Egypt. J. Agric. Res., 78 (3), 2000.

GRAPE YIELD RESPONSE TO SUBSURFACE DRIP IRRIGATION IN OLD VALLEY

MATOUK, A.M. [1]**, EL-GINDY, A.M.** [2]**, EL-ADL, M.A.** [3] **AND BONDOK, M.Y.** [4]

1 Prof. of Agric. Eng., Fac. of Agric., Mansoura Univ

2 Prof. of Agric.Eng., Fac. of Agric., Ain-Shams Univ.

3 Lecturer, of Agric. Mech., Fac. of Agric., Mansoura univ.

4 Agric. Engineer, Agric. Eng., Res. Inst. (ARC).

(Manuscript received 16 June 1999)

Abstract

This investigation aims to study the response of King Ruby seedless grapes to subsrface drip irrigation system in old valley. The field experiments were carried out during the two seasons, of 1996 and 1997, in "Gharbia Governorate".

Soil moisture, salinity distribution, weeds growth and crop yield (quantity and quality), were measured. Water use efficiency by grapes was also considered.

In a comparison between subsurface drip irrigation system and surface drip irrigation system, the results showed that highest yield and best quality of grapes were obtained when irrigated the grapes by using suburface drip irrigation system.

INTRODUCTION

Sustainable agricultural system can be established if the basic water management, water conservation, salinity and erosion control are recognized.

The main objectives of the agricultural strategy are to increase agricultural production per unit of land and water, through more efficient use of these limited resources. Modern irrigation technologies would provide significant benefits in improving crop yield and quality, reducing cost of production and improving environmental conditions while minimizing environmental stresses.

In the last few years, the planted area of grape were increased gradually to 125000 feddan, producing about 740000 metric tons in the year 1996 according FAO (1996).

King Ruby grape is chosen in this study as example of seedless grpe yield in Egypt.

James (1988) mentioned that trickle irriqation encompasses several systems of irrigation, including drip, subsurface, bubbler, and spray irrigation.

Awady *et al.* (1975) studied tricle irrigation on pea crop in Qalubia Governorate using trickler plastic tubes with about 1.3 mm I.D. They found that, trickler system successfully operated with very low pressure (about 40 cm head), with less plugging troubles.

Turner and Anderson (1980) reported that, in subsurface irrigation water is applied below the surface by porous or perforated plantic pipe.

This method of applying water is somewhat similar to trickle irrigation. But instead of the pipe being placed on top of the ground, it is " planted" under the row in the root zone.

Zamber (1989) reported that drip irrigation is an efficient method of providing water directly into the soil at the root zone of the plant.

Lamm *et al.* (1995) defined suburface drip irrigation system as a technology that can make significant improvements in water use efficiency through better management of irrigation water.

Bakeer *et al.* (1996) studied subsurface drip irrigation management for vegetable production at North Sinai and found that cantaloop production under subsurface drip irrigation was higher by about 40% than that under surface drip irrigation.

Saad and Firzzonet (1996) also defined trickle irrigation as a convenient and efficient method of supplying water directly to the root zone of row crops or to individual plants, such as trees and vines. Also, they studied the water requirement for subsuurface drip irrigation of corn in northwest KANSAS. They fouund that, careful management of subsurface drip-irrigation system can reduce net irrigation needs by about 25%, while still maintaining top yield of 12.5 ton/ha. Most of these water savings can be attributable to minimizing nonbeneficial water balance components such as soil evaporation. El-Gindy (1988) stated that the moisture content of the top soil (0.20 cm) was higher in the drip irrigation field than those of surface and sprinkler ones.

Hanafy (1993) showed that seasonal irrigation volumes applied to the surface drip irrigation treatments were equal to that applied to subsurface drip irrigation treatments.

El-Morsy (1996 a) indicated that in flat area the moisture was distributed symmetrically around the tree. On the other hand, Abd El-Razek *et al.* (1992) indicated that, the larger of maximum salinity was found near the soil surface at the midpoints between emitters and laterals as well as the deeper depths.

Ismail *et al.* (1994) also indicated that salt distribution was found to be a function of the distance from the dripper and soil layer depth under drip irrigation system before and 24 h after irrigation.

