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DISTRIBUTION OF SOIL MOISTURE CONTENT AND SALTS IN SOIL PROFILE AFFECTED BY SUBSURFACE DRIP IRRIGATION SYSTEM UNDER DIFFERENT DISCHARGE RATES OF EMITTER

Aboamera, M.A.; Gomaa, A.H. and Asmaa T.S. Agiez

Agricultural and Biosystems Engineering, Faculty of Agriculture, Menoufia University

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ABSTRACT: Field experiments were conducted during the year 2019, in the experimental farm at the Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt. The site of the experiment was 30' 54ºN and 31ºE. During the field experiments, the minimum night temperature ranged between 17ºC and 22ºC, and the maximum temperature during the day ranged between 30ºC and 36ºC.The objective of this study was the field evaluation of the subsurface drip irrigation system used in the tomato crop under different emitter discharge.To achieve this aim, a subsurface drip irrigation system was installed, which was tested hydraulically before the field study. It consisted of a main irrigation line (PVC) with an inner diameter of 51mm, a branch (PVC) with a length of 32m and an inner diameter of 36mm, and secondary irrigation lines (PE) with a length of 9m for each line and a diameter of 16mm installed.It has longpass emitters with 4, 6 and 8 l/h. Two distances were used between the emitters, 30 cm and 50 cm. Subsurface irrigation lines were buried at a depth of 15cm under soil surface.

Using longpass emitter at emitter spacing 30 cm and emitter discharge 8 l/h in order to achieve the lowest percentage of salt accumulation in the root zone. Using longpass emitters at emitter spacing 30 cm and emitter discharge 4 l/h due to obtaining the highest productivity per feddan and also obtaining the highest water use efficiency. Application of the subsurface drip irrigation system in the clay lands to obtain a large percentage of irrigation water saving in each irrigation and seasonal total irrigation water.

Keywords: Emitter discharge – Emitter spacing – longpass – root zone – subsurface drip irrigation.

INTRODUCTION

Water shortage is a global problem. It is estimated that the global population will be about 9 billion to 10 billion by 2050, and more water will be thus needed. The irrigated agriculture is the largest sector of consumptive water use. How to use the water resources in a sustainable way to ensure food security is a major challenge for present and future generations. Therefore, increasing water productivity through technologies that produce more foods by drip water is essential for the sustainable agricultural development (FAO, 2021; Wanga *et al.,* 2022). Water scarcity associated with intense and frequent droughts has increased the need for the implementation of drought adaptation strategies that can save water and sustain crop productivity in water limited environments, (Sharma *et al.*, 2014).

Subsurface drip irrigation has been a form of irrigation-driven agriculture for more than 50 years. In the last 20 years, the adoption of subsurface drip irrigation has grown dramatically, owing to increasing pressure on water resources and the availability of reliable system components. The advantages of subsurface drip irrigation include more efficient water use, high yield, good quality, and delayed pipeline aging. In addition, reclaimed municipal wastewaters can be applied through subsurface drip irrigation. Recently, SDI is regarded as the most efficient form of micro-irrigation (Guo, 2019). Worldwide studies reveal advantages of subsurface drip irrigation of many crops over surface drip and other irrigation methods in terms of reduced evaporation loss and precise placement and management of water, enhanced plant growth, crop yield and quality (Singh *et al.*, 2020).

*Corresponding author: asmo2atalat@gmail.com

Waseen and Abid (2020), mentioned that subsurface drip irrigation system is increasingly used in regions with limited water resources to irrigate crops. The best design of subsurface drip irrigation systems requires knowledge of soil salt and water distribution patterns around the emitters that match the root extraction and minimize water losses. Abdel Hamza and Mahdi (2020), indicated that the increasing in the values of uniformity coefficient with an increase in the operating pressure, the uniformity coefficient gave the highest values at a pressure of 60 Kpa by 96.23, 95.33 and 97.78% for the distances between the subsurface drip lines 50, 75 and 100 cm, respectively. Whereas, the lowest values were at a pressure of 40 Kpa by 88.98, 90.06 and 91.32% for the same distances of the drip lines above. Moreover, they demonstrated that discharge variations relationship with the operating pressure, and it was observed that there was a decrease in the discharge variations with increasing the operating pressure. The operating pressure, 60 Kpa gave the lowest discharge variations amounted to 16.17, 18.44 and 7.40% for the distances between the subsurface drip lines 50, 75 and 100 cm respectively, while operating pressure 40 Kpa gave the highest discharge variations was 36.02, 38.05 and 40.63% for the distances between the drip lines as above. Increasing operating pressure reduces the friction effect of water molecules with the pipe walls with each other because of an increase in the water flow speed, which reduces the chance of discharge variations of the emitters.

Aboamera *et al.* (2008), studied the average values of soil moisture content at different soil depths and its changes, after irrigation, horizontally at distance of 25 cm from both sides of pepper plant. Also, they found that the highest value of soil moisture content (10.15%) in soil profile was observed for the lateral line buried at 20cm depth with 30 cm emitter spacing. This value represents 105.73% of soil moisture content at field capacity. The lowest average value of soil moisture content (7.86%) in soil profile was observed when the lateral line lied at the soil surface with 50 cm emitter spacing and represents 81.88% of soil moisture content at field capacity.

Zaman *et al.* (2018), mentioned the concept of leaching requirement (LR) does not function under subsurface drip irrigation specially to leach the salts from surface above the buried drip lines. However, salt accumulation in this zone above the buried irrigation line can be managed by supplementing subsurface drip irrigation with sprinkler irrigation. This approach may be costly, but is a necessary compromise. Salt accumulation occurs more rapidly when saline/brackish water is used, and also when the soils are fine textured. Only a heavy rainfall and/or occasional switch over from subsurface drip irrigation to sprinkler irrigation can leach salts from this zone. The alternative will be an accumulation of salts to toxic levels. Waseen and Abid (2020), recorded that salt and water pattern reached the soil surface when the depth of emitter is 10 cm, and that rise in the losses of water by evaporation. The vertical spread of salt was larger than the lateral due to gravity; the salt quantity at depth 10 cm is larger than 20 cm and 30 cm and has bigger lateral spread. When the emitter depth was 30 cm, the salt and water wetting pattern may by penetrated to deep percolations. In the coarse-textured soil the perfect depth for emitter should be (30 cm) for medium-textured soil should be (20 cm) at a shallow depth.

