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# USING SOME SURROUNDINGS AROUND SURFACE DRIPPERS TO BE USED AS SUB-SURFACE

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## ABSTRACT

This work aims to reduce the costs of subsurface irrigation system by using surface drip lines. Also to study the impact of using some surroundings media around subsurface dripper lines on the amount of irrigation water, soil moisture distribution, salt content distribution, water use efficiency (WUE), soil water storage and onion yield. This work was conducted on sand soil at a private farm, Badr El Hedaya Society Center, in Governorate of El Bohera during two seasons (2004 and 2005). It was used irrigation water had 1.4 ds/m. Five treatments: T(1) was surface drip irrigation system with irrigation level 100% from irrigation requirements, T(2), T(3), T(4) and T(5) were subsurface drip irrigation system (SSDIS) with surroundings of sponge, stones, sponge with stones and without sponge with stones respectively with irrigation rate 80% from irrigation requirements. The irrigation interval for the last treatments was every day (daily irrigation). These treatments were repeated with each three days as irrigation interval in T(6), T(7), T(8), T(9) and T(10), respectively. However the results show that:

* Amount of irrigation water were 1972.1 and 1577.7 $m^3$/fed for 100% with SDIS and 80 % with SSDIS crop water requirement respectively.
* The best Soil moisture distribution was for after irrigation by using stone (T3) with 80% crop water requirement. Then before irrigation the best treatment was T(5).
* The salt content distribution (EC) of the five treatments irrigated each three days are higher than the other five treatments for daily irrigation.
* Water use efficiency (WUE) It is prefer to use treatments of sponge with stones (T(4)) under using SSDIS with daily irrigation rather than for three days intervals.
* The best soil water storage at three days irrigation SDIS with 100% IR (T (6)) and at T(9) without surroundings under using 80% IR and SSDIS.
* The highest yield was T(5) SSDIS with 80 % of crop water requirement with daily irrigation interval with 10.327 ton/fed.

That is mean the T(5) is the optimum treatment for the studied conditions. It is the best treatment at soil moisture and salt distributions and better in WUE and soil water storage.

## INTRODUCTION

As a result of the over population in Egypt and the limitation of the irrigation water, Egypt faces using sandy soil to increase the cultivated soil with the modern irrigation systems. Sandy soils occupy about 96 % from the Egyptian area, so the future sight is to face that via the combination work between cultivation of sandy soil and using modern irrigation systems with high irrigation water efficiency. Surface drip irrigation and subsurface drip irrigation systems have irrigation water efficiency more than 85%. Solomon (1988)

Salt distribution around the wetting area in the surface drip irrigation system and on the surface soil under using subsurface drip irrigation are the greatest problem, so, this phenomena needs to study its effect on plant growth.

Heerman et al. (1990) reported that irrigation scheduling is a key element to proper management of irrigation systems. The goal is to apply the correct amount of water at the right time to meet management tasks may be to maximize water efficiency, crop production, or economic return or to minimize irrigation costs. Xin et al. (1995) reported that irrigation management should maintain soil-water content at the optimum for the given production system and should avoid applying too little or too much water. Lamm et al. (1995) reported that, careful management of subsurface drip irrigation systems reduced net irrigation needs by nearly 25% while still maintaining top yields of 12-15 t/ha. Also, they added that, increasing the spacing and / or length of drip line laterals would be one of the most important factor for reducing the investment costs of drip irrigation system. Soil type, drip line installation depth, crop type and the reliability and amount of in-season precipitation are the major factors which determine the maximum spacing. El Berry, et al. (2003) reported that the subsurface drip irrigation is on the positive growth side in case of elements concentration low in heavy metals. High nutrient elements in mulberry leaf, high mulberry growth and leaf production, high water use efficiency and low in applied water. In the environmental side, the subsurface drip irrigation decreased the potential risk to the health of farmers and weed growth, that needs goods operation management with high filtration and continuous maintenance for the network system. Aboamera (1999) illustrated that the 20-cm depth of the sub-drip lateral produced the most uniform distribution of soil moisture content in both magnitude and direction compared with the 0, 10, 30 cm depths in the sandy soil. The highest percent of root weight was located at 10 cm depth of the soil layer for all treatments. The highest values of both pea and water use efficiency were obtained at 20-cm depth of sub drip lateral. Phene, et al. (1992); ASAE (1996) indicated that assessment of system application uniformity is more difficult for sub-surface drip irrigation systems than for surface drip irrigation because most components are buried and not available for direct assessment. Soil moisture content was more than 90% of F.C under drippers. A bulb onion is mainly considered among the most important vegetable crop in Egypt. The total planted area is about 111,000 feddan, which produce over 1149,000 ton yearly (Ministry of Agriculture and Land Reclamation, 2005). Onions are a major irrigated crop. an excessive amount of water is generally applied, because the crop is shallow-rooted and requires frequent irrigation to achieve good yields. Onion Is a small, hard seeded crop which is difficult to germinate and very susceptible to competition from weeds, especially during the germination and early growth stages. Al-Jamal et al.,(2000). Zedan (2005) used a drip irrigation system for cultivating squash plant in order to study the soil water distribution under a dripper, he found that the maximum width in onion shape of water distribution was 45 cm depth below dripper.

## MATERIALS AND METHODS

**Materials:**

This work was conducted on sandy soil at a private farm (Badr El Hedaya Society Center in El-Behera Governorate) during 2004 and 2005 seasons. Tables (1 and 2) show the physical and chemical properties of experimental soil.