El-Morsy (1996b) also indicated that the salt distribuution was appositely related to the soil moisture distribution. The salt accumulated at the soil suface and the boundaries of the wetted zone. He also found that, the electric conductivity (Ec) values increased in the surface layer and decreased by going down in the soil profile from the surface layer into the bottom one.

MATERIALS AND METHODS

2.1. The experimental site.

The field experiments were carried out at El-Beltagy fram (15 km wast south El-Mahalla El Kabra, Gharbia Governorate) during the seasons of 1996 and 1997. The farm has been planted by king Rubey seedless grape vines (3.00 m rows spacing and 1.50 m vines spacing in the row)for five successive years. The soil experimental site is silt loamy texture in the top soil (50 cm) changing to clayey soil in the sub-surface soil layers (50-100 cm layer). Soil physical properties of the soil and classification are shown in Tables (1 and 2).

2.2. Irrigation treatments and systems.

Two drip irrigation systems were selected for this study, surface drip lines using built in drip lines (4 Lph / 50 cm) and sub-surface drip lines using the same type of surface system but lateral depth was below the ground surface by 30 cm. Full details of the setup and treatments were described by Bondok (1998).

Four different treatments were imposed on both surface and subsurface drip irrgation systems. So the eight treatment were as follows:

1- A_1 B_1 C_1 surface drip irrigation with one irrigations daily using 100% of farm amount of irrigation water which estimated in the farm by using pan evaporation class "A".

2- A_1 B_1 C_2 surface drip irrigation with two irrigations daily (50% of the total amount at each irrigation) using 100% of farm amount of irrigation water.

3- A_1 B_2 C_1 surface drip irrigation with one irrigation daily using 80% of of farm amount of irrigation water .

4- A_1 B_2 C_2 surface drip irrigation with two irrigations daily (50% of the total amount at each irrigation) using 80% of farm amount of irrigation water.

5- A_2 B_1 C_1 subsurface drip irrigation with one irrigation daily using 100% of farm amount of irrigation water .

6- A_2 B_1 C_2 subsurface drip irrigation with two irrigations daily (50% of the total amount at each irrigation) using 100% of farm amount of irrigation water.

7- A_2 B_2 C_1 subsurface drip irrigation with one irrigation daily using 80% of farm amount of irrigation water .

8- A_2 B_2 C_2 subsurface drip irrigation with two irrigations daily (50% of the total amount at each irrigation) using 80% of farm amount of irrigation water.

The eight treatments were replicated three times each. Fig. (1) shows the drip irrigation network.

2.3. Data recording:

Data recorded in this study may be summarized as follows:

2.3.1. Soil moisture and salinity distribution:

Moisture and salt distribution in the root zone under and around the drippers were measured by collecting soil samples from the different layers (0- 25, 25-50, 50-75 and 75-100 cm) across the laterals, and 25,50 and 75 cm (from the dripper) along the laterals. The moisture content samples were collected before and after five hours of irrigation. While soil salinity was measured by using electrical conductivity meter in 1: 5 soil water suuspension samples as described by Black (1965). Soil samples were taken from the same layers (0-25), (25-50), (50-75) and (75-100) cm along and across the laterals at the end of the season.

2.3.2. Grape yield:

Grape was harvested when total soluble solids (T.S.S) reached about 16-17% in berry juice (El-Banna, 1968). The following measurements were conducted on the yield:

The average weight of cluster.

