with the interaction between surface drip irrigation system, 2.5 L / h discharge and 8 days irrigation interval which reached 56.0 cm. The reason may be small number of days between irrigation intervals and the retention of soil moisture in the subsurface irrigation system compared to the evaporation of irrigation water from the soil of the surface drip irrigation system. These results are consistent with the results reached by Ati, (2014).

Table.4: The effect of irrigation systems and different irrigation discharge and intervals on stem length cm.

Indicators	Stem length (cm)			
Irrigation Systems	Interaction between Irrigation Systems, and irrigation Discharge and Intervals			Interaction between Irrigation Systems and Discharge
Irrigation systems	Discharge	irrigation intervals		
		4 days	8 days	

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Subsurface Drip Irrigation	2.5	61	58	59.5
	3.0	66	60.5	63.2
	3.5	78	65	71.5
Surface Drip Irrigation	2.5	56.2	56	56.1
	3.0	59.5	57.3	58.4
	3.5	66	62.4	64.2
Lsd = 0.05		0.86		
Irrigation Intervals Medium		55.3	51.2	
Lsd =0.05		0.99		
Discharge	Interaction between Irrigation Discharge and Intervals			Medium Discharge
2.5		58.6	57	57.8
3.0		62.7	58.9	60.8
3.5		72	69.7	70.8
Lsd = 0.05	0.42			1.01
Irrigation Systems	Interaction between Irrigation systems and Intervals			Medium Irrigation Systems
Subsurface Drip Irrigation		68.3	61.1	64.7
Surface Drip Irrigation		60.5	59.5	60.0
Lsd = 0.05		1.23		0.98

Dry weight (gm) :

Table (5) shows the effect of irrigation systems and different discharges and irrigation intervals on the dry weight of the green onion plant. Subsurface drip irrigation system was superior in getting higher dry weight stood 78.6 gm/plant while dry weight in the surface drip irrigation system got 74.1 gm/plant. 3.5 L / h discharge got the highest value of dry weight amounted 81.8 gm/plant and the 4 days irrigation interval got higher dry weight amounted 80.2 gm/plant comparing with other treatments. The triple interaction between subsurface drip irrigation system and 3.5 L / h discharge and the 4 days Irrigation interval got the highest dry weight amounted 86.4 gm/plant compared with the interaction between surface drip irrigation system, 2.5 L / h discharge and 8 days irrigation interval which reached 62.0 gm/plant. The reason may be the diameter of root ,and stem diameter and length. These results are consistent with the results reached by Khalil, (2013).

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Table.5: The effect of irrigation systems and different irrigation discharge and intervals on dry weight (gm /plant)

Indicators	Dry Weight (gm/plant)		
	Interaction between Irrigation Systems and Irrigation Discharge and Intervals		
Irrigation Systems	Discharge	Irrigation Intervals	Interaction between Irrigation Systems and Discharge
		4 days	8 days
Subsurface Drip Irrigation	2.5	73.8	73.1	73.4
	3.0	85.2	76.2	80.7
	3.5	86.4	77.4	81.9
Surface Drip Irrigation	2.5	68	62	65
	3.0	82.7	68.2	75.4
	3.5	85.2	78.5	81.8
Lsd = 0.05	1.79			
Irrigation Interval Medium	80.2	72.5		
Lsd =0.05	1.22			
Discharge	Interaction between discharge and irrigation interval		Discharge Medium	
2.5	70.9	67.5	69.2	
3.0	83.9	72.7	78.3	
3.5	85.8	77.9	81.8	
Lsd = 0.05	1.86		1.99	
Irrigation Systems	Interaction between Irrigation Systems and Irrigation Intervals		Irrigation Systems Medium	
Subsurface Drip Irrigation	81.8	75.5	78.6	
Surface Drip Irrigation	78.6	69.5	74.05	
Lsd = 0.05	0.98		1.09	

Green weight (gm/plant):

Table (6) shows the effect of irrigation systems and different discharges and irrigation intervals on the dry weight of the green onion plant. Subsurface drip irrigation system was superior in getting higher green weight stood 232.3 gm/plant while green weight in the surface drip irrigation system got 206.8 gm/plant. 3.5 L / h discharge got the highest value of green weight amounted 249.4 gm/plant and the 4 days irrigation interval got higher green weight amounted 231.4 gm/plant comparing with other treatments. The triple interaction between subsurface drip irrigation system and 3.5 L / h discharge and the 4 days Irrigation interval got the highest green weight amounted 252.3 gm/plant compared with the interaction between surface drip irrigation system, 2.5 L / h discharge and 8 days irrigation interval which reached 158.1 gm/plant. The reason may be the diameter of root ,and stem diameter and length. These results are consistent with the results reached by Khalil, (2013).

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Table.6: The effect of irrigation systems and different irrigation discharge and intervals on green weight, gm/plant.

Indicators	Green weight (gm/plant)			
	Interaction between Irrigation Systems and Discharge and Irrigation Intervals			
Irrigation Systems	Discharge	Irrigation Intervals		Interaction between Irrigation Systems and Discharge
		4 days	8 days	
Subsurface Drip Irrigation	2.5	228.2	214.3	221.2
	3.0	242.0	199.9	220.9
	3.5	252.3	259.1	255.7
Surface Drip Irrigation	*2.5*	*195.9*	*158.1*	*177.0*
	3.0	227.0	174.1	200.5
	3.5	243.3	243.1	243.2
Lsd = 0.05		0.86		
Irrigation interval Medium		231.4	208.1	
Lsd =0.05	3.61			
Discharge	Interaction between discharge and irrigation interval			Discharge Medium
2.5		212.0	186.2	199.1
3.0		234.5	187.0	210.7
3.5		247.8	251.1	249.4
Lsd = 0.05		3.05		3.13
Irrigation Systems	Interaction between irrigation systems and irrigation interval			Irrigation systems Medium
Subsurface Drip Irrigation		240.0	224.4	232.2
Surface Drip Irrigation		222.0	191.7	206.8
Lsd = 0.05		2.68		2.01

IV. CONCLUSIONS AND ACOMMENDATION

From the above results, subsuarface irrigation system was superior in getting higher dry weight , green weight , root daimeter and stem daimeter and stem length . 3.5 L/h discharge was superiority in getting dry weight , green weight , root daimeter , stem detemer,stem length . 4 days irrigation intervals was superior in getting higher dry weight , green weight , root daimeter and stem daimeter and stem length. Triple interaction between subsarface drip irrigation system and discharge 3.5 L /h and first irrigation interval 4 days was superior in getting the highest dry weight , green weight , stem daimeter,root diameter , stem lenght .

Therefore, using subsarface drip irrigation system, discharge 3.5 L/h and first irrigation interval 4 days in cultivation green onion is acommend.

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