Table 1: Soil physical properties and the soil classification.

| Depth | Particle size distribution, % | | | F.C. | W.P. | B.D. | pH | EC | Texture |
|---|---|---|---|---|---|---|---|---|---|
| (cm) | Sand | Silt | Clay | % | % | $gm/cm^3$ | 1/2.5 | ds/m | class |
| 0 - 30 | 89.80 | 3.60 | 6.60 | 15.3 | 2.02 | 1.68 | 8.26 | 1.1 | Sandy |

Table 2: Soil chemical properties.

| Depth (cm) | Soluble Cations,* meq/100 g soil | | | | Soluble Anions,* meq/100 g soil | | | |
|---|---|---|---|---|---|---|---|---|
| | $Ca^{++}$ | $Mg^{++}$ | $Na^+$ | $K^+$ | $CO_3^{--}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^{--}$ |
| 0 - 30 | 0.20 | 0.27 | 0.01 | 0.09 | ---- | 0.20 | 0.32 | 0.05 |

**- Onion crop:**

Onion (Allium, Aaryllidaceae family) was planted at the first of January (2004) for the first season and replicated at the same time for the second season. The plantation was on two rows ridge (60- cm width) the distance between rows 20-cm and 7.5-cm distance between plants on two side.

**- Irrigation systems:**

Two irrigation systems were tested in this study (surface and subsurface drip irrigation systems). Quantity of applied water (100 % as a control) and 80 % of CWR), irrigation intervals (daily and every three days) and soil circumstance around drippers (stone and sponge).

It worthy to mention that, the diameter of each dripper for subsurface drip irrigation system (SSDIS) was 1.0 mm, which was drilled by a drill on the fourth sides along the dripper lines diameter (Φ=32 mm).

**Methods:**

**1) Experimental design and treatments:**

The experimental area was 434 $m^2$ (31 m × 14 m) divided into three parts, which were used to represent ten treatments. Surface (16 cm between drippers) and subsurface (20 cm depth and 8 cm between drippers) of drip irrigation systems included ten treatments as follows:

T1(control)- Surface drip irrigation system (SDIS) with 100 % of crop water requirement(CWR) and irrigation interval every day (daily).

T2- Sub surface drip irrigation system (SSDIS) with 80 % of crop water requirement and irrigation interval every day (daily) using sponge as a surroundings around drippers.

T3- SSDIS with 80 % of crop water requirement and irrigation interval every day (daily) using stone as a surroundings around drippers.

T4- SSDIS with 80 % of crop water requirement and irrigation interval every day (daily) using stone with sponge as a surroundings around drippers.

T5- SSDIS with 80 % of crop water requirement and irrigation interval every day (daily) without any surroundings around drippers.

T6(control)- SDIS with 100 % of crop water requirement and irrigation interval every three days.

T7- SSDIS with 80 % of crop water requirement and irrigation interval every three days using sponge as a surroundings around drippers.

T8- SSDIS with 80 % of crop water requirement and irrigation interval every three days using stone as a surroundings around drippers.

T9- SSDIS with 80 % of crop water requirement and irrigation interval every three days using stone with sponge as a surroundings around drippers.

T10- SSDIS with 80 % of crop water requirement and irrigation interval every three days without any surroundings around drippers.

Fig. (1) shows experiment design and layout for drip irrigation system.

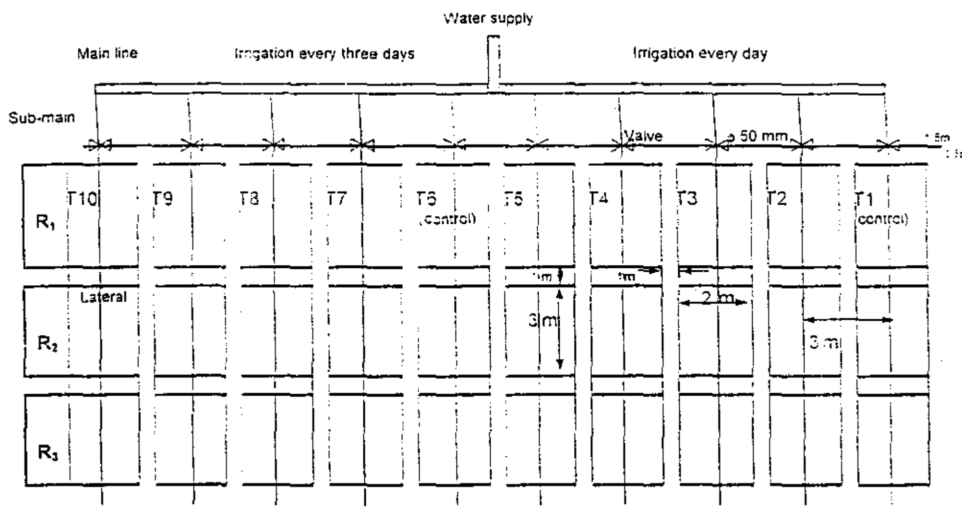


**Fig. (1) Drip irrigation network and layout.**

**2) Measurements**

**1- Soil moisture distribution**

it was measured vertically and horizontally before and after irrigation. samples were collected vertically at different depth 0,5,10,15 cm under soil surface and horizontally at 0,5,10 cm from laterals in both sides (right and left) from laterals.

**2- Salt content distribution**

The soil samples, which were taken for determining soil moisture contents, were also used to determine the electric conductivity (EC, dS/m) in order to study salt distribution.

**3- Amount of irrigation water**

The irrigation water quantity was calculated according to Omary, et al. (1995), which was added daily for the first five treatments (1 to 5) and for each three days for the next five treatments (6 to 10). Irrigation water quantities had been calculated for the surface drip irrigation system and subsurface drip irrigation at 100 and 80 % from crop water requirements, respectively.