Guo (2019), found that under initial irrigation amounts 10, 12, 24, 34, and 40 mm the root growth depths that were surveyed from the sidewalls of the transparent soil columns. The root growth depth increased with time. Before the first irrigation happened, the root growth depth increased as the lateral line depth decreased. After the first irrigation was applied, the root growths of 10mm and 12mm treatment also differed, but no obvious regular pattern was discerned. The result was similar for 24, 34, and 40 mm treatments,. After one week, the root growth depths of the five treatments were greater than 40 cm. The depths of some roots that could not be visualized may have exceeded 40 cm. Kanda *et al.* (2020), studied the effect of moistube and subsurface drip irrigation on cowpea. They found that subsurface drip irrigation compared to moistube irrigation (MTI) tended to increase biomass per plant and per hectare, but these were only significantly higher at the 70% and 40% ET_c deficit irrigation levels. Deficit irrigation at 70% and 40% ETc decreased pods, pod mass, seed mass and biomass per plant as well as grain yield significantly, compared to where irrigation was applied at 100% ET_c, irrespective of irrigation system type. Compared to subsurface drip irrigation at 100% ET_c, a significant reduction in yield (57.7%) was recorded at 40% ET_c under MTI while drip at 40% ET_c led to a decline in yield by 50.2%. Similarly, the decline in yield at 70% ET_c relative to the fully irrigated crop was 20.5% and 13.9% under MTI and subsurface drip irrigation, respectively.

Liu *et al.* (2023), found that the average value of tomato fruit number, fruit weight, and yield for two cultivation periods in the greenhouse were 13.6, 162.4 g, 114.4 Mg/ha at the working water head of 0.4 m for subsurface irrigation with ceramic emitters (SICE), increasing by 4.21%, 8.96%, and 8.03% compared to SDI, respectively. Moreover, the average fruit weight and yield under different treatments in autumn cultivation were 148.1 g and 99.9 Mg/ha, and its values were 4.20% and 7.84% lower than that in spring cultivation.

Santos *et al.* (2016) concluded that a 0.2 m drip depth was the most appropriate for an efficient water use when using treated sewage effluent. When drippers were installed at a 0.2 m depth, water content was mostly concentrated at a depth of 0.8 m. Drippers placed at a 0.4 m depth may increase the risk of deep percolation.Afzal *et al.* (2020), achieved that drip lateral placed at 12 cm depth with 40% deficit irrigation estimated maximum irrigation water used efficiency of 52 and 49 kg/m^3 for growing seasons 2015-16 and 2016-17 respectively. Total depth of irrigation water was 325 mm, 270 mm and 225 mm for 100%, 80% and 60% irrigation levels under different depths of drip laterals.

MATERIALS AND METHODS

Tomato

Very early variety. Suitable for mechanical harvesting. Matures 105 - 110 days after sowing. The fruits cuboid-rounded, weight 95 - 105 g ., Dense, very transportable. Designed for fresh consumption and processing, resistant to Verticillium and Fusarium wilt, Alternaria stem cancer, gray leaf spot. Yields of the different collections were summed together to estimate the total tomato yield (Mg/ Fed.) for each treatment.

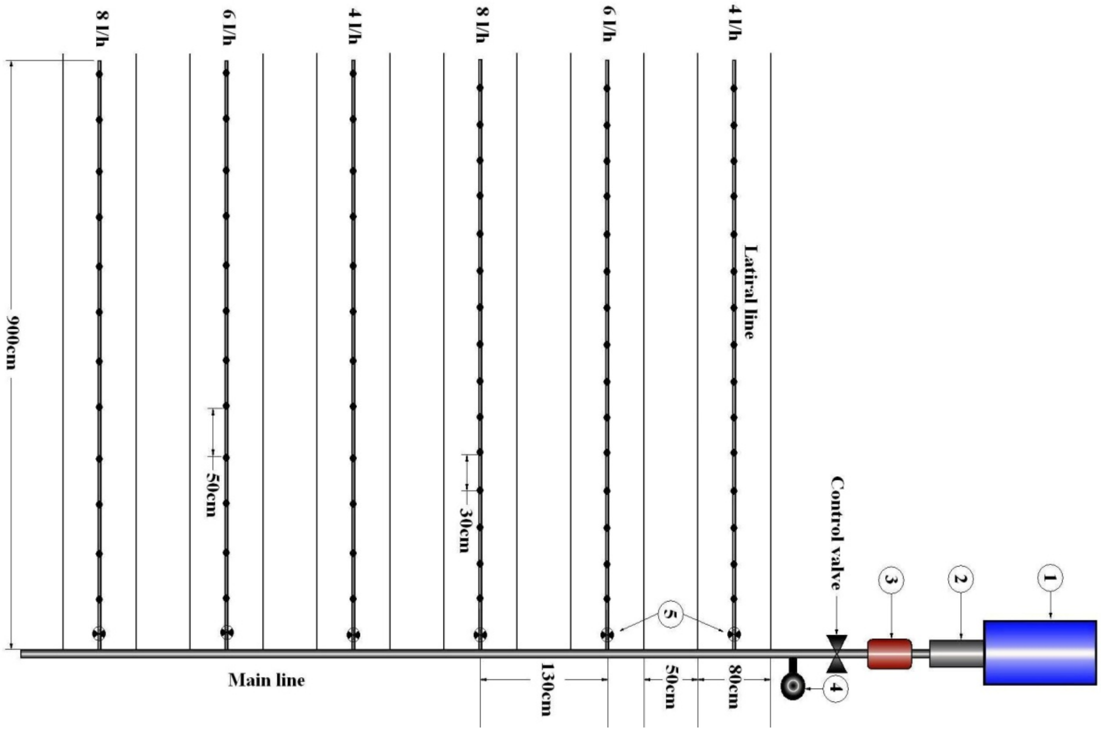
Experimental irrigation system

Subsurface drip irrigation system was constructed and tested hydraulically before used in the experimental location. The main components of subsurface drip irrigation network was:

- 51 mm diameter of Polly VienilCloride(PVC) for main line pipe.
- (PVC) manifold line of 36 mm diameter with 32 m long.
- Lateral line was 9 m along per treatment and was 16mm diameter, polly ethylene.
- Emitters were long path type built-in (GR) lateral irrigation line with an average discharge 4, 6, 8 lit/h and 0.3 and 0.5 m emitter spacing. Laterals spacing were 1.60 m. In the subsurface drip irrigation system, lateral lines were buried at 15 cm depth beneath the soil surface.
- Pressure gauge
- Control valve
- Centrifugal pump with electrical motor

Experimental layout

The experimental area was (9 × 32 m) divided into 6 experimental treatments with four replicates. Field experiments designed by split-split plot design and all the obtained parameters were statistically analyzed. Space between replicates (0.5m) to prevent the interference effects between the tested treatments.The cultivation bench was 0.8m wide and 9m long. The distance between plants was the same as the distance between the emitters, which is 30 and 50 cm. The discharge of the used emitters was 4, 6, 8 lit/hr as shown in Fig. 1. The distance between two plants rows was 80cm and lateral line layed at the meddle between two plant rows. A centrifugal pump was used to pump the water from the water source inside the main line. The pump operated by electrical motor had (1200 kW) power.