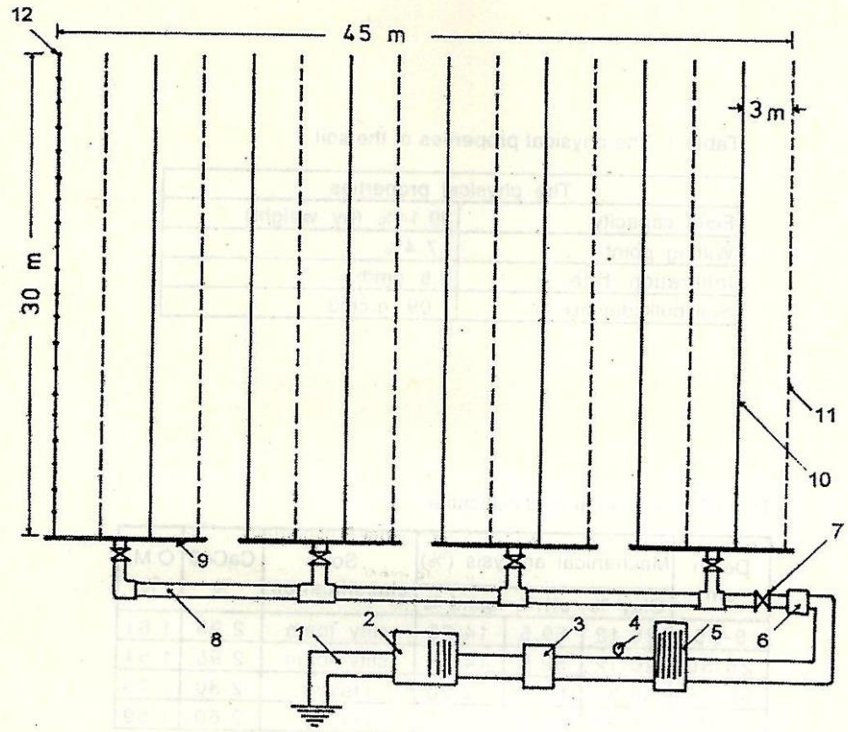
The average number of clusters/vine.

Table 1. The physical properties of the soil.

The physical properties	
Field capacity	39.14% (by weight)
Wilting point	17.4%
Infiltration rate	0.8 cm/h
Soil bulk density	1.09 g/cm3

Table 2. Soil data and classification.

Depth cm	Mechanical analysis (%)			Soil classification	CaCo3 %	O.M. %
	Clay %	silt%	sand %			
0-25	26.12	59.5	14.35	silty loam	2.95	1.61
25-50	26.12	59.5	14.35	silty loam	2.95	1.54
50-75	48.31	39.49	12.20	clayey	2.30	1.73
75-100	48.31	39.49	12.20	clayey	2.60	1.59



1- Main line (Φ = 160 mm)
2- Water pump
3- Filter
4- Pressure gauge
5- Pressure regulator
6- Flow meter
7- valve
8- Submain line (Φ = 75mm)
9- Manifold (Φ = 32mm)
10- Surface lateral (Φ = 16 mm)
11- Subsurface lateral (Φ = 16 mm)
12-Dripper

Fig. (1) The drip irrigation network.

The average weight and the volume of 100 berries.

The average juice volume and juice % of 100 berries.

-Total soluble solids (T.S.S.)%:

This was estimated as a percentages in juice of mature fresh berries by using a cerlzeiss hand refractometer according to A.O.A.C (1990).

-Total acidity%:

it was determined by titrating 10 ml of clear juice against 0.1N of NaoH after the addition of 2-3 drops of phenophaline as an indicator. The free acidity was expressed as grams of tartaric acid in 100 ml of juice. It was calculated according to A.O. A.C. (1990) using the following formula.

$$\text{Tartaric acid in mg /100 ml juice} = \frac{\text{ml NaoH N NaoH 0.075}}{\text{ml juice}} \quad 100$$

where:

0.075 = milliequivalent weight of tartaric acid.

N = Normality of NaoH.

-Vitamin C:

Vitamin C as mg / 100 ml juice was determined in grape juice according to Ranganna (1979). Two ml grape juice was taken and mixed with 2 ml oxalic acid (3%) antiocdation and then titrated just below end point with 2.6 dichlorophenol-indophenol as an indicator.

2.3.3. Weeds growth:

Five random samples of each treatment were taken at the end of the season to determine the amount of weeds under and around emitters by using a wooden frame (1 m X 1m). Dry weight of weeds inside the frame have been determined.

2.3.4. Water use efficiency (WUE):

It was determined according to the following equation:

$$\text{Water use efficiency} = \frac{\text{average yield kg /m}^2}{\text{applied water m}^3 \text{ / m}^2} = \text{kg /m}^3$$

RESULTS AND DISCUSSION

The aim of this study was to evaluate the response of grape to sub-surface drip irrigation system in old valley of Egypt where the soil is silt loamy texture. So more emphasis is placed on soil moisture and salinity patterns, crop yield (quantity and quality) and water use efficiency for both surface and subsurface drip system.

