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A Review: Effect of draining emitters on Mean Weight Diameter (MWD) and salt and moisture distribution in clay soils.

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Abstract: The present article refers to the study of different draining and their effect on the salt distribution and movement, improvement of the physical properties of the soil, including soil building, as well as the relationship of the spread of plant roots to the draining emitters in soils of clay texture. The draining of 4 L / hour, 6 L / hour and 8 L / hour were used, and the salt and moisture distribution was studied starting from under the emitters in a direction perpendicular to the tube carrying the emitters and for three distances (under the emitters, 15 cm, 30 cm) (and to two depths of 20 cm, 40 cm. (Mean weight diameter of two depths (20 cm, 40 cm) and the spread of roots according to the amount of draining. The results showed that the draining excelled 8 L / hour by washing salts and expelling them to a distance farther than the other two types, meaning that the wetting area is larger than the other two types, thus spreading the roots more and forming the granular shape and thus better soil groups, and this is all due to the good moisture distribution and expelling the salts far to the end of the wetting front boundaries compared with other charges used in the experiment.

Key words: drain, soil building, salt distribution, Mean Weight Diameter, Wetting area.

1. INTRODUCTION

Iraq suffers from a major shortage of freshwater resources, and there are also climatic reasons represented in the country's location within the driest belt in the world, and this, in turn, results in a decrease in the amount of precipitation and an increase in evaporation rates. The United Nations Development Program (2006) found that the scarcity of water, its scarcity and the increasing demand for it made the country suffer from a deficit in the available water resources. Therefore, it is necessary and at the management, level to adopt irrigation technologies that ensure the achievement of (water and saline balance) in the soil section in line with the growth and productivity of crops. The use of the drip irrigation system works on partial moistening of the soil in the form of a circle below the drip, and the diameter of this circle increases according to the draining emitter, the physical properties of the soil, including the texture and construction, as well as the mechanical properties, in addition to the operating time of the system and the amount of ready water. (Al-Hadithi et al, 2010).The drip irrigation system is one of the technologies that have spread widely in arid and semi-arid regions, due to its high efficiency and its preservation of the physical properties of the soil, and this system is also suitable for irrigation of many soils (medium and coarse texture). One of the most important disadvantages of this system is the accumulation of salts at the boundaries of

the Wetting Front of the emitters, and it is considered one of the determinants of the spread of plant roots, and the spread of plant roots is limited to the extent of the area wet with water. Among the solutions that were used to push the salts and give a greater area for the spread of the roots is the use of high drainage of emitters, which achieved improvement in the physical properties of the soil, the growth of yield and an increase in the efficiency of washing salts. (Al-Mayahi, 2010).
The presence of a balanced state of air, moisture and salt creates an appropriate environment for the growth of roots, easy access to and the nutrients and water they need, and thus increases their apparent density (Oregon, 2004). Which it showed that there is a significant relationship between the number of roots, plant height and vegetative size . Dudley et al, (2008) showed that the important advantage of the drip irrigation system is to add irrigation water at a close distance or in the root zone in an efficient manner compared with other irrigation systems, thus pushing the salts out of the root zone. Azmira et al. (2016) concluded that the draining variation (qvar) is an evaluation and design indicator for evaluating the performance of the drip irrigation system, and the value 10% is an acceptable value, while if the value exceeds 20%, then this is an unacceptable value. Jassim and Nafawa (2017) showed that the drip irrigation system should be designed in a good method, important and basic factors must be taken into consideration, including soil traits, type of crop, cultivated area to be irrigated, water consumption, as well as hydraulic standards for the drip irrigation system. The aim of the study is to know the effect of draining emitters on the distribution of salts within the wetting area and the movement of water and the effect on the stability of soil groups or Mean Weight Diameter.