1 Water source
2 Main line pipe
3 Centrifugal pump
4 Flow meter gauge
5 Control valve
Scale: 1:10
Dims. In cm

Fig. 1: The one experimental treatment replicate with the required fittings and dimensions.

Determination of soil moisture distribution pattern and salts movement and accumulation distribution pattern in soil profile

Soil moisture was gravimetrically determined directly 24 hours after irrigation Soil samples were collected using special cylinders (Auger) was used to from different depths to determine soil moisture content. The auger penetrates the soil profile from the surface by simply turning and pushing downward at the same time. It was used at each depth. Samples from 9 points around the emitter were taken from each treatment. The samples were collected by soil tube from two depths 0-20, 20-40 cm as shown in Fig. 2. They were weighted by sensitive balance before putting in the drying oven then dried in the drying oven at 105°C for 24 hours and weighted again to measure moisture content. Soil moisture content was calculated by using the following equation by (Casillas, 1978)

$$Pw = \left(\frac{Ww - Wd}{Wd}\right) \times 100 = \left(\frac{Ww}{Wd} - 1\right) \times 100$$

Where:

PW = Soil moisture content (dry weight basis) %.

Ww = Wet weight of soil sample (gm).

Wd = Dry weight of soil sample (gm).

The movement of salts around the cultivated plant for each treatment was studied, eight spots were considered in all directions with 16 data points were obtained around the individual plant to form a grid of electrical conductivity (EC) values at an equal distance of (25 cm). The values of (EC) were obtained for each data point from the soil samples that were taken for soil moisture content measurements in the soil profile, using an electrical conductivity meter. Also, the data points were mirrored in other locations to obtain the 16 data points from the grid. As mentioned before the soil samples were taken at tow depths, which were 0-20 and 20-40 cm. These data points were used to prepare contour maps of salt accumulation for the different depths and in the direction perpendicular to the buried lateral irrigation line, using the same computer SURFER program. Contour maps of electrical conductivity (EC) will be used for differentiation between treatments.

Measuring of salts accumulation in profile

Electrical conductivity meter was used for measuring lectrical conductivity (EC) in (ds/m) for each soil moisture samples have been measured by using; (EC meter as shown in Fig 3.). The values of EC were used for draw contour map to the salt distribution for each treatment by using the surfer program.

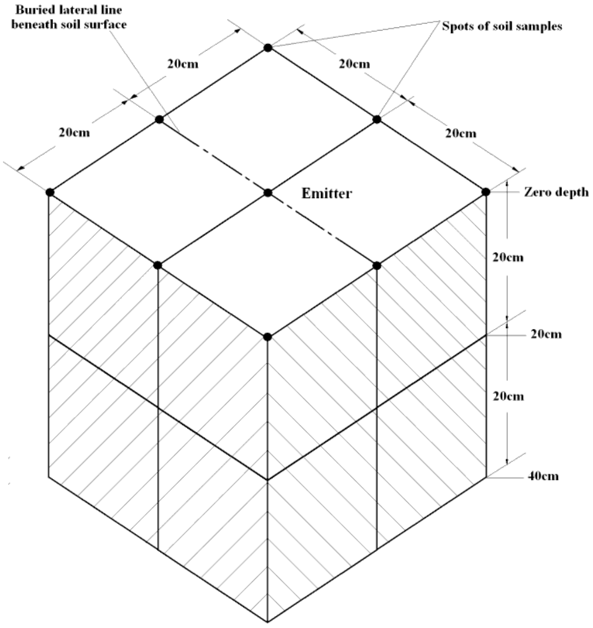


Fig. 2: Schematic diagram of moisture content distribution spots for driving the contour maps of both soil moisture content and salt movement.

Fig. 3: An image of the used Electrical Conductivity (EC) meter

Water use efficiency (WUE)

Water use efficiency of tomato was calculated using the following equations:

$$WUE = \frac{Y}{I}$$

where:

WUE: Irrigation water use efficiencyin (kg /m^3)
Y: Yield in (Mg/fed)
I: Irrigation water applied in (m^3/fed)

Statistical analysis

Data were computerized and analyzed according to the following model by SPSS Program (2004). Also significant differences among means were detected by Duncan (1955).

$Y_{ij} = \mu + ES_i + ED_j + (ES\times ED)_{ij} + e_{ij}$

Where:

Y_{ij}: Observation of i Emitter spacing , Emitter discharge;
μ : General mean;
ES_i : Fixed effect of Emitter spacing;
ED_j : Fixed effect of Emitter discharge;
$(ES\times ED)_{ij}$: Effect of interaction $(ES\times ED)_{ij}$;
e_{ij} : Residual effect.

RESULTS

Moisture content distribution in soil profile

Fig. 4 showed the moisture content distribution of soil as measured in each treatment after the irrigation event at the mid season. The distribution is representative of three series of measurements that carried out for emitter discharges 4, 6 and 8 l/h at emitter spacing 30cm, directly 24 hours after irrigation. The figure also demonstrate the contour maps of soil moisture distribution for all treatments from 9 points around the emitter that were taken from each treatment. Results illustrated that the average of moisture content for the soil layer of 0-20 cm depth were about 0.31, 0.36 and 0.36 for the emitter discharges of 4, 6 and 8 l/h, respectively, at 30 cm of emitter spacing. Meanwhile, the averages of moisture content for the soil layer of 20-40 cm were about 0.34, 0.38 and 0.35, respectively.

Fig. 5 showed the moisture content distribution of soil as measured in each treatment after the irrigation event at mid season. The distribution is representative of three series of measurements that carried out for emitter discharges 4, 6 and 8 l/h at emitter spacing of 50cm, directly 24 hours after irrigation. The figure demonstrates the contour maps of soil moisture distribution for all treatments from 9 points around the emitter that were taken from each treatment. The figure also illustrated that the average moisture content for the soil depth layer of 0-20 cm were about 0.35, 0.38 and 0.40 for the emitter discharges of 4, 6 and 8 l/h, respectively, at 50 cm of emitter spacing. Meanwhile, the averages of moisture content for soil layer of 20-40 cm were about 0.36, 0.37 and 0.38, respectively.

The results showed that the highest values of soil moisture content at a depth of 0-20 cm and 20-40 cm were observed for emitter spacing 50 cm compared with emitter spacing 30 cm which were 34%, 37% and 38% at 4, 6 and 8 l/hr emitter discharge, respectively.