3.1. Soil Moisture and Soil Salinity Distribution:

Data in Figures. 2,3,4 and 5 show the soil moisture distribution before and after 5 h of irrigating grapes under surface and subsurface drip irrigation systems for all irrigation treatments. It can be seen that the wetted areas under surface and sub-surface drip irrigation systems were affected by quantities and timing of applied water and soil texture. On the other hand, the soil moisture pattern was varied according to laterals location. In other words, the variations in wetted areas under surface and sub-surface drip irrigation systems may be attributed to factors related to quantities, timing of applied water and soil texture.

Data in Figures 2,3,4 and 5 indicated also that the moisture content increased under the emitter. The maximum moisture content values (more than 90 % of F.C) - were found around and below the emission point directly in sub-surface drip irrigation. While the lowest values (75% of F.C or less) were found at the mid-distance between both emitters and laterals for all treatments. Regarding salt accumulation, the soil salinity distribution more or less coincided with moisture distribution patterns. Less salt accumulation was observed in the root-zone in case of sub-surface drip irrigation system as shown in Figures 6 and 7.

3.2. Grape Yield:

Higher grape yield (4.33 Kg/m2) was obtained under sub-surface drip irrigation with treatment $A_2B_2C_1$ (one irrigation daily using 80 % of farm amount of irrigation water). While the lower yield (3.20 kg/m2) was obtained under surface drip irrigationt treatment A_1B_1 C_2 (two irrigations daily with 100% of farm amount of irrigation water).

Data in Table 3 show that the maximum grape yield was 19.53 kg/vine for treatment (A_2B_2 C_1). While the minimum grape yield was 14.43 kg/vine for treatment (A_1B_1 C_2). This means that, subsurface drip irrigation system produced higher yield compared with surface drip irrigation system.

Table 3. The effect of irrigation treatments on grape yield, weight of cluster and number of cluster.

Irrigation water treatment		Grape yield (kg/vine)	Average weight of cluster (gr)	Average number of cluster per vine
Surface drip irrigtion	$A_1B_1C_1$	15.80	500.00	32.33
	$A_1B_2C_1$	18.07	512.67	35.00
	$A_1B_1C_2$	14.43	403.00	36.33
	$A_1B_2C_2$	16.00	450.00	37.33
Subsurface drip irrigtion	$A_2B_1C_1$	29.26	423.00	46.67
	$A_2B_2C_1$	19.53	530.00	36.00
	$A_2B_1C_2$	18.83	510.67	32.33
	$A_2B_2C_2$	18.63	512.67	37.33

Table 4. The effect of irrigation treatments on king Ruby seedless grape measurements.

Irrigation water treatment		weight of 100 berries (gr)	volume of 100 berries (ml)	juice volume of 100 berries (ml)	juice (%)
Surface drip irrigtion	$A_1B_1C_1$	333	200	180	90
	$A_1B_2C_1$	413	280	205	73
	$A_1B_1C_2$	347	180	165	91
	$A_1B_2C_2$	322	280	225	80
Subsurface drip irrigtion	$A_2B_1C_1$	312	190	165	86
	$A_2B_2C_1$	527	350	285	81
	$A_2B_1C_2$	385	220	205	93
	$A_2B_2C_2$	441	310	250	80

Table 5. The effect of irrigation treatments on king Ruby seedless grapes measurements.

Irrigation water treatment		T.S.S (%)	Vitamin C (mg/100 cm^3)	Acidity (mg/100 cm^3)
Surface drip irrigtion	$A_1B_1C_1$	17.00	2.8	0.58
	$A_1B_2C_1$	16.00	2.4	0.58
	$A_1B_1C_2$	17.00	2.8	0.56
	$A_1B_2C_2$	16.70	3.6	0.57
Subsurface drip irrigtion	$A_2B_1C_1$	17.00	3.6	0.56
	$A_2B_2C_1$	18.40	2.5	0.56
	$A_2B_1C_2$	17.90	3.2	0.58
	$A_2B_2C_2$	16.40	3.6	0.60

Table 6. The effect of irrigation treatments on weeds growth (gr/m^2)

Surface drip		Subsurface drip		The reducing	Reduction %
Treatment	Dry weight	Treatment	Dry weight		
$A_1B_1C_1$	250.90	$A_2B_1C_1$	186.19	64.71	25.79
$A_1B_2C_1$	224.60	$A_2B_2C_1$	100.18	124.42	55.39
$A_1B_1C_2$	280.16	$A_2B_1C_2$	120.60	159.56	56.95
$A_1B_2C_2$	226.12	$A_2B_2C_2$	180.09	46.03	20.35