**4- Onion yield, ton/feddan**

**5- Water Use Efficiency (WUE)**

WUE was calculated for the ten treatments according to Jensen (1980) using the following formula:

$$WUE = \frac{Total\ fresh\ yield\ (kg / fed)}{Total\ applied\ water\ (m^3 / fed)} \qquad kg/m^3$$

**6- Soil Water Storage**

Soil water storage is water quantity, which is holding within the soil profile resulted from irrigation process. Soil water storage was calculated via average volumetric soil moisture for any soil depth multiplication this depth or using soil water storage formula according to Hartman (1983) using the following formula:

$$SWS = \int_{Z=0}^{Z=15} \theta \, dz$$

Where:

Z: the soil depth, mm

θ: average soil moisture content, $cm^3/cm^3$

**Statistical analysis**

Statistical analysis was done for the experiment according to Bisher and El Robi (1979).

## RESULTS AND DISCUSSION

**1- Soil moisture distribution**

The soil moisture distribution was within root zone of onion (0 –15 cm depth). Also, the selection of studying soil moisture distribution in 0 –15 cm layer is for studying the effect of SDIS and effect the capillary rise for moisture from layout of SSDIS (at 30 cm depth). Soil moisture distribution below SSDIS is not included the comparison between SDIS and SSDIS.

**After irrigation for daily irrigation**

Figs. (2 and 3) include the soil moisture distribution in the root zone of the onion plant as average of the two growing season for onion plant.

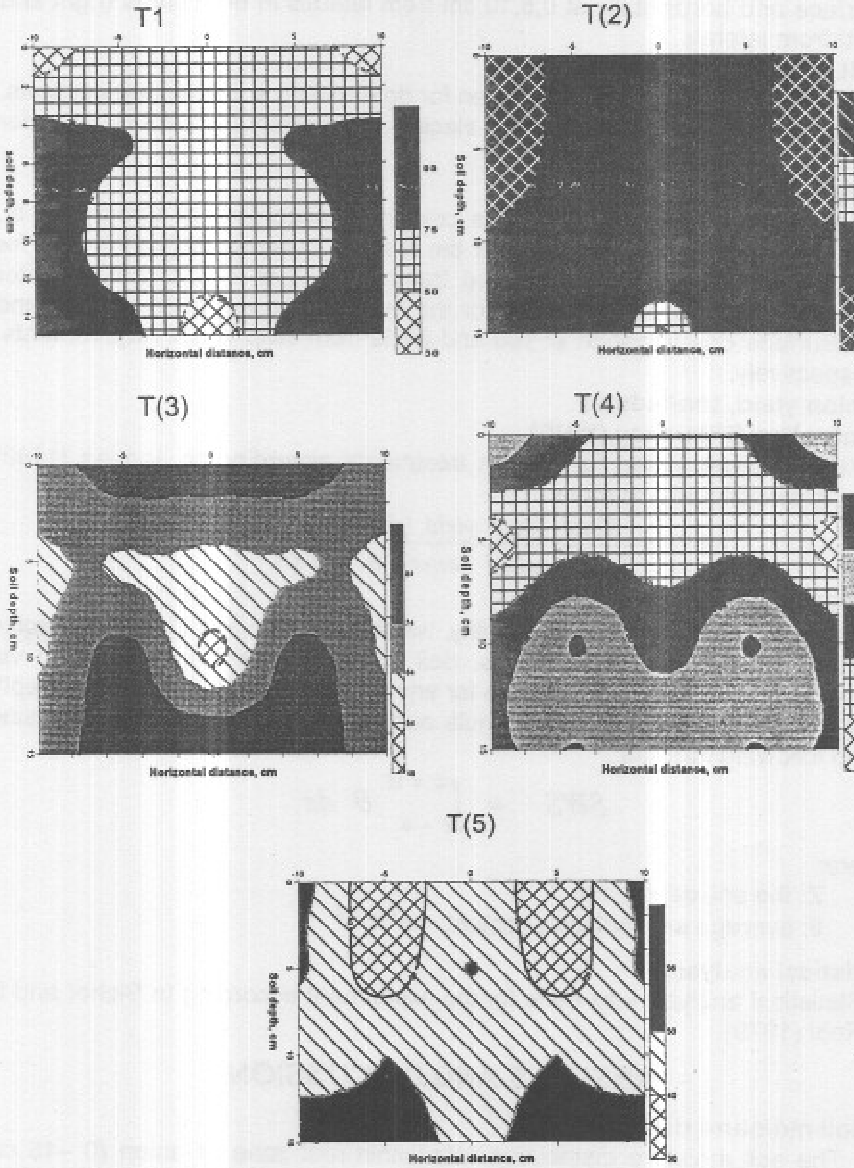


**Fig. (2): Soil moisture distribution as a ratio from available water for 1, 2, 3, 4 and 5 treatments after irrigation for daily irrigation as average of the two growing seasons for onion.**

