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Comparative Study of some Micro-Irrigation Systems Under Semi-Arid Regions

by

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Abstract

Micro Irrigation Systems (MIS) means in the present work ,mini - sprinkler and drip irrigation systems. Both drip and mini sprinkler are low - volume, fairly low pressure and less energy consuming systems than conventional pressurized irrigation systems. The application of drip irrigation became the most favorite irrigation system in Egypt, while the usage of mini-sprinkler system is still limited . Therefore, this work aimed to study pattern, uniformity and distribution of soil moisture and salt in the wetted area to find out which system is more readable under semi-arid region.In order to investigate such goal, 8 different treatments for both mini-sprinkler and drip irrigation, were tested (5 different distances, 8 irrigation timing, and 4 different irrigation discharge rates). The experiment was conducted in Kom Oshim farm, Cairo - Fayoum Desert Rood, 63 km away from Cairo, and the filed work was extended over 290 days approximately . Sandy loam soils was concluded in order to represent most desert soil in Egypt . The results showed that due to the irrigation water and the soil salinity, it is better to use mini – sprinkler irrigation system in Egyptian arid zones, However the use of drip irrigation system is better in the long run when the water quality is good.

Introduction

Commercially MIS has been started to become quite widespread during the eighties in Egypt, specially under limited water resources, sandy soil and desert conditions. MIS carries water through system pipes to the nearest point to the plant . Therefore, the objective of this work was to compare drip and mini - sprinkler irrigation systems in terms of soil moisture distribution profile, soil salinity distribution, distribution uniformity (DU), emission uniformity (EU), and coefficient of uniformity (CU). Jensen (1983) described drip or trickle irrigation as the frequent, slow application of water to the soil through mechanical devices called emitter or applicators located in selected points along the lines of water delivery . The emitters dissipate the pressure from the distribution system by means of orifices, vortices and tortuous or long flow paths, thus allowing a limited volume of water to be discharged. Bresler and Green . (1987) defined drip irrigation as the managing tool for irrigation cropping, providing improved control of water, pesticides and fertilizers applied through a drip system . Another definition was delivered by Bucks et al. (1974) who stated that drip irrigation is the slow delivery of water to the soil surface from plastic pipe - line fitted out with a series of emitters.

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Badr (**1987**) found that the wetted area in drip irrigation is about 40 - 50 % from the total area in summer, and moisture percentage was reduced as far as going deep in soil. That was done by using double lateral lines having inner drippers which added water at the side of tree row to give better moisture distribution. He found that the moisture distribution in the drip irrigation system is directly dependent on the discharge rate of drippers, duration of irrigation and the distribution of drippers on the lateral line. **Saied Mostaghimi et al** .(**1983**)found that increasing trickle discharge rate resulted in an increase in the vertical component and a decrease in the horizontal component of the wetted zone when they studied the effects of trickle discharge rate on the distribution of soil water from trickle source. **Bresler and Green** (**1987**) studied water content distribution in two dimensional (x,z directions) in clay soil by using 2 L/h emitter discharge rate.They found that the moisture gradient and its changes in position were clearly seen at the end of both infiltration and redistribution processes, (the gradient can be evaluated from the distances between two different moisture content) . They also found that the shape of soil moisture distribution within the wetted zone with respect to the two space coordinated (x,z) was clearly seen only after infiltration while at the end of two redistribution days water content was almost constant with a small gradient in both x and z directions, and the vertical components of the wetted zone after infiltration are slightly deeper than the horizontal component. **Hassan** (**1987**) reported that increasing drip discharge rate resulted in an increase in the horizontal component and a decrease in the vertical component of the wetted zone. Discharge rates of less than 4 L/h were recommended for drip irrigating crops grown on sandy soils, and also maximum dripper spacing should not be more than one meter. **AH - Koon et al.** (**1990**) studied the effect of 3 emission rates (1 , 2 and 4 L/h) for drip irrigation on the distribution and drainage of water beneath sugar - cane crop and fallow plot. They found that the faster rates of emission resulted in an increase in the wetted soil diameter, an increased lateral movement of water and a decrease in the wetted depth. They attributed these to the relatively low hydraulic conductivity of the soil. Emission rate did not affect the amount of drainage, and more drainage occurred beneath the drip line than further from it. Drainage from the bare plot was greater than that the of cane plot. **Badr (1987)** found that the wetted area in the case of irrigation by mimi - sprinkler reached 80 - 85 % from the total area in summer, and clarify that by the reduction by going deep in soil profile moisture percentage. He also found that the moisture distribution in the mini - sprinkler irrigation system was directly dependent on the discharge rate of the mini- sprinkler, the duration of irrigation and the distribution of mini-sprinkler on the lateral. It is better to be used at night when daily temperature goes down. **Goldberg et al.** (**1976**) showed that the salts gradually accumulated at the periphery of the wetted zone as extending deep into the soil profile. The depth of the maximum accumulation was a function of quality and quantity of irrigation water applied and the soil properties. **West et al.** (**1979**) found that the lowest salt concentration occurred immediately below the dripper outlet, and the highest at the edge of the wetting pattern . **Badr et al.** (**1992**) discussed the distribution and redistribution of salt in the soil during and after leaching with time. They found that the salt accumulating after one season , by irrigation with low water quality , in the surface layer around the emitter , reached 22.5 mmohs/cm. They also found that the leaching by 60 mm water caused more troubles for plant growth by the redistribution of salt in the root zone. the leaching by 120 mm water, gave good results by removing more than 50% of the accumulated salt. The leaching by 180 mm water gave also satisfactory results. **Pair et al. (1975)** mentioned that sprinkler irrigation at very low application rates has shown exceptionally good results in reclaiming some saline soils. Sprinklers prevent the build -up of salt on soil surface, which was associated with furrow irrigation. **Furuta and Coleman (1977)** reported that the salt which moves with water, and accumulates in different areas of the soil mass, is depending on the irrigation m, and overhead irrigation soil salinity can by controlled by regulating the amount of water percolating through the soil . Excess salt will be flushed out from the entire soil mass. **Marrian et al.(1978)**showed that for drip irrigation the distribution efficiency is calculated using the discharge per plant rather than the depth of the infiltrated water, and the so called emission uniformity (EU) is computed by :

$$EU = \frac{\text{mimum discharge per plant}}{\text{a verge discharge per plant}}$$

For sprinkler irrigation, the(DU) indicates the distribution uniformity throughout the field and computed by

$$DU = \frac{\text{A verge low – quarter depth of water received}}{\text{A verge depth of water received}} \times 100$$

They also mentioned that the coefficient of uniformity (CU) for sprinkler irrigation is computed

$$CU = \frac{\text{A verge low – half depth of water received}}{\text{mean depth of observations}} \times 100$$

Materials and Methods

This work aimed to carry out a comparative study between drip and mini - sprinkler systems as representatives for MIS. The following aspects were studied and evaluated :

1- Moisture distribution in soil profile.
2- salt.distribution in soil profile. .
3- Distribution uniformity (DU) and coefficient uniformity (CU) for mini - sprinkler Irrigation system and emission uniformity (EU) for drip irrigation system.