Salt accumulation and movement in soil profile

For all the tested treatments, accumulation salt distribution in root zone were measured as a value of electrical conductivity (EC) in both downward with soil depth and horizontally around the plant. Fig. 6 shows the salt accumulation when using discharge of 4 l/h and emitter spacing 30cm.It evidence that the movement of salts in the soil profile was moving upwards and the movement of salts in the soil profile decreased when using 6 l/h and 8 l/h of emitter dischage.

Therefore, the 30 cm spacing and discharge 8 l/h might be recommended to achieve the lowest accumulation of salts in root zone. Uniform distribution of salts that can be reflected in increasing the obtained yield.

The vertical spread of salt was larger than laterally spread due to gravity; the salt quantity in a 50 cm of emmitter spacing treatment was larger than 30 cm emmitter spacing and has the bigger laterally spread. The salts and water wetting pattern may by penetrated to deep percolations, when the emitter spacing was 50 cm,.

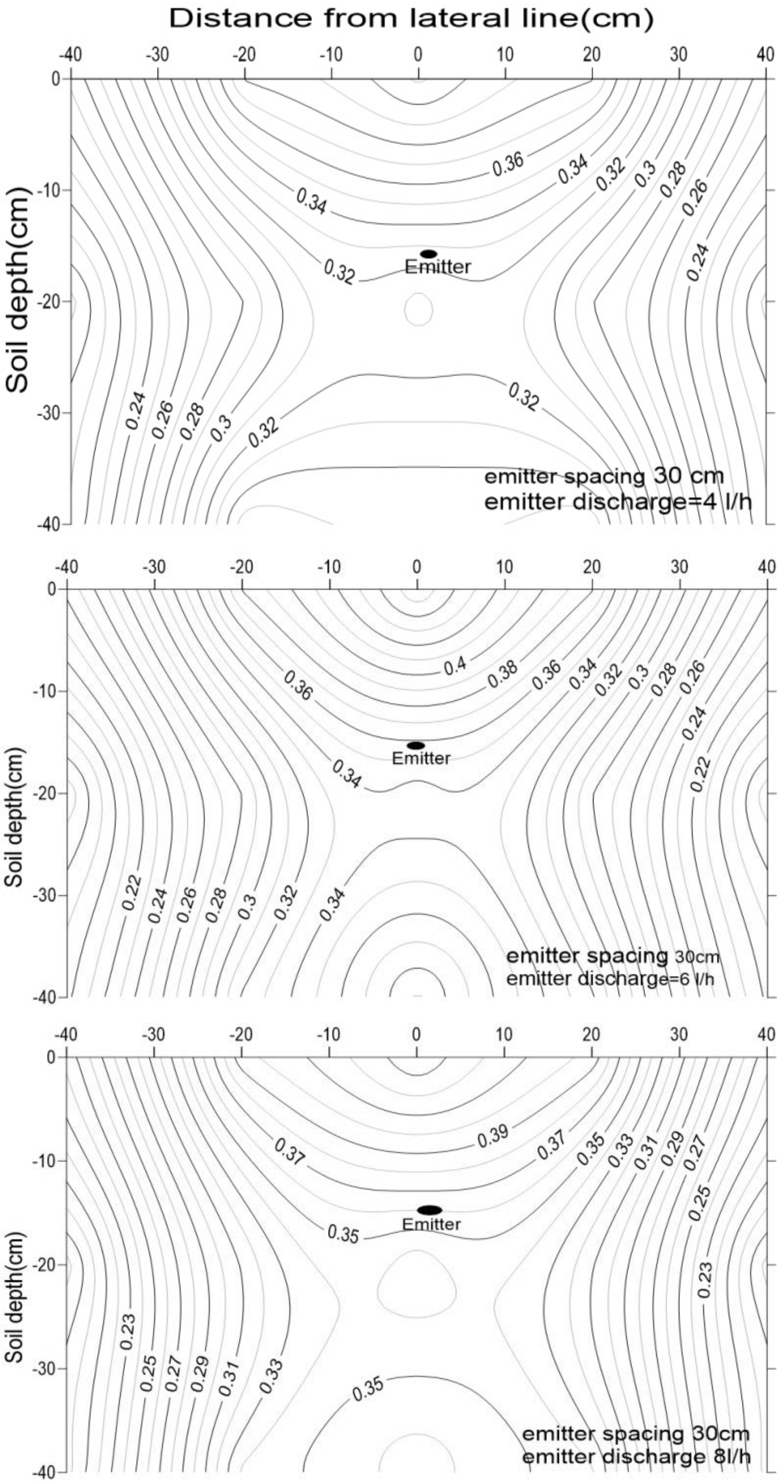


Fig. 4: Contour maps of soil moisture content distribution in soil profile at 30 cm of emitter spacing for 4, 6 and 8 l/h emitter discharge.