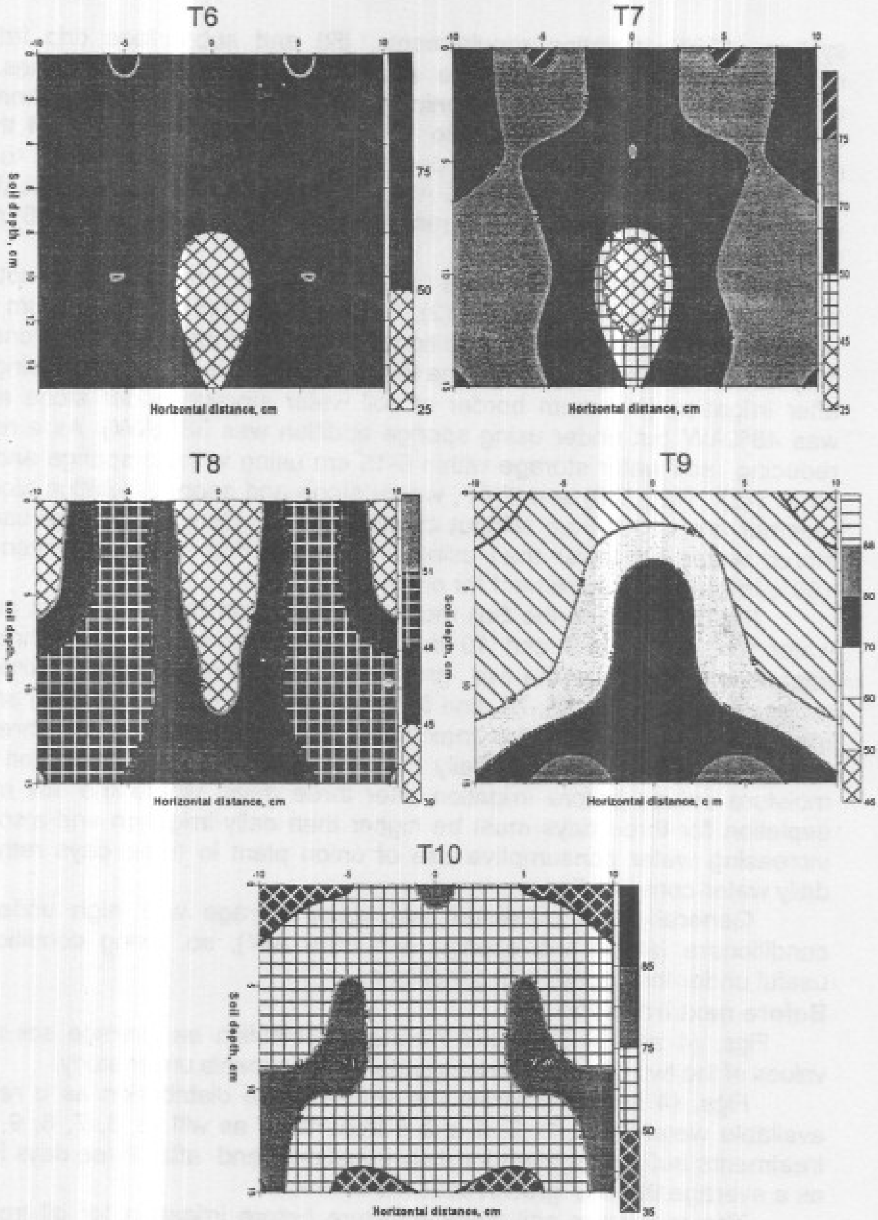


**Fig. 3: Soil moisture distribution as a ratio from available water for 6, 7, 8, 9 and 10 treatments after irrigation for three days irrigations average of the two growing seasons for onion**

Fig. (2) illustrates the soil moisture distribution as a ratio from available water for the five treatments (1, 2, 3, 4 and 5), after irrigation for the daily irrigation as average of the two growth seasons of onion, under drip irrigation system (100% irrigation requirements, IR) and subsurface drip irrigation system (80% IR) using sponge and stones around dripper lines. This distribution was studied around onion plant within 10 cm distance (horizontal distance) and vertical distance to 15 cm depth. T (1) shows that the soil moisture content values did not decrease 30 %AW and increased to 95 % AW. T(2) ranged from 38 to 78% AW , T(3) ranged from 48 to 84 %AW and was better than T(2). As for T(4) ranged from 0 to 90 % AW and T(5) ranged from 30 to 56 % Aw.

From the discussed before using stone T(3) with 80% Aw is not better than T(1), T(1) was better than T(2), T(3), T(4) and T(5). The minimum limit of water storage using sponge additions was lower than stone additions. This may be due to the ability of sponge to hold moisture is higher than using stone after irrigation (minimum border of soil water storage under stone addition was 48%AW but under using sponge addition was 38%AW). As a result of reducing soil water storage within 0-15 cm using without sponge and stone as in T(5) T(2), T(3) and T(4) , where stone and sponge addition alone and together are better than without conditioner. So, Conditioners are useful for stored water but lower than using the surface drip irrigation system using 100% irrigation requirement for onion crop.

Fig (3) illustrate the Soil moisture distribution as a ratio from available water for 6, 7, 8, 9 and 10 treatments after irrigation for three days irrigations as average the two growth seasons of onion. The maximum soil moisture was 88, 85, 75, 75, and 51%AW for T(9), T(10), T(6), T(7) and T(8), respectively. It is logic the maximum soil moisture value for three days intervals to be lower than daily irrigation that is due to reduction of soil moisture values before irrigation after three days, where the soil moisture depletion for three days must be higher than daily irrigation and also due to increasing water consumptive use of onion plant in three days rather than daily water consumption.

Generally, the maximum soil water storage was high under using conditioners (stone and sponge with 88% AW), so, using conditioners is useful under the experiment conditions.

**Before next irrigation**

Figs. (4 and 5) show soil moisture distribution as average soil moisture values of the two growing seasons under the treatments under study.

Figs. (4 and 5) illustrate the soil moisture distribution as a ratio from available water for 1, 2, 3, 4 and 5 treatments as will as 6, 7, 8, 9, and 10 treatments before irrigation for daily irrigations and after three days irrigation as a average the two growth seasons of onion.

The maximum soil water moisture before irrigation for all treatments were 100, 33, 85, 60, 80, 75, 30, 39, 41, and 44% from AW for T(1), T(2), T(3), T(4), T(5), T(6), T(7), T(8), T(9) and T(10), respectively. T(1) of the surface drip irrigation using 100% requirements of onion is best one, T(3) of using sponge addition with using 80% requirements of onion is very good, as will as T(4) of using sponge and rocks together additions with using 80% requirements of onion is good to make high residual soil moisture in the soil profile. T(7)and T(8) were better although without any conditioner addition. On the other hand, the rest treatments (T(7), T(8), T(9) and T(10)) indicated that the moisture values were lower than 50% AW.

Although high residual moisture in some parties of the soil profile but is better because the roots of plant expand to high moisture at-the irrigation intervals.

In General discussion soil moisture values before irrigation sponge and rocks additions made improving in high residual soil moisture.