The experimental work was executed in kom Oshim farm ,Cairo - Fayoum Rood, 63 km away from Cairo . The field experiment was carried out during the summer season from April to February. The irrigation systems were designed to achieve the aim of the present work in comparing both drip and mini-sprinkler irrigation performances. The irrigation system consisted of pumping unit, fertilizing unit, filteration unit, main lines, sub-main lines, laterals, emitters, and mini-sprinklers. Some other attachments were added such as pressure regulator, valves and some pressure gauges. Both the two systems were similar in term of components except the emitters and the mini- sprinklers. In drip irrigation systems the lateral diameter was 25 mm, the distance between the lateral was 1 m ,strip width was 3m and lateral length was 25 m. Each strip had (3) laterals and the distances between emitters on the same lateral were 40 or 60 cm. For mini- sprinklers system, lateral diameter was 25 mm, strip width and length were 2 and 25 m respectively, Each strip had 2 laterals and the distance between the mini- sprinkler on the same lateral were 105, 140 and 210 cm as shown in Fig (1). The experiment concluded eight treatments for both drip and mini-sprinkler irrigation systems, four treatment each. One type of self compensating emitters was used, with two different discharges 4 and 8L/h. Emitters were located at two different distances 40 and 60 cm. Mini-sprinkler type (360 spray sprinkler) with three different distances and two different rates were used as shown in tabe (1).

Water quantity and quality:

The water quantity addition in all treatments were the same, but different in each season. It was determined according to the evapotransprtion of the kom sham area, which were 6, 9, 7 and 4 mm / day for spring, summer, automn and winter respectively. The averages of water applied were as shown in table 1. Water quality was as shown in table (2).

Table (1) Drip and mini - Sprinkler irrigation treatments

Irri . sys	treatments	Q	D	N	total water applied m^3/T.S			
			cm	L/h	SP	SU	Aut	Wint
Dirp	T 1	8	60	125	27	40.5	36.5	18
	T2	8	40	185	27	40.5	36.5	18
	T3	4	60	125	27	40.5	36.5	18
	T4	4	40	185	27	40.5	36.5	18.
mini sprinkler	T 5	34	105	47	27	40.5	36.5	18
	T6	34	140	35	27	40.5	36.5	18
	T7	75	140	35	27	40.5	36.5	18
	T8	75	210	23	27	40.5	36.5	18

N : *number of dripper or mini-sprinkler*
D : *distance between dripper or mini-sprinkler (cm)*
Q : *discharge rate of emitter or mini - sprinkler (L/h)*
S : *sp , su , aut and wint (saesones)*
T : *treatment*

Table (2) Chemical analysis of water under investigation

		Anions (meq ./ L)			Cations (meq./L)		
P H	Ec(mmhos/cm)	Hco2	CL	So2	Ca	Mg	Na + k
7.2	1.4	0.2	10	3.8	7	2	5

Soil mechanical and chemical analyses :

Mechanical analysis of the investigated soil, table (3), was carried out using standard procedure described by Black (1965). Data illustrated the physical properties of the soil profile representing the selected area. Briefly, the soil texture was sandy - loam. The chemical analysis of the soil extract is shown in table (4).

Table (3) The granulometric composition of soil

< 2 u m clay	2–50 u m silt	50- 2000 u m fine sand	> 2000 u m coarse sand	Calcium carbonate (%)	Salt	soil texture
13.0	20.75	66.05	0.1	10.0	0.1	Sandy Loam

Table (4) The chemical analysis of the soil extract

P H	Ec(ms/cm) 25 C	Salt(%)	Anions (meq./L)			Cation (meq./L)			
7.9	0.32	0.10	0.31	0.6	0.65	0.48	0.23	0.76	0.09

Soil moisture characteristics were determined to be :

Field capacity % by weight	*20 %*
Permanent wilting point % by weight	*11 %*
Avalilable water % by weight	*9 %*
Total porosity %	*42 %*
Bulk density gm/cm3	*1.09*

Moisture content calculation

Soil Moisture distribution was determined according to **Liven and Van Rooyen (1979).** That was done mainly by 10 cm diameter auger used for taking the samples from the soil directly after irrigation at 20cm spacing at the emitters line side, as well as in spacing between and below the emitters until 100 cm depth. For mini-sprinkler, samples were taken at 35cm spacing, below and at the sides of mini-sprinkler line within the particular area. Soil moisture content was measured by the gravimetric methods, Michael (1987). Soil moisture content percentage was determined as a dry weight (S.M.W) and soil moisture content percentage by volume (S.M.V) was calculated from the following equation :

$$S.M.W = \frac{W1 - W2}{W2} \times 100 \text{ (percentage)}$$

where

W1 = weight of the wet soil sample (g)

W2 = weight of the oven dried soil sample (g)

Soil salinity content :

Soil salinity content was measured before starting the experiment and after each 100 days, three times for all treatments in saturated soil extract (1 : 5) and was determined by the electrical conductivity for all samples using Ec meter.