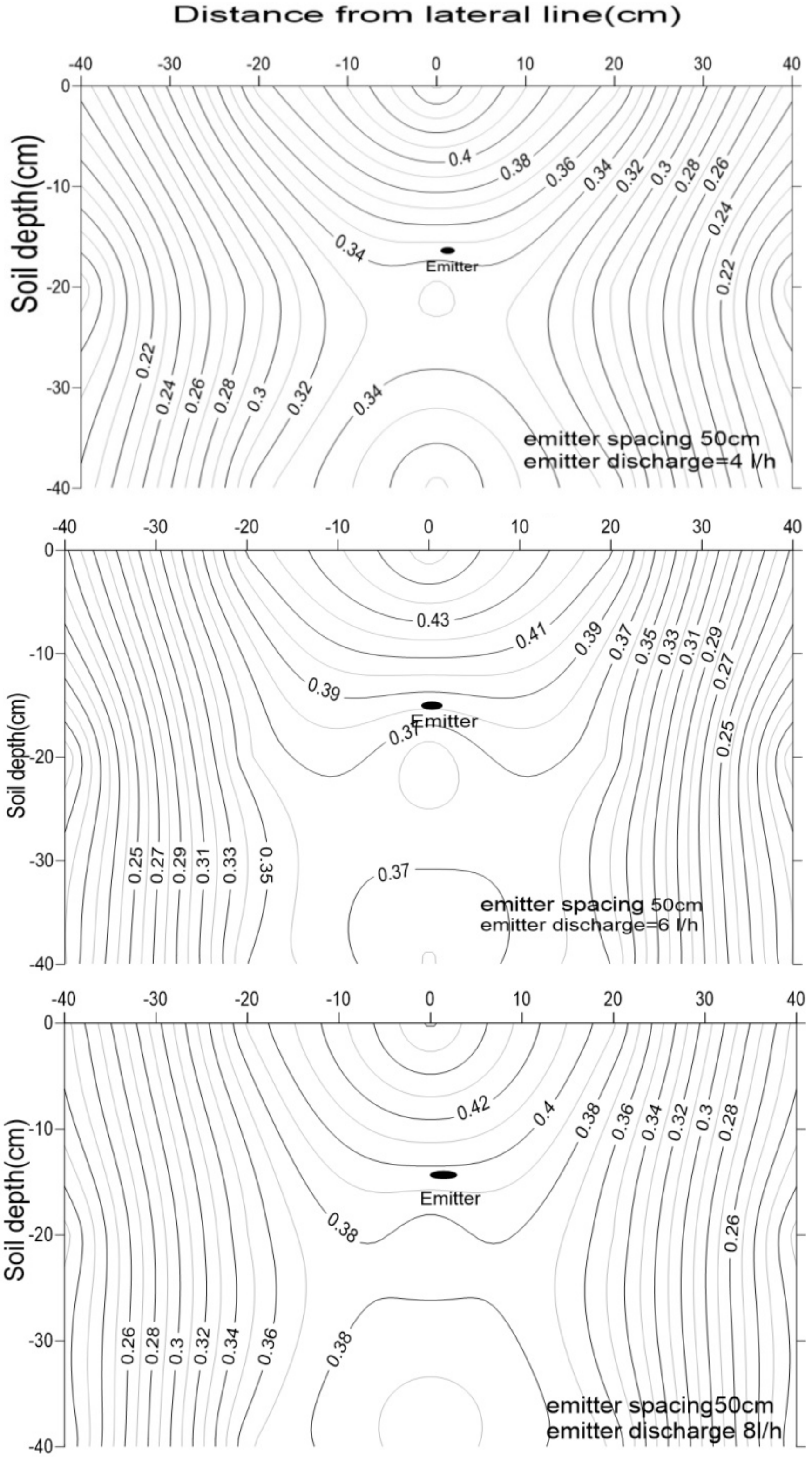


Fig. 5:Contour maps of soil moisture content distribution in soil profile at 50 cm emitter spacing for 4, 6 and 8 l/h emitter discharge.

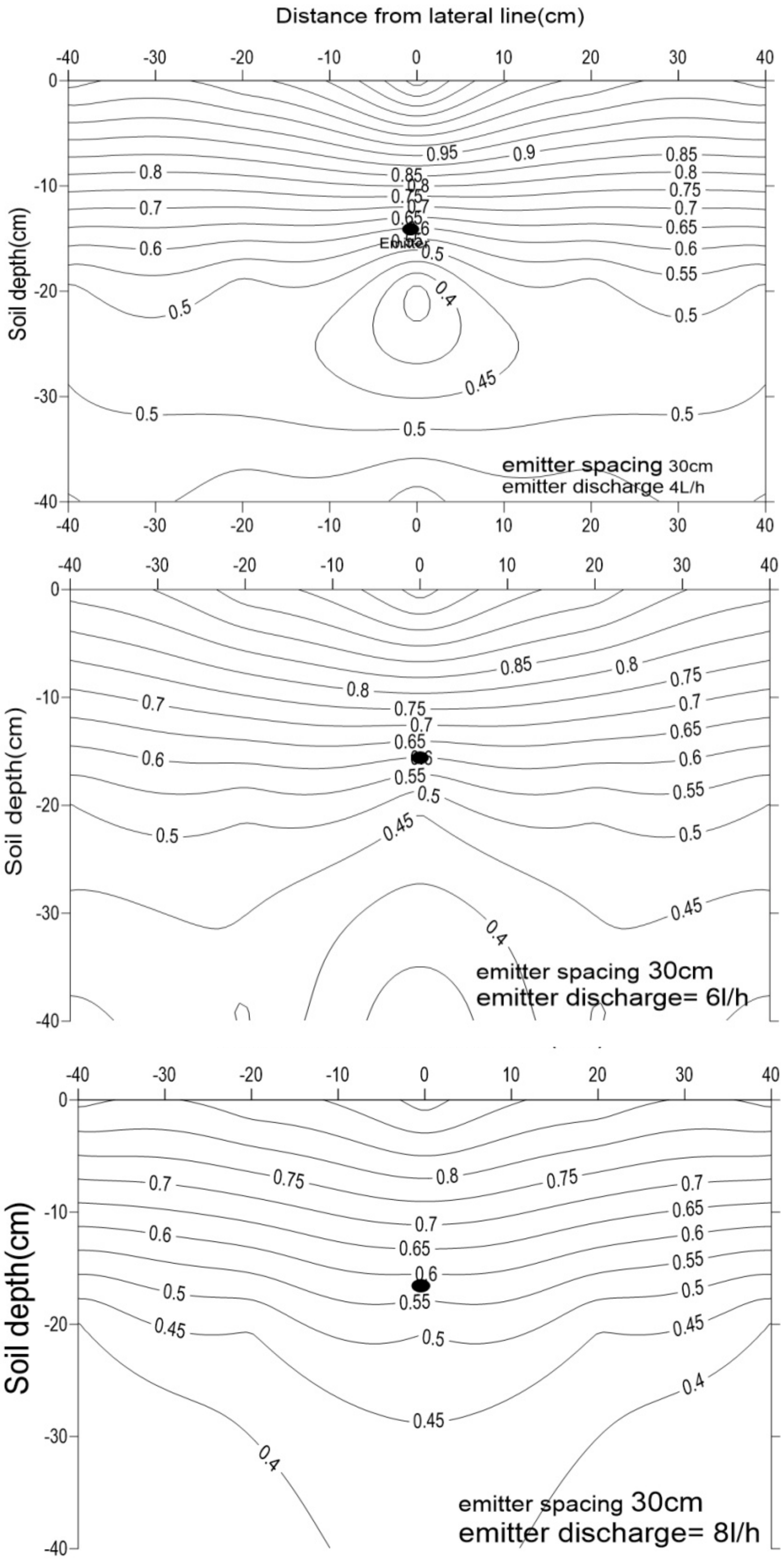


Fig. 6: Contour maps of soil salt content distribution in soil profile at 30 cm emitter spacing for 4, 6 and 8 l/h emitter discharge.

At emitter spacing 50 cm, Fig. 7 illestrated that salt accumulation when using 4 l/h of emitter discharge, the movement of salts in the soil moved upwards and downwards. While the movement of salts through the soil profile decreased downwards when using both emitter discharge 6 l/h and 8 l/h. The salts and wetting soil volume depended directly on the amount of irrigation water. Therefor, higher irrigation amounts initially produced higher quantity of salts and water content near the emitter.