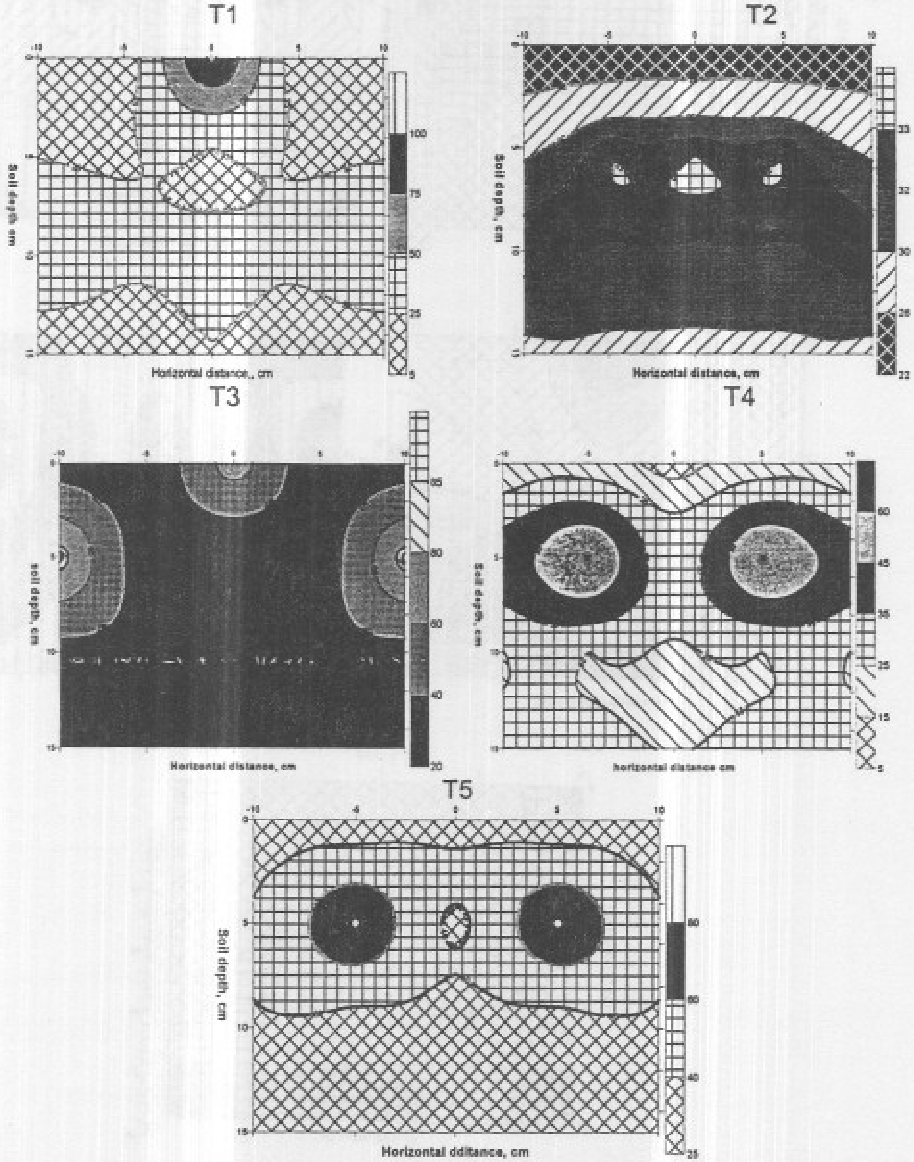


Fig. 4: Soil moisture distribution as a ratio from available water for1, 2, 3, 4 and 5 treatments before irrigation for daily irrigations average of the two growing seasons.