Water uniformity :

Irrigation efficiency is a concept used extensively in system design and management. It can be divided into two components, uniformity of application and losses. If either uniformity is poor or losses are large, efficiency will be low. The uniformity of water application was calculated for the two systems of irrigation, mini - sprinkler and drip irrigation systems. Emission Uniformity (EU) of drip irrigation system is a m sure of the Un   ity of emissions from all the emission points within an entire drip rigation system for field tests:

$$EU = 100 \frac{q_n}{q_a}$$

where

EU = field tested emission uniformity

q_n =average rate of emitter discharge readings of the Lowest one-fourth of the field data , L/h

q_a = average discharge rate of the emitters checked in the filed,L/h

For mini-sprinkler irrigation system, a useful term for placing a numerical value on the uniformity of application for agricultural irrigation systems is the distribution uniformity, **Merrian and keller (1978)** which indicates the uniformity of application throughout the filed and is computed by :

$$DU = \frac{\text{Average low-quarter depth of water received}}{\text{Average depth of water received}} \times 100$$

The Average low-quarter depth of water received is the average of the lowest one-quarter of the measured values, where each value represents on equal area. Another parameter that is widely used to evals prinkler irrigation uniformity is the coefficient of uniformity (CU) developed by christiansen (1942).

$$CU = 100 \left(1.0 - \frac{\Sigma x}{nm} \right)$$

where

Cu = coefficient of uniformity %

x = z - m = absolute deviation of individual observations from the mean, mm.

z = individual depth of catch observations from uniformity test,mm

n= number of observations

Du = 100 - 1.59 (100 - CU).

m = (Σ z) In mean depth of observation,mm

Results & Discussion

Soil Moisture Distribution :

It was clear from the results shown in fig (2) through (5) that there are differences in the soil moisture distribution under. The results in Fig (2 and 3) for treatments (1,2,3 and 4) under drip irrigation system exhibited some variations between these treatments. The variations in the wetted areas , which represented moisture content values more than 17%, may be attributed to factors related to discharge rate of drippers , irrigation time, spacing of drippers on the lateral and soil texture. It is clear that the average of moisture content percentage ranged from 10 to 26 % of the investigated wetted area, according to the data of soil samples in three directions from the dripper orifice. The data showed that the highest moisture content in all treatments, were below drippers directly, and getting less as going far from dripper orifice as shown in Fig (2 and 3). Regarding the effect of the discharge rate on soil moisture content when the same amount of irrigation water was added for the same area, it can be concluded that using higher discharge rate (8 L/h for T_1 and T_2) gave high moisture content (14 to 26 %) in all soil profiles after irrigation directly, compared to the lower discharge rate (4 L/h for T_3, T_4) which gave less values for moisture content ranged form 10 - 21 % as shown in Fig (2 and 3). Regarding the effect of spacing between emitters, it affected the irrigation time, sine the same amount of irrigation water was given for the same area. It can be concluded that reducing the time of irrigation by increasing the number of drippers, gave high moisture content percentage for all different soil profiles after irrigation directly. On the other hand, the data exhibited some thing different for all treatments in this experiment, which clear that the soil moisture distribution decreased with depth for layers of 0, 20 ,40 and 60 cm depths, but the soil moisture content was increased in soil depth of 80 cm. Moreover, the soil moisture content in this layer was bigger for the higher discharge rate and the short irrigation time than the lower discharge rate and long irrigation time. This means that in this agriculture area, there was on unpermeable layer at the depth of 80 cm.

Fig (4 and 5) show the soil moisture distribution under mini-sprinkler irrigation system treatment 5 , 6 , 7 and 8 It is clear from the results that most of the zone for each depth had moisture content percentage rarged from 15-24%, ecsept under treatment 8 which exhibited a portion having values of 10-11% moisture content. This was due to the fact that the distance between the mini-sprinkler were more than optimum, and hence, the percentage of interaction was not enough. Regarding the effect of the discharge rate on soil moisture distribution to add the same amount of irrigation water for mini-sprinkler for the same area of soil, it can be concluded that using higher discharge rate of 75 L/h. gave high moisture content in soil after irrigation directly, compared to that of the lower discharge vale (34 L/h). Regarding the effect of irrigation time it can be concluded that for the depths of 0 , 20 , 40 , 60 cm under this experiment, the reduced time of irrigation by increasing the number of mini-sprinklers for the same area to add the same amount of water gave better soil moisture distribution in these soil profils. But in the soil depth of 80 cm, the data exhibited the same problem as mentioned above under drip irrigation system . In this layer of 80cm depth, the data indicated that most of the soil profile had approxmity the same values of soil moisture content which ranged from 22-25%. This was due to the fact that this layer of soil was unpermeable layer.

Salt Distribution :

Fig (6) shows the salt distribution in the soil before and during the 315 days of the experiment, where T1 , T2 , T3 and T4 show the salt distribution under drip irrigation, while T5 , T6 , T7 and T8 represent the salt distribution under mini-sprinkler. The result exhibited that the soil salinity Ec values before starting the experiment was similar in all treatments. With the continuation of irrigation and after 105 days , the data indicated some differences between the salt distribution under both irrigation systems. It is clear that the salt under drip irrigation tended to mainly move in the direction of soil depth. These results differ than those.of most recershes in the distribution of salt under drip irrigation system. This salt distribution was due to the distances between laterals and drippers which made the situation approxmity similar to that of the surface irrigation system. Regarding to the discharge rate of the emitters the data indicated that with high discharge rate of 8L/h the salt moved down in the direction of soil depth more than that of the low discharge rate of 4 L/h. Moreover, the salt tended to spread in the surface layer for low discharge rate more than that of the high discharge rate.

At the same time, the salt under mini-sprinkler system tended to move down from the surface layer to deep layers. The data indicated that even with high and low discharge rates, the concentration of the salt was approximately the same in most the layers since it ranged between 2-2.5 EC. However, after 210 and 315 days from the start of the experiment, the EC values for drip treatments tended to spread in the different depth layers, mainly in the surface layer between the drip laterals. This was due to the effect of rainfall on salt accumulation under drip irrigation system. Under mini-sprinkler treatments, it was clear that the leaching of salts occurred from surface layer down to deep layers. In comparing the two irrigation systems, it is clear that there were some differences in soil moisture distribution and salt distribution under the two systems. This was due to the following reasones :

1- The different methods of water application over the soil surface under the two systems, the mini-sprinklers caused the spread of the irrigation water over all the soil surface, while the emitters distribution the irrigation water from point sources .

2- The flow rates, of mini-sprinklers were bigger than those of the emitters .

3- The overlapping of mini-sprinkler system was better than that of the drip irrigation system.

Water uniformity:

Emission uniformity (EU) of drip irrigation system

A system designed for more uniform water application, may usually be considered as more efficient. In drip irrigation, water is carried in a pipe network to the point where it infiltrates into the soil. Therefore, the uniformity of application depends on the uniformity of emitter discharge throughout the system. Nonuniform discharge is caused by differences due to friction loss and elevation, variations between emitters due to manufacturing tolerances, and clogging. For uniformity determination, calculations of drip irrigation treatments are shown in table (5) .

Table (5) EU values for drip irrigation system

discharge rate (8 L/h)		
Emitter spacing (cm)	40	60
EU	83%	83%
discharge rate (4 L/h)		
Emitter spacing (cm)	40	60
EU	81%	81%

Coefficient of uniformity (CU) and distribution uniformity (DU) of mini-sprinkler irrigation system

Irrigation efficiency is a concept used extensively in irrigation system design and management .It is represented by two components (CU) and (DU). If either uniformity is poor or losses are large, irrigation system efficiency will be decreased. Table (6) shows the values of (CU) and (DU).