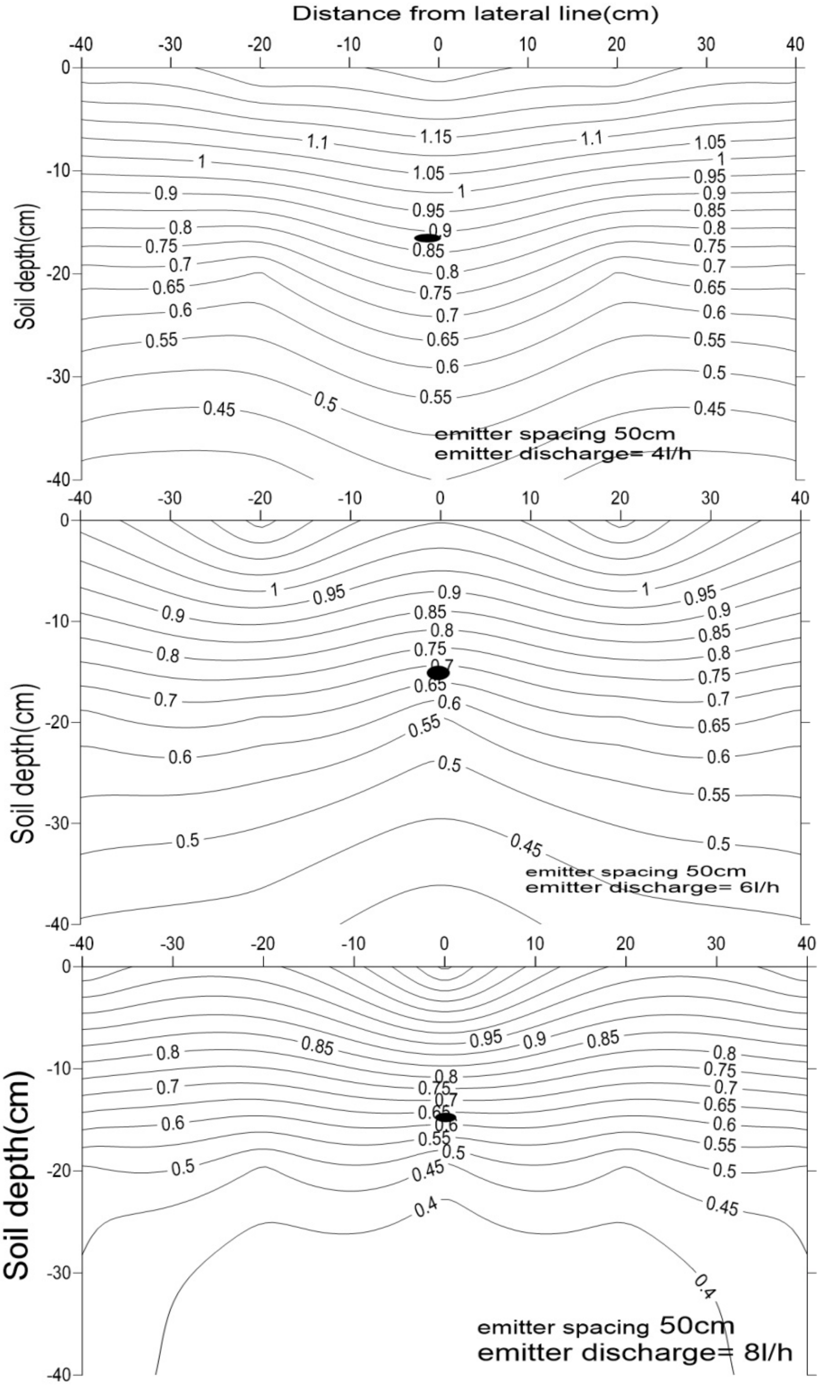


Fig. 7: Contour maps of soil salt content distribution in soil profile at 50 cm emitter spacing for 4, 6 and 8 l/h emitter discharge.

The results also showed that the highest values of salt accumulation at a soil layer depth of 0-20 cm and 20-40 cm were observed with emitter spacing 50 cm compared with 30 cm of emitter spacing.

Distribution of root weight as affected by emitter spacing and emitter discharge

Table (1) showed that there were highly significant differences between root weights affected by emitter spacing, emitter discharge and it's interaction at (P≤0.01). Root weight recorded highest weight (64.7, g)at a depth of (0-20 cm) of soil layer at emitter spacing 50 cm and discharge 4 l/h, whereas the lowest weight (50.3, g) recorded with emitter spacing 30 cm and discharge 6 l/h. Meanwhile, at a depth (20-40 cm) and emitter spacing 30 cm and discharge 6 l/h highest weight (21.7, g), whereas the lowest weight (11.7, g) was recorded with emitter spacing 30 cm and discharge 4 l/h. The highest weight (84.0, g)of total root was recorded with emitter spacing 50 cm and discharge 6 l/h, whereas the lowest weight (72.0, g) recorded with emitter spacing 30 cm and discharge 4 and 6 l/h and at emitter spacing 50 cm and discharge 8 l/h. Fig. 8 showed that highest percent of root weight distribution was (83.80%) for depth (0-20 cm) at emitter spacing 30 cm and discharge 4 l/h, and lowest percent was (69.91%) at emitter spacing 30 cm and discharge 6 l/h. On other hand, highest percent of root weight distribution was (25.93%) for depth (20-40 cm) at emitter spacing 50 cm and discharge 8 l/h, and lowest percent was (16.20%) at emitter spacing 30 cm and discharge 4 l/h.

Table (1): Root weight as affected by emitter spacing and discharge rate

Treatments		**Root weight at 0-20 cm, (g).**	**Root weight at 20-40 cm, (g).**	**Total root weight, (g).**
Emitter spacing	30cm	56.1±0.19	15.8±0.35	72.3±0.34
	50cm	60.8±0.19	19.0±0.35	79.8±0.34
Emitter discharge	4 l/h	62.5 ± 0.24^{a}	15.2 ± 0.43^{b}	77.7 ± 0.42^{a}
	6 l/h	57.3 ± 0.24^{b}	20.7 ± 0.43^{a}	78.0 ± 0.42^{a}
	8 l/h	55.5 ± 0.24^{c}	16.3 ± 0.43^{b}	72.5 ± 0.42^{b}
Interaction				
30cm	4 l/h	60.3 ± 0.33^{b}	11.7 ± 0.61^{d}	72.0 ± 0.59^{b}
	6 l/h	50.3 ± 0.33^{e}	21.7 ± 0.61^{a}	72.0 ± 0.59^{b}
	8 l/h	57.7 ± 0.33^{c}	14.0 ± 0.61^{c}	73.0 ± 0.59^{b}
50cm	4 l/h	64.7 ± 0.33^{a}	18.7 ± 0.61^{b}	83.3 ± 0.59^{a}
	6 l/h	64.3 ± 0.33^{a}	19.7 ± 0.61^{b}	84.0 ± 0.59^{a}
	8 l/h	53.3 ± 0.33^{d}	18.7 ± 0.61^{b}	72.0 ± 0.59^{b}
F value, significant and probability				
Emitter spacing (ES)		294.000	42.050	236.263
		0.000	0.000	0.000
		**	**	**
Emitter discharge (ED)		237.167	45.350	54.053
		0.000	0.000	0.000
		**	**	**
ES*ED		305.067	38.330	99.337
		0.000	0.000	0.000
		**	**	**

a,b,c, Differences between values having the same high script in each column are not significant

** significant differences at $P \leq 0.01$;

* significant differences at $P \leq 0.05$;

N.S. non significant differences.