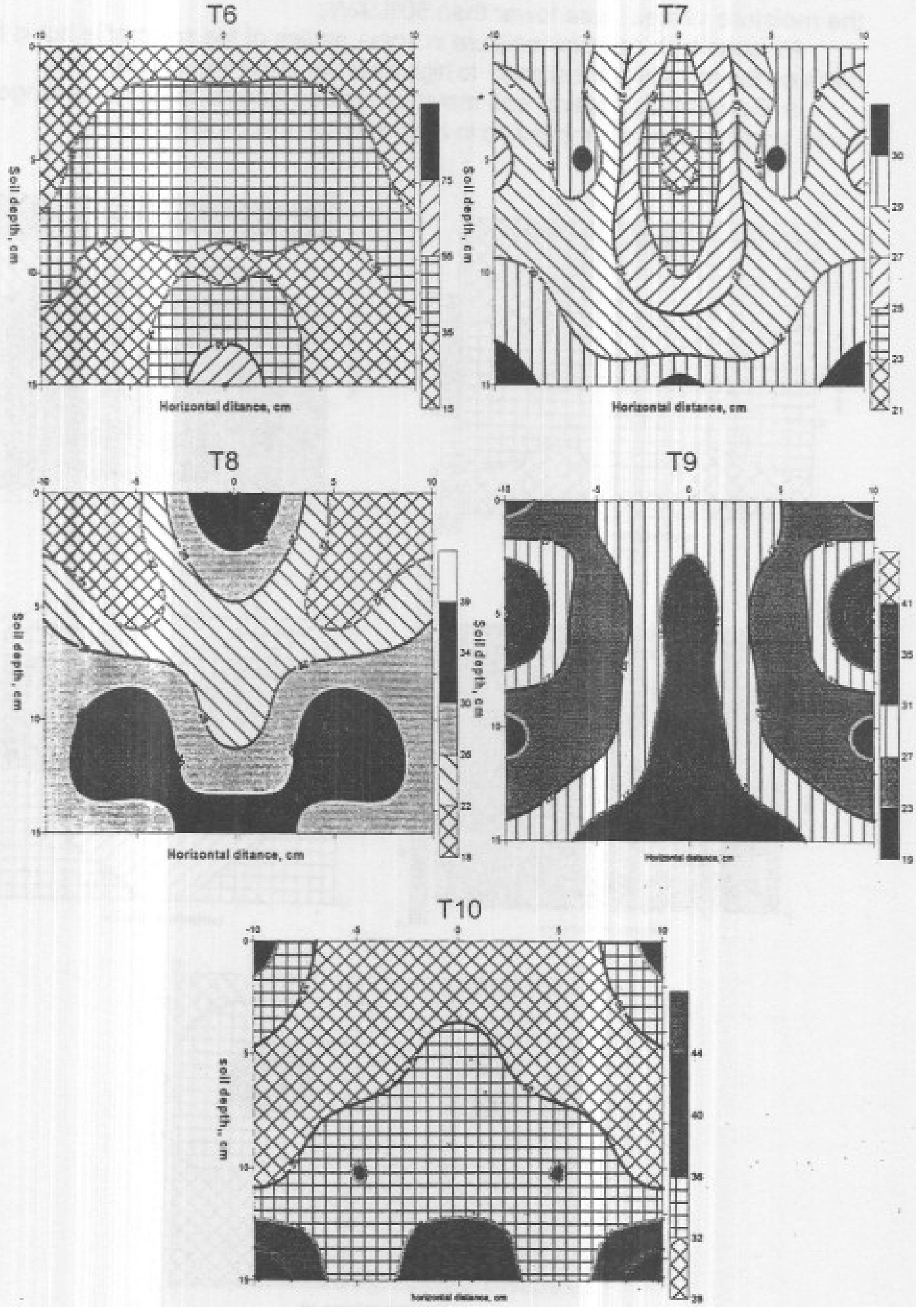


**Fig. 5: Soil moisture distribution as a ratio from available water for 6, 7, 8, 9 and 10 treatments before irrigation for three days irrigations intervals average of the two growing seasons.**

**2- Salt content distribution**

Fig. (6) illustrates the electric conductivity (EC, $d_S$/m) in root zone for Onion plant for the five treatments daily irrigation and the other irrigated each three days using SDIS and SSDIS.

Fig. (6) show that EC of T(9) is the highest one and T(8) is lowest one for three days irrigation using SSDIS and T(4) is also highest one and T(3) is the lowest one for daily irrigation using SSDIS. It is notice that EC of the five treatments irrigated each three days are higher than the other five treatments for daily irrigation.

No significant differences between the ten treatments (between SDIS & SSDIS, daily and three days irrigation, 100 & 80 % irrigation requirements, using sponge and stones together and each one alone as well as without sponge and stones. The cause for lower EC value is due to the salts accumulate at edges of the wetting area under drip irrigation emigrate rooting zone.

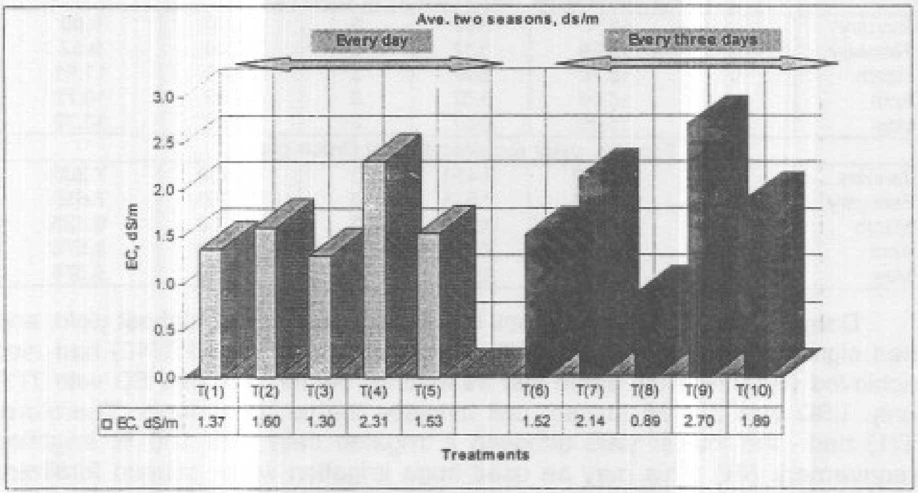


**Fig. 6: Electric conductivity within root zone of onion plant for the different treatments.**

**3- Amount of irrigation water**

Table (3), shows the amount of irrigation water for the two seasons. It worthy to mention that the cultivation was on the first January 2004 and surrounding of applied water was cased at the 15 May 2004.So, number of irrigations was 136 irrigation/season in daily irrigation, the total of applied water was 1972.1 m3/feddan per season for 100% water requirements. As for number of irrigations for each three days was 45 irrigations/season with the same total applied water of daily irrigation for 100% irrigation requirements. The total applied water of 80% irrigation requirements was 1577.680 m3/fed for SDIS and SSDIS. The irrigation water quantity was calculated according to Omary, et al. (1995), which was added daily for the first five treatments (1 to 5) and for each three days for the next five treatments (6 to 10). Irrigation water quantities had been calculated for the surface drip irrigation system and subsurface drip irrigation at 100 and 80 % from water requirements, respectively.

**4- Onion yield**

Table (4) includes average of onion productivity as affected by irrigation intervals (daily and every three days), irrigation water quantity and soil circumstance (sponge and stone). As well as it includes the statistical analysis (significant or non significant differences and LSD).