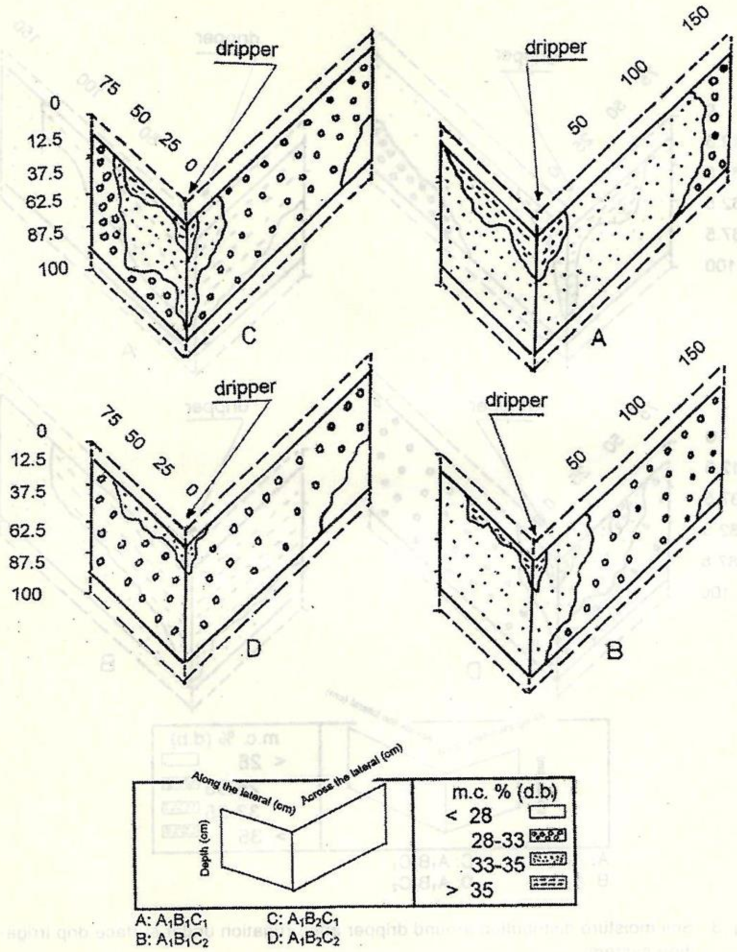


Fig. 2. Soil moisture distribution around dripper before irrigation under surface drip irrigation system.