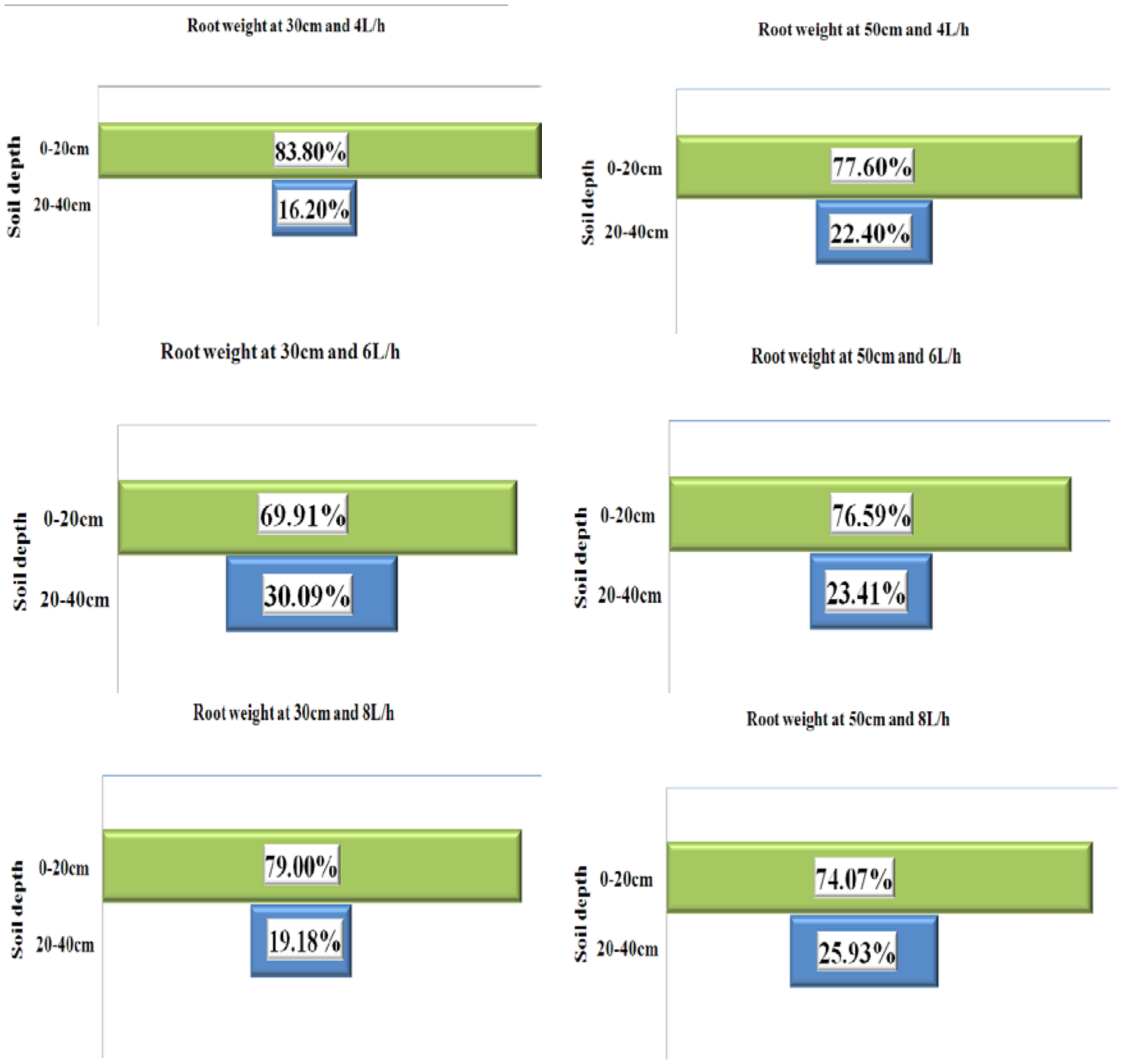


Fig. 8: Percent of root weight distribution as affected by interaction between emitter spacing and discharge.

Tomato yield as affected by emitter spacing and emitter discharge

Table (2) shows that there were highly significant differences between tomato yield as affected by emitter spacing, emitter discharge and it's interaction at P≤0.01. The heaviest weight of yield was 38.31 Mg/fed at emitter spacing 30cm and emitter discharge 4 l/h, and lowest yield was 25.86 Mg/fed at emitter spacing 30cm and emitter discharge 6 l/h as shown in Fig. 9.

Water use efficiency (WUE) as affected by emitter spacing and emitter discharge

Table (2) also shows that there were highly significant differences between water use efficiency (WUE) as affected by emitter spacing, emitter discharge and it's interaction at P≤0.01. The highest water use efficiency (WUE) was 10.15 Mg/m^3 recorded at emitter spacing 30 cm and emitter discharge 4 l/h, and lowest (WUE) was 6.85 Mg/m^3 at emitter spacing 30cm and emitter discharge 6 l/h as shown in Fig. 10.

Table (2): Tomato yield as affected by emitter spacing and discharge and its interaction.