**Table 3: Irrigation scheduling for onion crop (100 & 80% from water requirements of SDIS application according to Omary, et al. (1995).**

| Month | Irrig. Interval, Days | Irrig. Water quantity, $m^3$/irrig. fed | Water depth, mm/irrig. fed | Irrig. Interval, days | Irrig. Water quantity, $m^3$/irrig. fed | Water depth, mm/irrig.fed |
|---|---|---|---|---|---|---|
| For 100% water requirements of Onion plant | | | | | | |
| January | 1 | 12.70 | 3.00 | 3 | 38.00 | 9.00 |
| February | 1 | 13.30 | 3.17 | 3 | 40.00 | 9.52 |
| March | 1 | 16.70 | 3.92 | 3 | 50.00 | 11.91 |
| April | 1 | 15.00 | 3.57 | 3 | 45.00 | 10.72 |
| May | 1 | 15.00 | 3.57 | 3 | 45.00 | 10.72 |
| For 80% water requirements of Onion plant | | | | | | |
| January | 1 | 10.160 | 2.400 | 3 | 30.400 | 7.200 |
| February | 1 | 10.640 | 2.536 | 3 | 32.000 | 7.616 |
| March | 1 | 13.360 | 3.136 | 3 | 40.000 | 9.528 |
| April | 1 | 12.000 | 2.856 | 3 | 36.000 | 8.576 |
| May | 1 | 12.000 | 2.856 | 3 | 36.000 | 8.576 |

Data in Table (4) revealed that T(5) had achieved the highest yield, and had significant difference (SD) with T(1) and T(8). T(2) and T(10) had also achieved (S.D) with the same last treatments. As for T(3) had SD with T(1) only. LSD was 3.8178 ton/fed. unit between the ten treatments. Therefore, T(1) had the lowest yield although it irrigated daily with 100 % irrigation requirement (IR). This may be used huge irrigation water caused fertilizers leaching below onion root zone especially with sandy soil. T(6) had the same conditions which was irrigated with 80% IR was better than T(1). Data in the previous Table pointed to yield of treatments (T2, T3, T4 and T5) under SSDIS was better than T(1) under using SDIS specially daily irrigation. As for T(7) and T(10) were irrigated each three days under using SSDIS were better than T(6) under using SDIS and T(8) and T(9) under using SSDIS. This reflects that 80% irrigation requirement is better than treatment of 100% irrigation requirement (water saving 20% from irrigation requirement) and SSDIS also is better than SDIS.

**Statistical analysis**

Using sponge and stones under daily irrigation did not effect on yield onion (there are not significant differences between T(5) and their treatments, T(2), T(3) and T(4)). As for three days irrigation, T(10) (without sponge and stones) had significant difference with T(8) (used stone) but no significant differences between T(10) and T(7)( using sponge) as well as T(9) (using sponge and stones).

**Table 4: Yield of onion as affected by the treatments under study and statistical analysis.**

| Treatments | Irrigation intervals, days | Yield Ton/fed |
|---|---|---|
| T(1) | daily | 05.388 |
| T(2) | | 10.243 |
| T(3) | | 09.457 |
| T(4) | | 08.881 |
| T(5) | | 10.327 |
| T(6) | Every Three days | 06.743 |
| T(7) | | 08.125 |
| T(8) | | 06.277 |
| T(9) | | 06.510 |
| T(10) | | 10.173 |
| L.S.D between 10 treatments | | 3.8178 |
| L.S.D between irrigation intervals | | No. Significant |
| L.S.D for interaction | | No. Significant |

**5- Water Use Efficiency (WUE)**

Fig. (7) illustrates that WUE for the ten treatments, five for the daily irrigation (1, 2, 3, 4 and 5) also five treatments for the three days irrigation (6, 7, 8, 9 and 10).

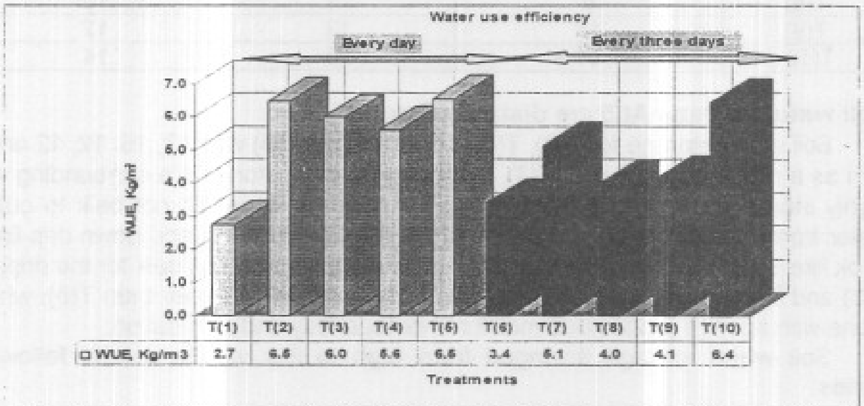


**Fig. 7: Water use efficiency as average of the two growing seasons of onion as affected by the five treatments irrigated daily and the other every three days as well as soil circumstance under using SDIS and SSDIS.**

It is prefer to used treatments of sponge with stones under using SSDIS with daily irrigation rather than for three days intervals ( due to soil moisture stress on onion plant). Anson and May (1998) reported that increasing irrigation water will increase onion yield linearly.

**6- Soil Water Storage**

Soil water storage is the best criterion to comparison between the five treatments at the different irrigation intervals (daily irrigation and three days irrigation).

Table (5) includes the soil water storage at 0, 5,and 10 sites for the ten treatments.

**Soil water storage At zero cm distance from dripper**

Data in Table (4) point to stone surrounding with SSDIS at 80 % IR (T3) and sponge as a surroundings with SSDIS at 80% IR for daily irrigation had achieved the soil water storage within root zone higher than T(1) using SDIS with 100% IR. As well as T(9) (sponge + stone) surrounding under using SSDIS at 80 % IR and T(10) without any surroundings are better than T (6) of SDIS with 100% IR for three days irrigation.