Drip irrigation efficiency

The drip irrigation efficiency expresses the extent of homogeneity and regularity of water distribution along the length of the flow pipelines. When the efficiency is high, the response of the crop is large, and on the contrary, this affects the productivity and the regularity of the work and draining of water in the drip irrigation networks is not necessarily the result of the variation in the manufacture of the system. There are other factors that affect the regularity of water distribution, the most important of which is the draining of the pump. The operating pressure of the pump, and the differences in the pressures resulting from the friction losses in the conveying and distributing water pipes, their lengths and diameters, the difference in the field topography and the type of emitters, thus affecting the efficiency of the overall drip irrigation system (Al-Obaidi, 2003).
The drip irrigation method is considered one of the best irrigation methods used in the world because it is highly efficient because water is distributed more uniformly through a network of tubes through which water is transported to plants compared to other irrigation methods Almajeed and Alabas (2013).The effect of dripping drainage on some hydraulic parameters of a drip irrigation system
Among these criteria: -

1- Friction losses

Howell and Hiler (1974) conclude (design equations for calculating energy losses by friction in field pipes by using Wiliam and Hazen's equation: -

$$HF = 1.212 \times 10^{10} \left(\frac{Q}{C}\right) \xrightarrow{1.852} \times D \xrightarrow{-4.871} \times L \ldots\ldots\ldots\ldots$$

As Hf: - energy losses by friction (m).
Q: - Discharge (liters / s)

D: - inner tube diameter (mm)

C: - (Williams and Hazan) coefficient of roughness and depends on the roughness of the inner surface of the water-carrying tube, and its value ranges between 140-150 for plastic pipes.

L: - tube length (m)

2- Coefficient of variation(CV)

This Coefficient is used to describe the expected difference in the draining emitters due to poor manufacturing, where a slight change or difference in the design dimensions of the emitters for the class or the same type causes a marked and clear variation in the draining emitters (Al-Obaidi, 2003).

3- Emission uniformity

Emission uniformity is defined as the ratio between the rate of the least-discharged quarter of the emission to the general emission rate of draining (Ortega et al., 2002).

$EU=(\overline{q}25\% / \overline{q}) \times 100$ ....

Where

Eu: - Emission uniformity (%)

$\overline{q}25\%$: - the draining rate for the quarter less than the total number of droppers (L / hour)

$\overline{q}$: - total draining rate (L / hour).

4- Mean Weight Diameter (MWD)

It refers to the stability of soil aggregates or soil building, and that the high moisture content in the soil at high levels of irrigation or large irrigation weakens the bonding or carnivorous bonds formed between the minutes within the soil aggregations. As well as trapping the air inside the pores, which in turn leads to the breakdown of soil aggregates and the dispersion of their particles (Moutier et al., 2000).Three discharges of 4 liters/hour, 6 L/hour, 8 liters/hour were used as experimental factors. 25 cm was used as the distance between the draining, with a field tube length of 15 meters, and the following was found:

Table (1) The effect of the interaction between emitters drain, soil depth and field tube length on the values of the Mean Weight Diameter (mm).

field tube length(cm)			**soil depth (cm)**	**draining emitters(L/ hour)**
25	**20**	**15**		
0.322	**0.334**	**0.351**	**20 – 0**	**4**
0.302	**0.313**	**0.329**	**40- 20**	
0.366	**0.382**	**0.400**	**20 – 0**	**6**
0.335	**0.348**	**0.370**	**40- 20**	
0.418	**0.435**	**0.458**	**20- 0**	**8**
0.358	**0.368**	**0.383**	**40 - 20**	
0.0079			**$RLSD_{0.05}$**	

Abdul-Rahman and Al-Sheikhly (2011) confirmed when they conducted their study in Wasit province in clay-textured soils that there was a significant effect of the study factors in the traits of the Mean Weight Diameter, where the values were when treating the irrigation interval of 3 days and the irrigation level was 100% of the evaporation basin and the draining emitters. 5.35 L / hour is 0.371 mm, a decrease of 4.4% compared to values before cultivated ,Where the values decreased to 0.248 mm when treating the 5-day irrigation interval, the irrigation level was 50% of the American evaporation basin, and the draining emitters was 3.15 L / hour, with a decrease of 36.1% compared to the values before cultivation.

5-Salt distribution in soil

One of the disadvantages of drip irrigation is the accumulation of salts on the soil surface between emitters and drip tubes. Bader and Taaleb (2007) in Egypt, during their study, concluded the effect of draining emitters with 2, 4 and 8 liters/hour discharges in sandy soil. However, the draining of 8 L/hour led to the encouragement of the horizontal movement in the soil profile and the increase in the concentration of salts in the root zone and near the surface in comparison with the draining of 2 and 4 L/hour. Zhai et al., (2016)showed in their study that the salinity distribution in the soil profile using three different additional quantities of irrigation water is 280, 320 and 360 mm and different levels of salinity of irrigation water in loamy sand soil in China, and it was found that the saline distribution at the end of the growing season varies with the depth, as the values were 1.11 - 1.84 --0.91 - 1.45, 0.87 - 1.39 and 0.72 - 1.21 g / kg for depths 0 - 20, 20 - 40, 40 - 60 and 60 - 80 cm, respectively. Below the salinity level of the irrigation water itself ,On the other hand, the salts move to the deep soil layers when there are large quantities of irrigation water, compared to the treatments that give fewer water quantities and that there is a significant increase in the collection of salts at depths 40 - 60 and 60 - 80 cm, and it due that to the large quantities of irrigation water It is more effective in washing salts and removing them from the surface layer and reducing salt accumulations in it.