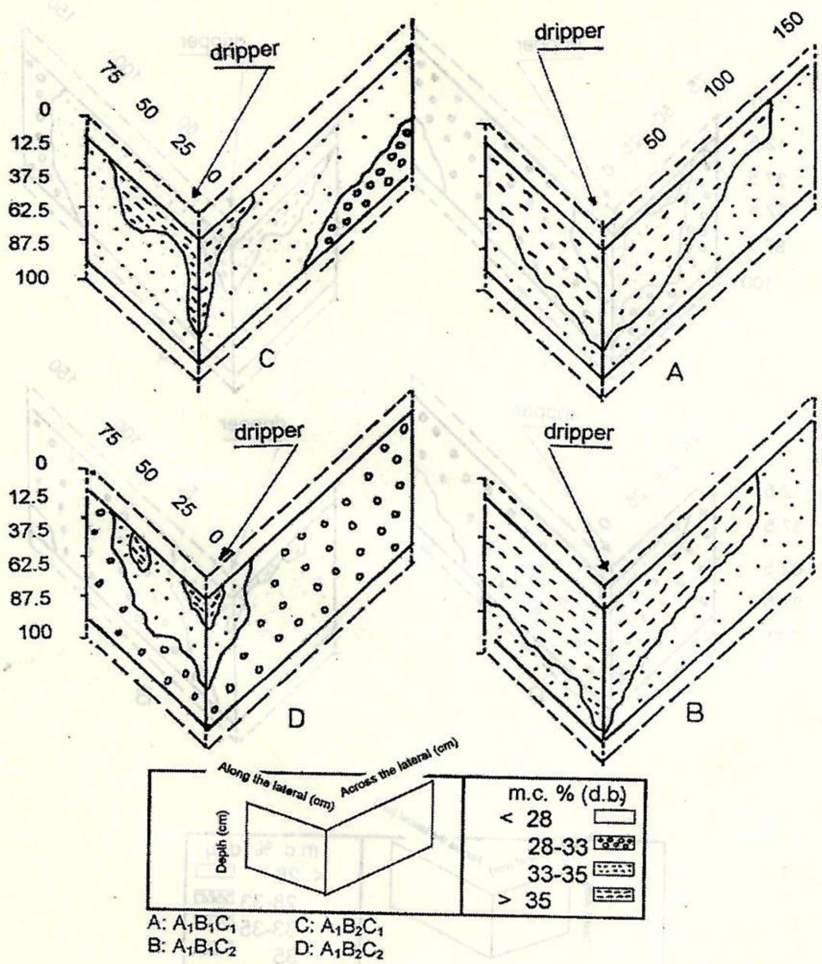


Fig. 3. Soil moisture distribution around dripper after irrigation under surface drip irrigation system.

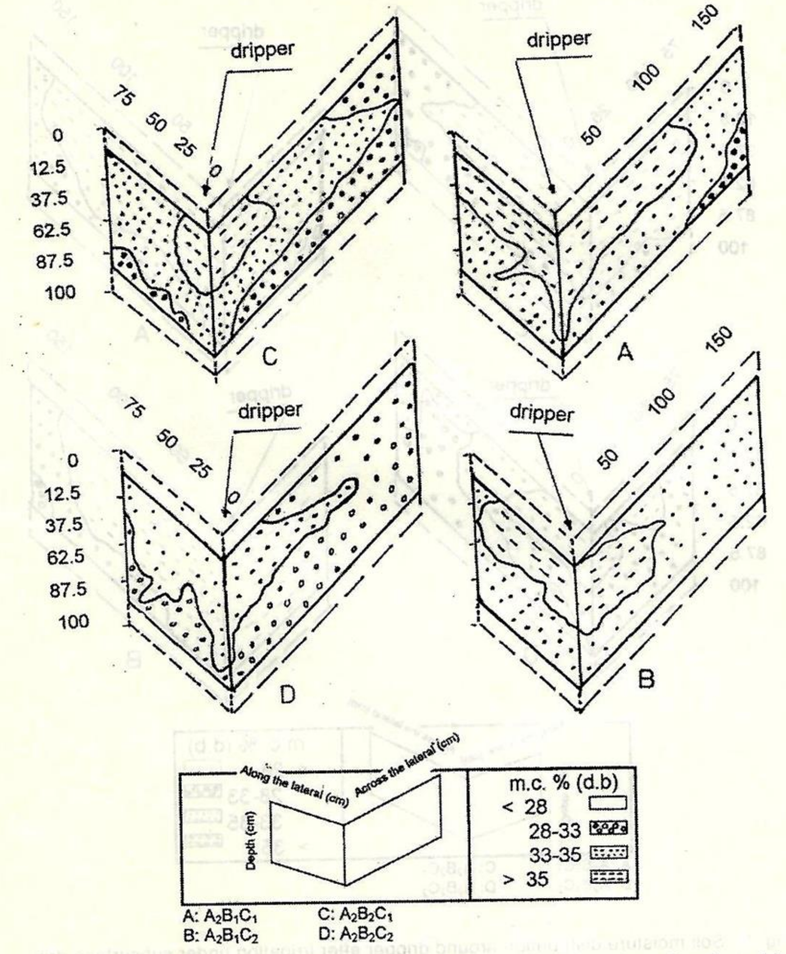


Fig. 4. Soil moisture distribution around dripper before irrigation under subsurface drip irrigation system.