**Table 5: Soil water storage (mm) after irrigation within root zone for the ten treatments under study**

| Treatment | *At zero cm distance from dripper* (mm) | *At 5 cm distance from dripper* (mm) | *At 10 cm distance from dripper* (mm) |
|---|---|---|---|
| T(1) | 12 | 15 | 16 |
| T(2) | 13 | 12 | 10 |
| T(3) | 14 | 17 | 14 |
| T(4) | 10 | 12 | 12 |
| T(5) | 10 | 9 | 11 |
| T(6) | 11 | 15 | 14 |
| T(7) | 9 | 9 | 9 |
| T(8) | 9 | 11 | 10 |
| T(9) | 15 | 13 | 12 |
| T(10) | 11 | 13 | 14 |

**Soil water storage At 5 cm distance from dripper**

Soil water storage for T(3), T(1), T(2),T(4) and T(5) was 17, 15, 12, 12 and 9 mm as a head, respectively. T(3), which represented stone as a surrounding was highly stored water treatment. This may be due to stone did not balk to output water from dripper, so water distributed on the soil profile up and down drip lines. Look like T(1), which represented the surface drip irrigation no balk for the dripper. T(2) and T(3) were equal in soil water storage but were higher than T(5), where stone with sponge made good moisture homogeneity and distribution.

Soil water storage arranged from high to low values as the following series:

**T (3) > T(1) > T(2)= T (4) > T (5) in daily irrigation case,**

The same thing was found for the three days irrigation treatments, where sponge with stones surroundings did not effect on soil water storage, but stone surroundings was better than sponge surroundings resulted from the ability of sponge to hold irrigation water.

Soil water storage arranged from high to low values as the following series:

**T (6) > T (9) = T (10 ) > T (8) > T ( 7) in case three days irrigation**

**Soil water storage At 10 cm distance from dripper**

**T (1) > T(3) > T (4)> T(5)> T(2), in case of daily irrigation**

**T(6) = T (10) > T(9) > T(8) > T(7), in case three days irrigation**

From the discussed before, it is clear that using stones at 5 and 10 sites at daily irrigation is better. As for at three days irrigation SDIS with 100% IR (T (6)) and T(9) without any surroundings under using 80% IR and SSDIS are the best.

**Conclusions**

From the results it can be concluded that:

* Amount of irrigation water were 1972.1 and 1577.7 $m^3$/feddan for 100% with SDIS and 80 % with SSDIS water requirements respectively.
* Soil moisture distribution for after irrigation (T(1) and T(9)) with 100, 80% IR respectively are the best treatments after irrigation. Then before irrigation the best treatment was T(1).
* The salt content distribution (EC) of the five treatments irrigated each three days are higher than the other five treatments for daily irrigation.
* Water use efficiency (WUE) It is prefer to used treatments of sponge with stones (T(4)) under using SSDIS with daily irrigation rather than for three days intervals.
* The best soil water storage at three days irrigation SDIS with 100% IR (T (6)) and at T(10) without any surroundings under using 80% IR and SSDIS.
* The highest yield was T(5) [SSDIS with 80 % of onion irrigation requirement with irrigation interval one day (daily) (without any surrounding) with 10.327 ton/fed.

That is mean, the T(5) is the optimum treatment for the studied conditions. It is the best treatment at soil moisture and salt distributions and better in WUE and soil water storage.

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# استخدام بعض الإضافات حول نقاطات الري السطحية لاستخدامها تحت سطح التربة

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تهدف هذه الدراسة إلى إمكانية تقليل نفقات نظام الري التحت سطحي وذلك باستخدام الري بالتنقيط تحت سطح التربة. كما يهدف أيضا إلى دراسة تأثير استخدام بعض الأوساط حول خطوط الري ودراسة تأثيرها على كمية الماء المضاف للتربة (ماء الري)، التوزيع الرطوبى الارضى، التوصيل الكهربي في منطقة انتشار الجذور(تركيز الأملاح)، كفاءة استخدام ماء الري، المخزون الرطوبى بالتربة وإنتاجية محصول البصل.

تم هذا العمل في مزرعة خاصة بمركز بدر بمحافظة البحيرة لأرض رملية القوام خلال عامي ٢٠٠٤، ٢٠٠٥ واستخدمت مياه ري ملوحتها ١,٤ ديسى سيمنز/ متر. وقد استخدمت ٥ معاملات: نظام الري بالتنقيط سطحيا بمعدل ري ١٠٠% من الاحتياجات المائية لمحصول البصل، استخدام نظام الري بالتنقيط تحت سطحي من خلال إضافة الإسفنج، الزلط، الإسفنج بالإضافة إلى الزلط بدون أي إضافات حول خطوط الري بمعدل ري ٨٠% من الاحتياجات المائية لمحصول البصل. وان الري لجميع هذه المعاملات كل يوم. وتم تكرار هذه المعاملات مع الري كل ثلاث أيام. ويمكن إيجاز النتائج المتحصل عليها في النقاط التالية:

- كمية الماء المضاف تراوحت ما بين ١٩٧٢,١، ١٥٧٧,٧ م٣/فدان عند ١٠٠% مع الري السطحي، ٨٠% مع الري تحت السطحي على التوالي.
- كان أفضل توزيع محتوى الرطوبى بالتربة بعد الري عند المعاملة الأولى والتاسعة، في حين كانت أفضل المعاملات هي المعاملة الأولى قبل الري.
- دلت النتائج على أن توزيع الأملاح بالتربة أعلى عند الري كل ثلاثة أيام في المعاملات الخمسة تحت الدراسة عنه عند الري اليومي.
- يفضل استخدام المعاملة الرابعة (إسفنج وزلط) مع استخدام الري التحت سطحي يوميا.
- أفضل ماء مخزن عند استخدام الري السطحي T(6)، وتحت السطحي T(9) كل ثلاث أيام.
- أعلى إنتاجية لمحصول البصل كانت ١٠,٣٢٧ طن/فدان عند المعاملة T(5).

ومن النتائج السابقة يوصى البحث باستخدام معاملة الري التحت سطحي عند الري ٨٠ % من الاحتياجات المائية لمحصول البصل بدون أي إضافة للوسط حول النقاط (T5).