Table(6) CU and DU values for mini-sprinkler irrigation system

discharge rates 75 L/h		
spacing (cm)	140	210
Du	66.6%	60%
CU	79 %	75%
discharge rates (34 L/h)		
spacing (cm)	105	140
Du	65.6%	57%
CU	78%	70%

From the data of water uniformity it can be concluded that the emission uniformity (EU) of drip irrigation system ranged from 81 to 83 %. This was due to the effect of emitter discharge rate which have been effect ed by emitter clogging.

The coefficient of uniformity (CU) of mini-sprinkler irrigation system ranged from 79 to 70%. It can be noticed that (CU) values decreased as the spacing between the mini-sprinklers increased. This mean that the overlabing was not enough, also, the data showed that the distribution uniformity (DU) of mini-sprinkler irrigation system ranged from 66 to 57 %. It is clear that the (CU) values also decreased as the distance between the mini-sprinkler increased moreover, the (DU) values decreased more than CU % . This might be due to the effect of the wind speed. From the previous discussion of the water uniformity, it can be concluded that there was generally same differences between the two irrigation systems. However the different under mini-sprinkler system were bigger.

Summary and Conclusion

MIS are considered the most important irrigation systems for irrigation the reclaimed areas in arid and semi- arid zones. The objective of this work was to carryout comparative study between drip irrigation system and mini-sprinkler irrigation system Under the two systems, the following aspect were studied: moisture distribution in soil profile, salt distribution in soil profile and irrigation uniformity. This work was carried out in kom -oshim farm Cairo - Fayom Desert Rood, 63 km a way from Cairo.

For moisture distribution in soil profile, clear differences were observed between the two systems. The moisture content in the soil under drip irrigation system decreased from the dripper in the three directions. Moreover, almost the soil profile was below the field capacity, except a small zones just under the emitters. Considering the effect of emitter discharge rate and application time, it was found that using high discharge

rate (8 L/h) with short application time caused an increased in soil moisture content in the whole soil profile more than that of the low discharge rate (4 L/h) with long application time. The moisture content under the mini-sprinkler system was approximately the same in most location in the three directions. Moreover, the moisture in the soil profile surface layer was near the field capacity. However, there was no clear difference between high and low discharge rate and application time of mini-sprinkler . For the salt distribution under the two systems, the values of EC. with high discharge rates were less than that of the low discharge rates for the both systems. However the values of EC. in all layers under mini-sprinkler irrigation were less than those of the drip irrigation. So, under the conditions of this study and according to the values of irrigation uniformity it is better to use mini-sprinkler irrigation system considering that there was no clear difference under drip irrigation system for all the studied factors.

As a result, it is important to recommend that in Egyptian arid zone , where water quality having the range of 800-1200 PPM, while soil salinity is more than 3000 P.P.M., it is much better to use the mini - sprinkler irrigation system. However the use of drip irrigation system with high water quality could be more better in arid zone in the long run .

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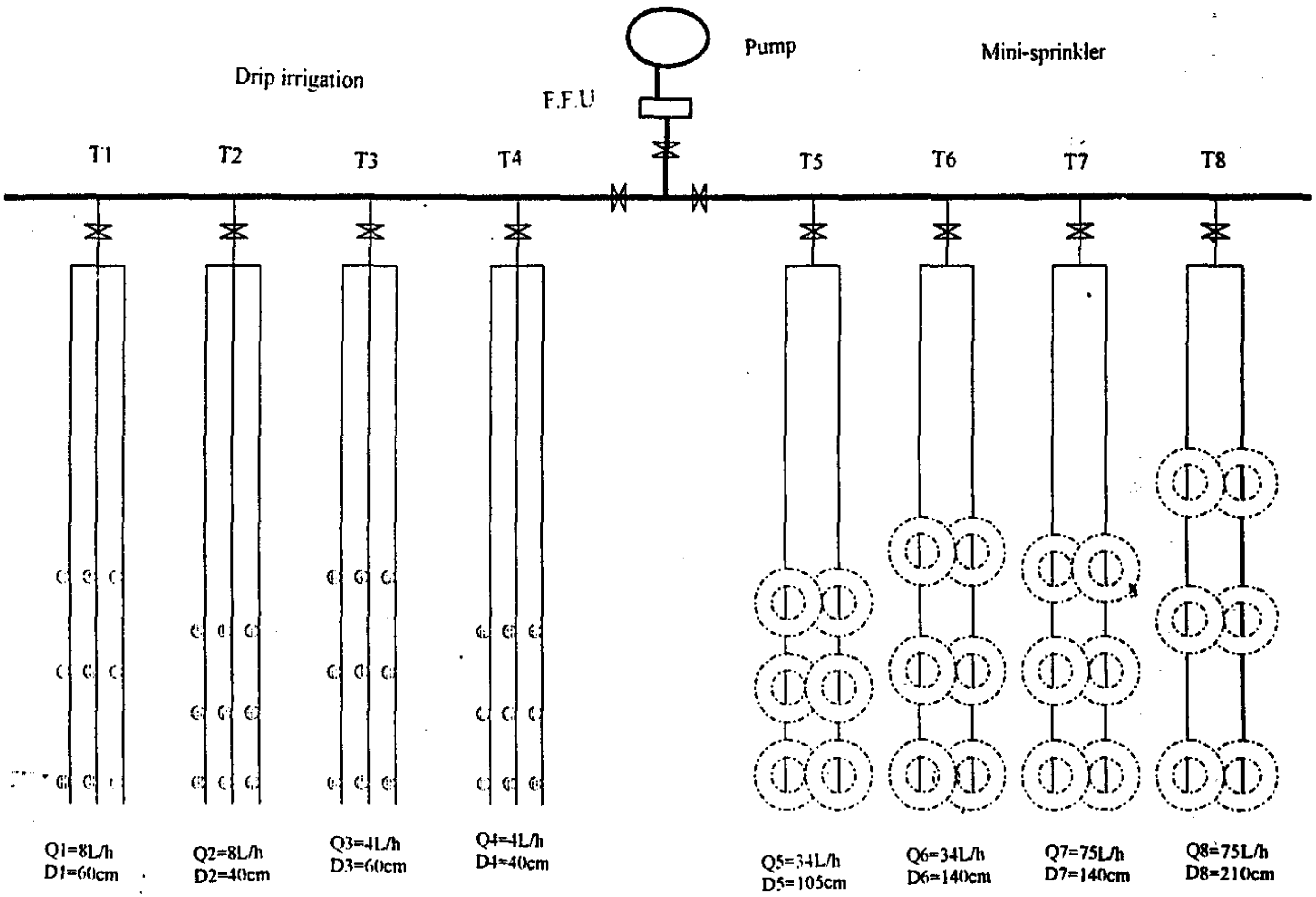


Fig(1) Layout of the experiment design.