Table (2) The effect of the interaction between the draining emitters and the distance between the emitters and the site of taking the sample on the electrical conductivity values (dS / m).

The site of taking the sample						**the distance between the emitters**	**draining emitters(L/ hour)**
D2X3	**D2X2**	**D2X1**	**D1X3**	**D1X2**	**D1X1**		
5.22	**4.74**	**4.25**	**4.24**	**3.50**	**3.14**	**25**	**4**
5.53	**4.93**	**4.87**	**4.36**	**3.8**	**3.18**	**30**	
5.63	**5.05**	**5.18**	**5.09**	**4.07**	**3.49**	**35**	
5.00	**4.48**	**4.07**	**3.88**	**3.34**	**2.88**	**25**	**6**
5.32	**4.72**	**4.29**	**4.22**	**3.75**	**3.06**	**30**	
5.46	**4.88**	**4.60**	**4.11**	**3.97**	**3.27**	**35**	
4.81	**4.38**	**3.74**	**3.42**	**3.31**	**2.54**	**25**	**8**
5.06	**4.56**	**4.23**	**3.68**	**3.58**	**2.78**	**30**	
5.19	**4.71**	**4.44**	**3.92**	**3.86**	**3.12**	**35**	

Where:
D: The depth of the sampling site
D1:The depth of the experiment taking site (20 cm)
D2: - The depth of the sampling site (40 cm)
X1: - The dimension is zero, in the horizontal direction from the drip, and perpendicular to the field tube
X2: - The dimension is 15 cm in a horizontal direction from the drip and perpendicular to the field tube

X3: - the dimension is 30 cm in a horizontal direction from the drip and perpendicular to the field tube

6-Moisture distribution in soil

The draining emitters affects the distribution of the moisture content within the soil profile. El-Hafedh et al. (2001), during their study, found the distribution of the moisture content on Loamy Sand soils in Egypt. The volume of wet and the surface area depends on the draining emitters. It also depends on the volume of the total water coming from the emitters in single irrigation and the distance between the emitters, and that the wet surface area was 0.19, 0.32, 0.48 for the discharge 4, 6, 8 L/hour and the distance between the emitters is 30, 50 and 70 cm, respectively. Al-Taie et al (2016)showed in their study, which included a study of three emitter discharges, which are 4, 6, 8 L / hour in Loamy soil in the fields of the College of Agriculture / University of Tikrit, that the moisture distribution under the drip irrigation system in the vertical and horizontal direction varies according to the different draining emitters used. They also showed an increase in the moisture content in the horizontal direction and its decrease in the vertical direction with an increase in the draining emitters from 4 to 8 L/hour, and also with the depth if the percentage of the increase in the moisture content of the depth 0-5 cm was 43.68%, while it decreased at the depth 10-15 cm by 4.21% Using the draining emitters 8 L / hour.

2. **CONCLUSIONS**: -

1 - The use of the 8 L / hour draining, because it achieved building good soil aggregates compared to other drainages and achieved better washing results and high moisture content compared to other draining, and thus better root distribution.
2 - The use of the drip irrigation system with a discharges design of 8 L / hour, the distance between the emitters is 25 cm, and the length of the field pipe is 15 meters.
3 - We recommend using the drip irrigation system under a drain of 8 liters/hour, with a distance of 25 cm between the draining, and a length of 15 meters for the pipe, as it achieved good results for all the measured characteristics.
4 - Conducting broader studies and research in the field of drip irrigation system design by introducing some other criteria for the system and building relationships related to straight-line equations and slope and linking them with operating pressure, the slope of the ground, pipe diameter and distance between field tubes and taking different types of drippers to know the best engineering and hydraulic design of the systems according to type Use, soil characteristics and type of economic crop.

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