Treatment		**Yield, Mg/fed.**	**Water use efficiency WUE, Mg/m^{3}**
Emitter spacing	30cm	33.12 ± 0.08^{a}	8.77 ± 0.02^{a}
	50cm	29.19 ± 0.08^{b}	7.76 ± 0.02^{b}
Emitter discharge	4 l/h	35.20 ± 0.10^{a}	9.33 ± 0.02^{a}
	6 l/h	27.27 ± 0.10^{c}	7.26 ± 0.02^{c}
	8 l/h	31.01 ± 0.10^{b}	8.22 ± 0.02^{b}
Interaction			
30cm	4 l/h	38.31 ± 0.14^{a}	10.15 ± 0.03^{a}
	6 l/h	25.86 ± 0.14^{f}	6.85 ± 0.03^{f}
	8 l/h	35.19 ± 0.14^{b}	9.32 ± 0.03^{b}
50cm	4 l/h	32.08 ± 0.14^{c}	8.50 ± 0.03^{c}
	6 l/h	28.67 ± 0.14^{d}	7.67 ± 0.03^{d}
	8 l/h	26.83 ± 0.14^{e}	7.11 ± 0.03^{e}
F value, significant and probability			
Emitter spacing (ES)		1166.121	1884.809
		0.000	0.000
		**	**
Emitter discharge (ED)		1359.059	886.6697
		0.000	0.000
		**	**
ES*ED		1586.961	1146.721
		0.000	0.000
		**	**

a,b,c, Differences between values having the same high script in each column are not significant

** significant differences at $P \leq 0.01$;

* significant differences at $P \leq 0.05$;

N.S. non significant differences.

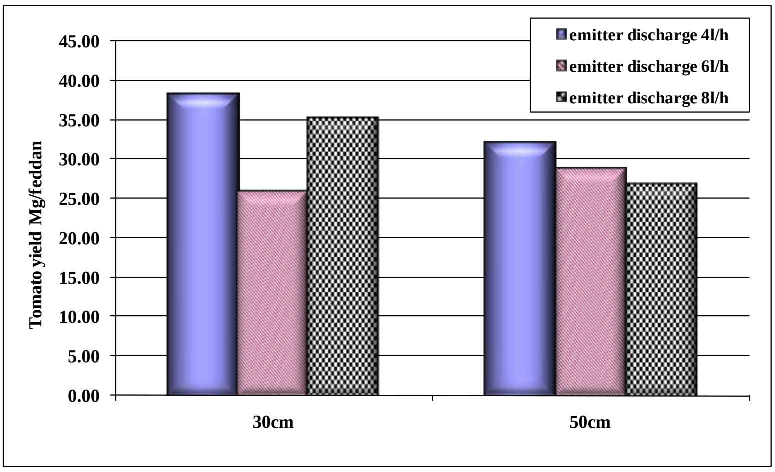


Fig. 9: Tomato yield as affected by interaction between emitter spacing and discharge.

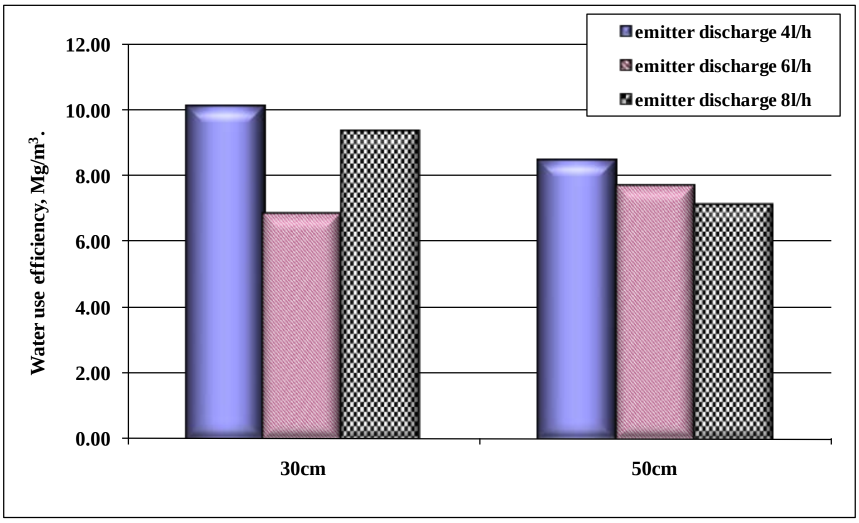


Fig. 10: Water use efficiency (WUE) as affected by interaction between emitter spacing and discharge.

CONCLUSION

The results showed that:

- Using longpass emitter at emitter spacing 30 cm and emitter discharge 8 l/h in order to achieve the lowest percentage of salt accumulation in the root zone.
- Using longpass emitters at emitter spacing 30 cm and emitter discharge 4 l/h due to obtaining the highest productivity per feddan and also obtaining the highest water use efficiency.
- Application of the subsurface drip irrigation system in the clay lands to obtain a large percentage of irrigation water saving in each irrigation and seasonal total irrigation water.

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توزيع المحتوي الرطوبي للتربة والأملاح في قطاع التربة المتأثر بنظام الري بالتنقيط التحت سطحي تحت تصرفات مختلفة للنقاطات

محمد علي حسن أبو عميرة، أحمد حسن جمعه، أسماء طلعت سليمان عجيز
قسم الهندسة الزراعية – كلية الزراعة – جامعة المنوفية

الملخص العربي

أجريت التجارب الحقلية خلال عام 2019، في المزرعة التجريبية بكلية الزراعة جامعة المنوفية شبين الكوم مصر وكان موقع التجربة 30′ 54° شمالا و 31° شرقا خلال التجارب الحقلية تتراوح درجة حرارة الليل الدنيا بين 17°م و22°م وتتراوح درجة الحرارة القصوى خلال النهار بين 30°م و36°م. واستهدفت هذه الدراسة التقييم الحقلي لنظام الري بالتنقيط تحت السطحي والمستخدم في محصول الطماطم تحت معدلات تصرف مختلفة للنقاطات.

ولتحقيق هذا الهدف تم تركيب منظومة للري بالتنقيط تحت السطحي اختبرت هيدروليكياً قبل الدراسة الحقلية وتكونت من خط ري رئيسي (PVC) بقطر داخلي 51مم ومشعب (PVC) بطول 32 متر وبقطر داخلي 36مم وخطوط ري فرعية (PE) بطول 9 متر لكل خط وبقطر 16مم مركب عليها نقاطات طويلة المسار بتصرفات 4، 6 و8 لتر/ساعة واستخدمت مسافتين بين النقاطات هما 30سم و50سم وتم دفن خطوط الري الفرعية علي عمق 15سم تحت سطح التربة.

وأظهرت النتائج أن: استخدام النقاط طويل المسار عند مسافة 30سم بين النقاطات وبتصرف مقداره 8 لتر/ساعة وحققت أقل نسبة لتراكم الأملاح في منطقة الجذور. استخدام النقاطات طويلة المسار عند مسافة 30سم بين النقاطات وبتصرف 4 لتر/ساعة نظراً للحصول علي أعلي إنتاجية للفدان وأيضاً الحصول علي أعلي كفاءة لاستخدام المياه. تطبيق نظام الري بالتنقيط تحت السطحي في الأراضي الطينية أعطت نسبة كبيرة لتوفير مياه الري في كل ريه ومياه الري الكلية الموسمية.