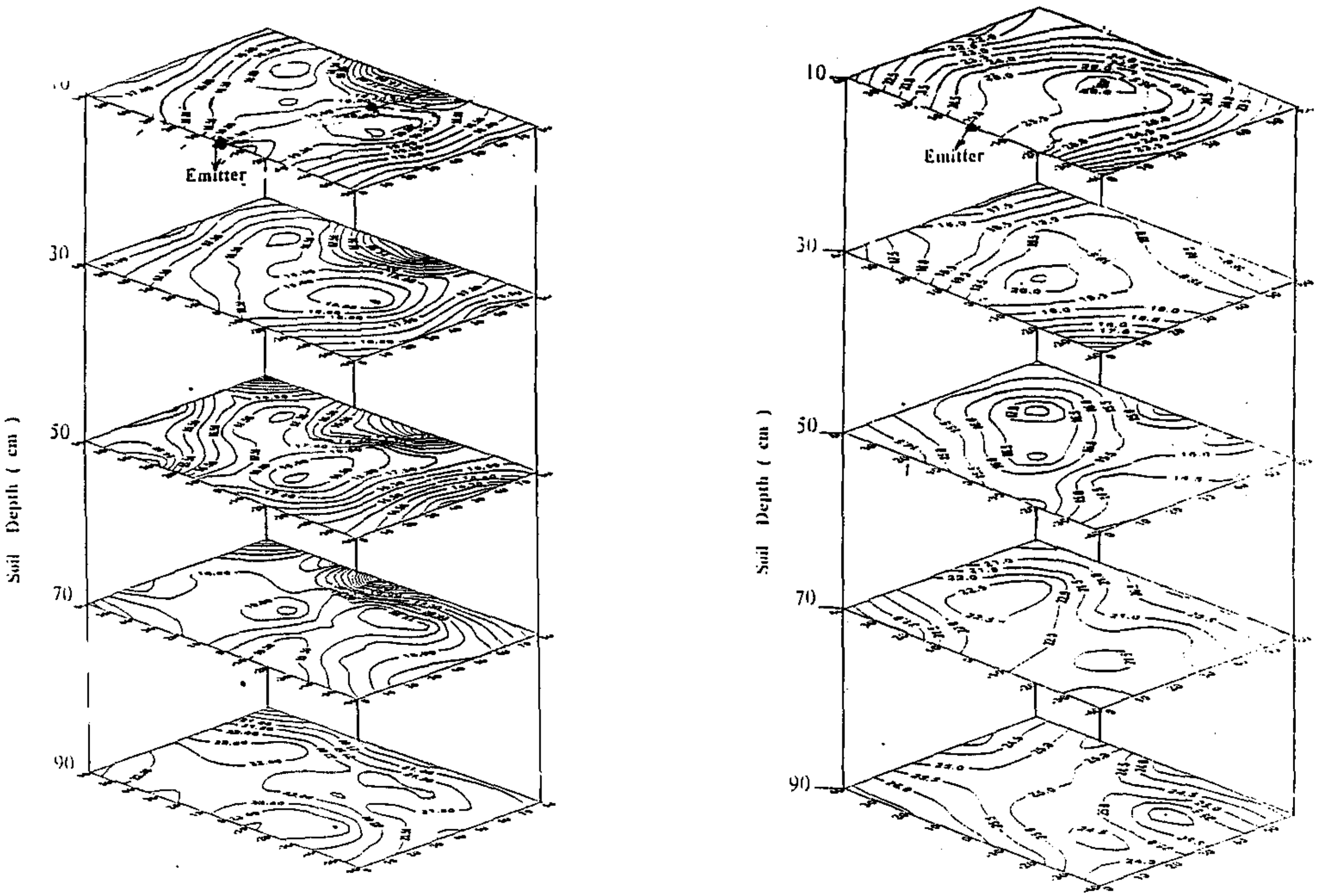
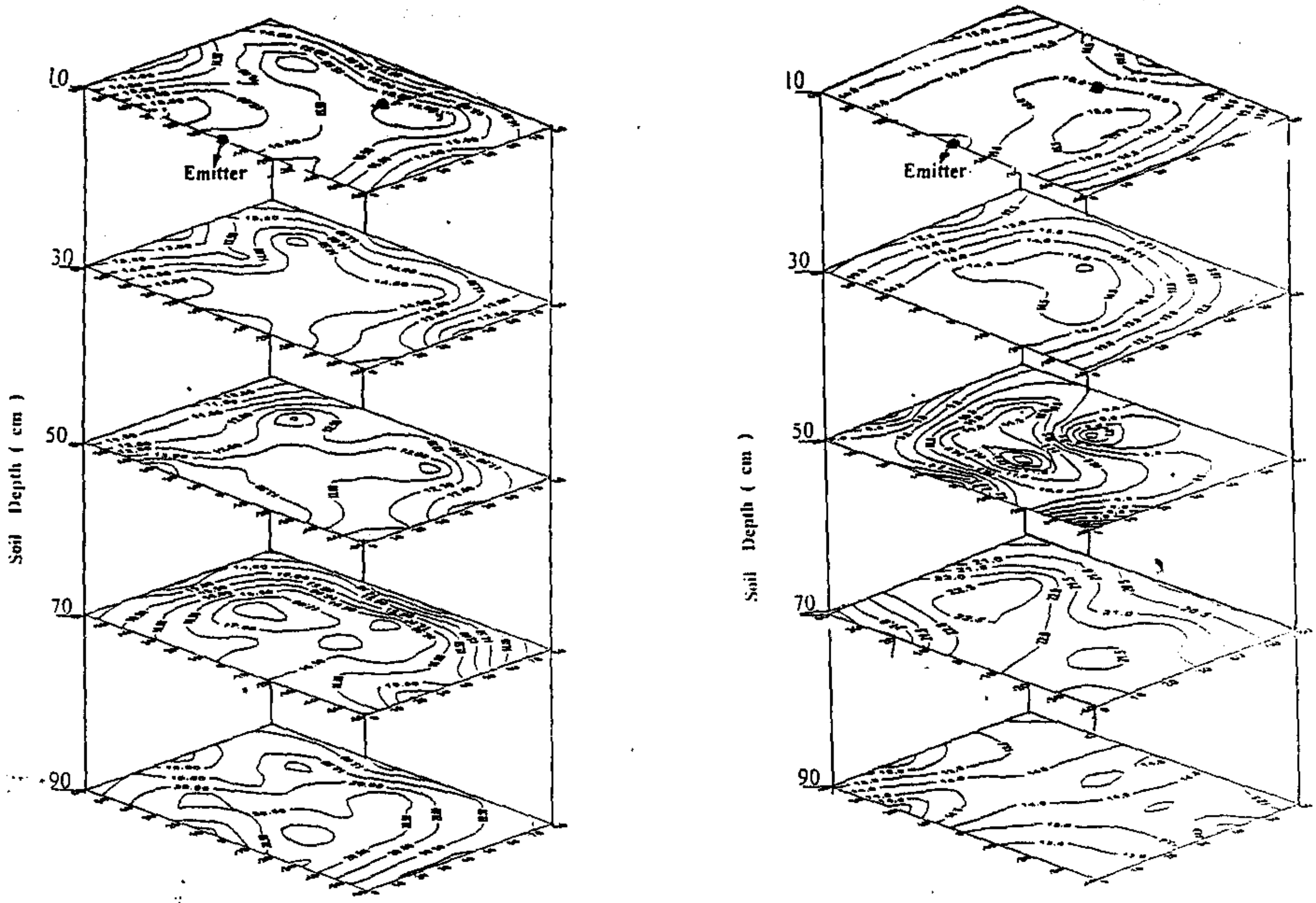


Fig (2) Contour lines representing average moisture distribution presentages of soil profile in three dimensions under drip irrigation system. for T and T,



Fig(3) Contour lines representing the average moisture distribution presentages of soil profile in three dimensions under drip irrigation system, for T_3 and T_4

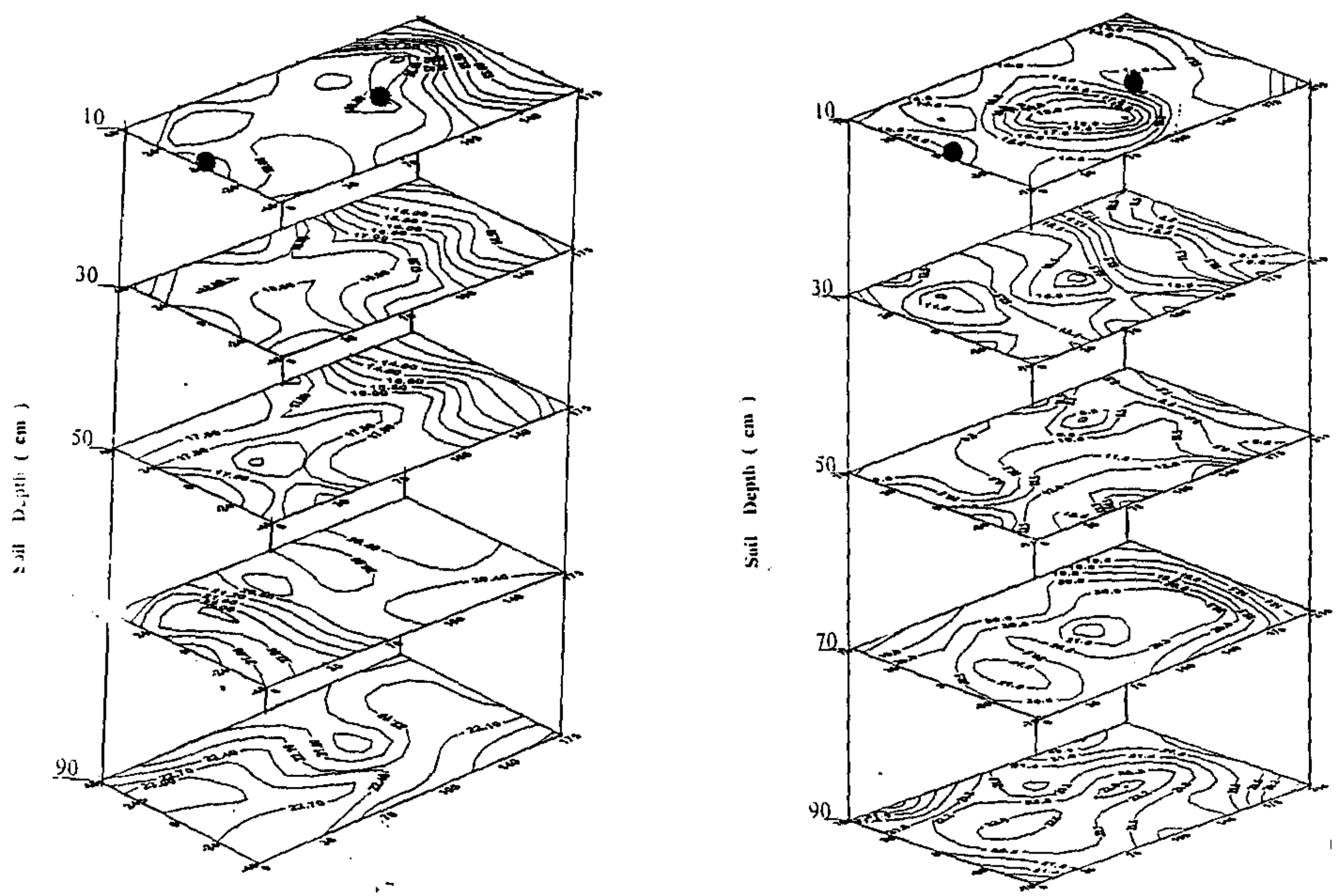


Fig (4) **Contour lines representing average moisture distribution presentages of soil profile in three dimensions under drip irrigation system, for T_5 and T_6**

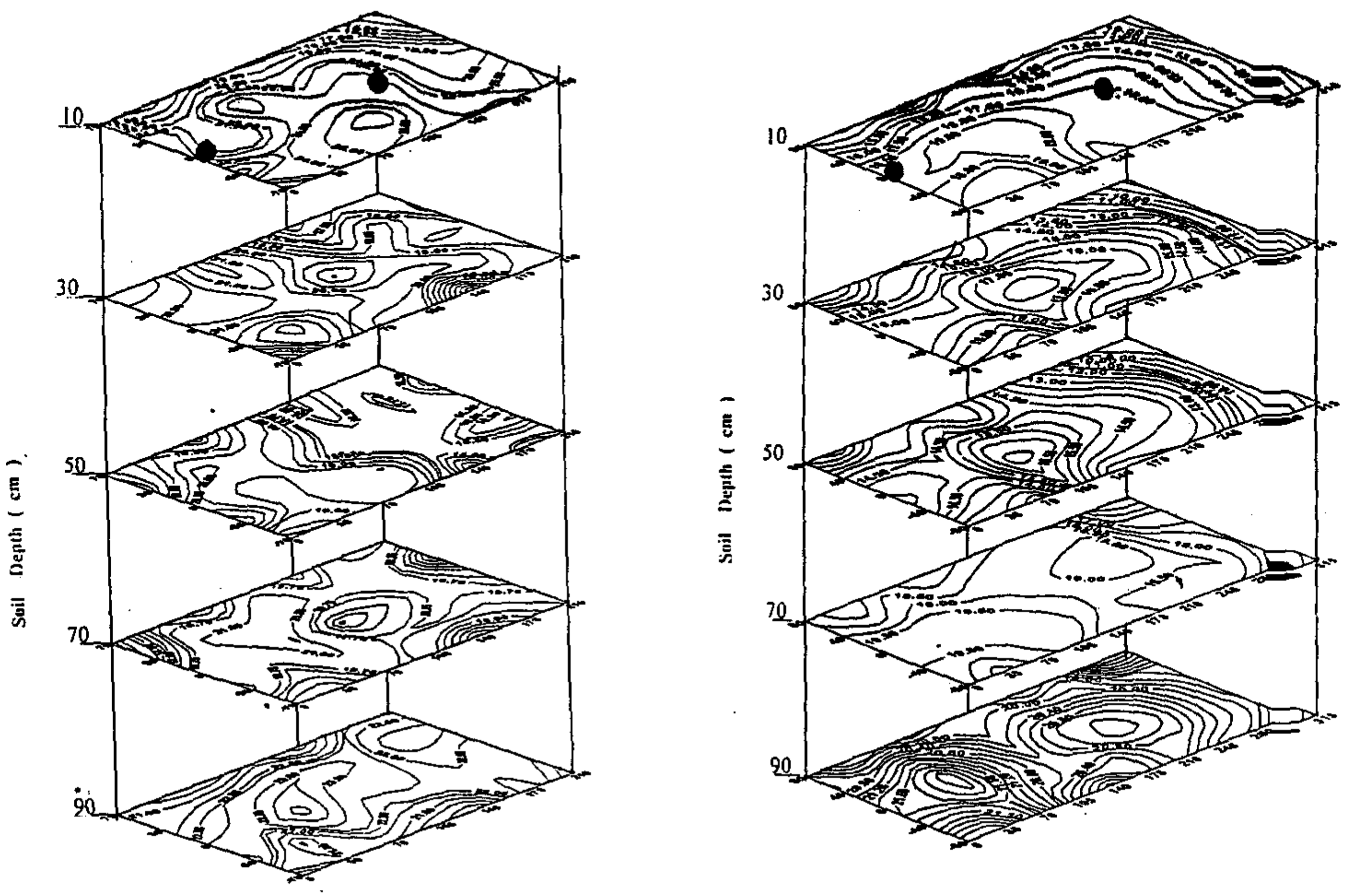


Fig (5) Contour lines representing average moisture distribution presentages of soil profile in three dimensions under drip irrigation system, for T_7 and T_8

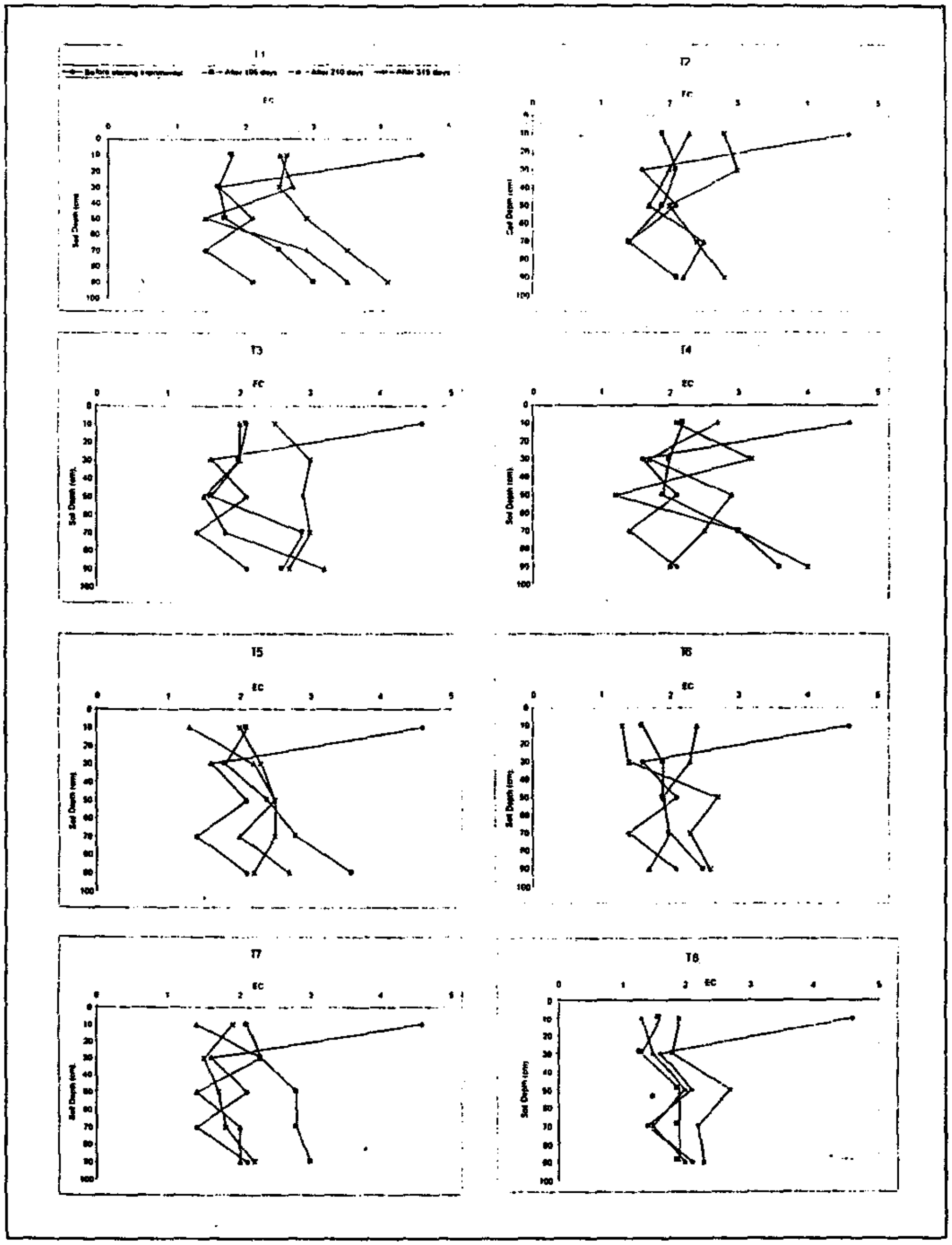


Fig (6) Measurement of electrical conductivity (EC) of soil profiles T_1 , T_2 , T_3 and T_4 for drip irrigation treatments and soil profiles T_5 , T_6 , T_7 and T_8 mini-sprinkler treatments.

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الملخص العربي

دراسة مقارنة لبعض نظم الري الشحيح تحت الظروف الشبه جافة

اهتمت الدراسة بعمل مقارنة بين الري بالتنقيط والري بالرشاشات الصغيرة حيث أنهما أكثر نظم الري الشحيح استخداما في تطوير زراعة الأراضي الصحراوية في المناطق الشبه جافة حيث التربة الرملية وندرة مياه الري ،ويتشابه النظامان في كثير من مكونات شبكة الري، والاختلاف الأساسي يتركز في أسس التصميم وكذلك الموزعات (النقاطات والرشاشات الصغيرة) والتي تختلف في معدل وشكل إضافة المياه علي سطح التربة • وقد أجريت التجربة في منطقة كوم أوشيم بمحافظة الفيوم، وتضمن البحث أربع معاملات للري بالتنقيط وأربع معاملات للري بالرشاشات الصغيرة • ففي الري بالتنقيط استخدمت النقاطات ذاتية تنظيم الضغط وبتصرف ٨ ، ٤ لتر / ساعة، ووضعت النقاطات علي مسافات ٤٠ ، ٦٠ سم لكل من التصرفيين علي الترتيب • وفي نظام الرشاشات الصغيرة استخدم الرشاش الصغير الذي يعطي دائرة كاملة وبتصرفين ٣٤ ، ٧٥ لتر / ساعة، ووضعت الرشاشات علي الخط الواحد علي مسافات ١٠٥ ، ١٤٠سم للتصرف الأول ، علي مسافات ١٤٠ ،٢١٠ سم للتصرف الثاني • وقد أسس البحث علي أساس توحيد مساحة الأرض المروية بكل من النظاميين وكذلك حجم مياه الري المضاف لكل معاملة ، وقد أختلف زمن الري حسب تصرف الموزعات والمسافة بينهما • ويهدف البحث الي عمل مقارنة بين النظاميين من حيث توزيع الرطوبة والأملاح وكذلك تقدير كفاءة

انتظام وتوزيع المياه تحت النظاميين •وقد أوضحت الدراسة أن انتظام توزيع المحتوي الرطوبي للتربة كان أفضل في نظام الري بالرشاشات الصغيرة علي سطح قطاع التربة تحت الدراسة عنه في نظام الري بالتنقيط ، في حين أرتفع المحتوي الرطوبي للتربة حول النقاطات في عمق قطاع التربة في الري بالتنقيط ، وقد تبين من التجربة ان المحتوي والرطوبي كان مرتفعا تحت معدلات الإضافة الكبيرة في النظاميين • أما بالنسبة لتوزيع الأملاح فقد تبين من النتائج المتحصل عليها ان حركة الأملاح قد اختلفت في النظامين ، فقد تحركت الأملاح الي أسفل في باطن القطاع تحت نظام الري بالرشاشات الصغيرة، ولكن تحت نظام الري بالتنقيط فقد انتشرت الأملاح في جميع اجزاء القطاع وخاصة في العمق من صفر – ٢٠ سم من سطح التربة •

كما أظهرت النتائج تباين في انتظامية توزيع المياه ومعامل التوزيع تحت النظاميين – ففي الري بالتنقيط كان انتظام توزيع المياه ٨١ ، ٨٣ ٪ لنقاط ٤ ، ٨ لتر/ساعة علي الترتيب ،ويعزي السبب في ذلك الي جودة المياه المستخدمة وسرعة انسداد النقاطات ذات التصرف الصغير ، كذلك في الرشاشات الصغيرة فقد اختلفت كلا من انتظامية التوزيع ومعامل التوزيع باختلاف كل من معدلات الإضافة والمسافة بين الرشاشات ،فقد كانت انتظامية التوزيع ٦٦٫٦ ، ٦٠٪ للرشاش بتصرف ٧٥ لتر / ساعة للمسافات ١٤٠ ، ٢١٠ سم علي الترتيب في حين كانت ٦٥٫٦ ، ٥٧ ٪ للرشاش بتصرف ٣٤ لتر / ساعة للمسافات١٠٥ ، ١٤٠ سم • في حين كان معامل التوزيع ٧٩ ، ٧٥ ٪ للمسافات ١٤٠ ، ٢١٠ سم للرشاش بتصرف ٧٥ لتر/ساعة علي الترتيب •وكان معامل التوزيع ٧٨ ، ٧٠٪ للرشاشة بتصرف ٣٤ لتر / ساعة للمسافات ١٠٥ ، ١٤٠ سم علي الترتيب • ومن النتائج المتحصل عليها فانه يوصي بالآتي :

١– استخدم النقاطات في حالة ما تكون مياه الري عالية الجودة والأشجار المزروعة ذات جذور عميقة مثل اغلب أنواع أشجار البساتين •

٢– استخدم الرشاشات في حالة ما تكون مياه الري متوسطة أو منخفضة الجودة وخاصة في الأشجار سطحية الجذور•

٣– استخدام الموزعات ذات التصرف العالي والمسافات المتقاربة بين الموزعات يعطي نسبة عالية من المحتوي الرطوبي في جميع قطاعات التربة ، وتعطي توزيع رطوبي متماثل وجيد ، وكذلك يكون تراكم الأملاح أقل في منطقة المجموع الجذري •

٤– يفضل ألا تزيد المسافة بين الرشاشات عن ١٠٥ – ١٤٠ سم للرشاشات تحت الدراسة •