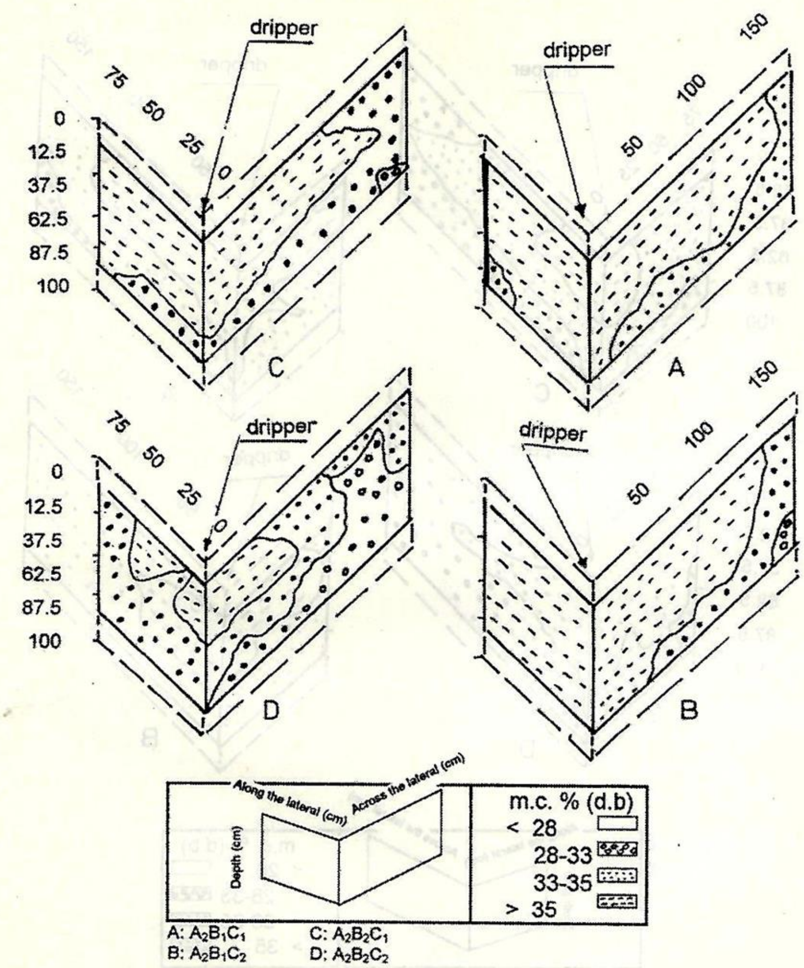


Fig. 5. Soil moisture distribution around dripper after irrigation under subsurface drip irrigation system.

3.2.1. The average weight of cluster:

Data in Table 3 show the effect of irrigation treatment on cluster weight. The data indicated that, the maximum value of the cluster weight was 530.0 gr (treatment $A_2B_2\,C_1$). While the minimun value of cluster weight was 403.0 gr (treatment $A_1B_1\,C_2$). This means that higher applied water encouraged the plant towards the vegetative growth which have greater number of clusters but less weight per cluster, compared with the other lower rates in other treatments.

3.2.2. The average number of clusters per vine:

Data in Table 3 also indicated that, the maximum value of the cluster number was 46.7 for treatment ($A_2B_1\,C_1$). While, the minimum cluster number was 32.3 for treatment ($A_1B_1\,C_1$). and ($A_2B_1\,C_2$). for surface and subsurface drip irrigation respectively.

This means that, when the plant received much water, the plant was encouraged towards the vegetative growth which increased the nuumber of cluster. But when the plant received less irrigation water the number of cluster were limited.

3.2.3. The average weight and the volume of 100 berries:

Data presented in Table 4 indicated that, the maximum weight of 100 berries was 527.0 gr for the treatment ($A_2B_2\,C_1$). The minimum weight of 100 berries was 312.0 gr for the treatment ($A_2B_1\,C_1$).

The maximum volume of 100 berries was 350.0 ml for the treatment ($A_2B_2\,C_1$). But the minimum volume was 180.0 ml for the treatment ($A_1B_1\,C_2$).

3.2.4. The average juice volume and juice % of 100 berries:

The maximum juice volume of 100 berries was obtained from treatment ($A_2B_2C_1$), and found to be 285 ml. While maximum juice % in 100 berries was obtained from treatment ($A_2B_1C_2$), and found to be 93% as shown in Table 4. On the other hand, the minimum juice volume of 100 berries was obtained from treatment $A_1B_1C_2$ (surface irrigation) and $A_2B_1C_1$ (subsurface irrigation), and found to be 165 ml. While minimum juice% in 100 berries was obtained from treatment ($A_1B_2C_1$) and found to be 73%.

3.2.5. Total soluble solids (T.S.S)%:

Data in Table 5 show the effect of irrigation treatments on maximum and mini-

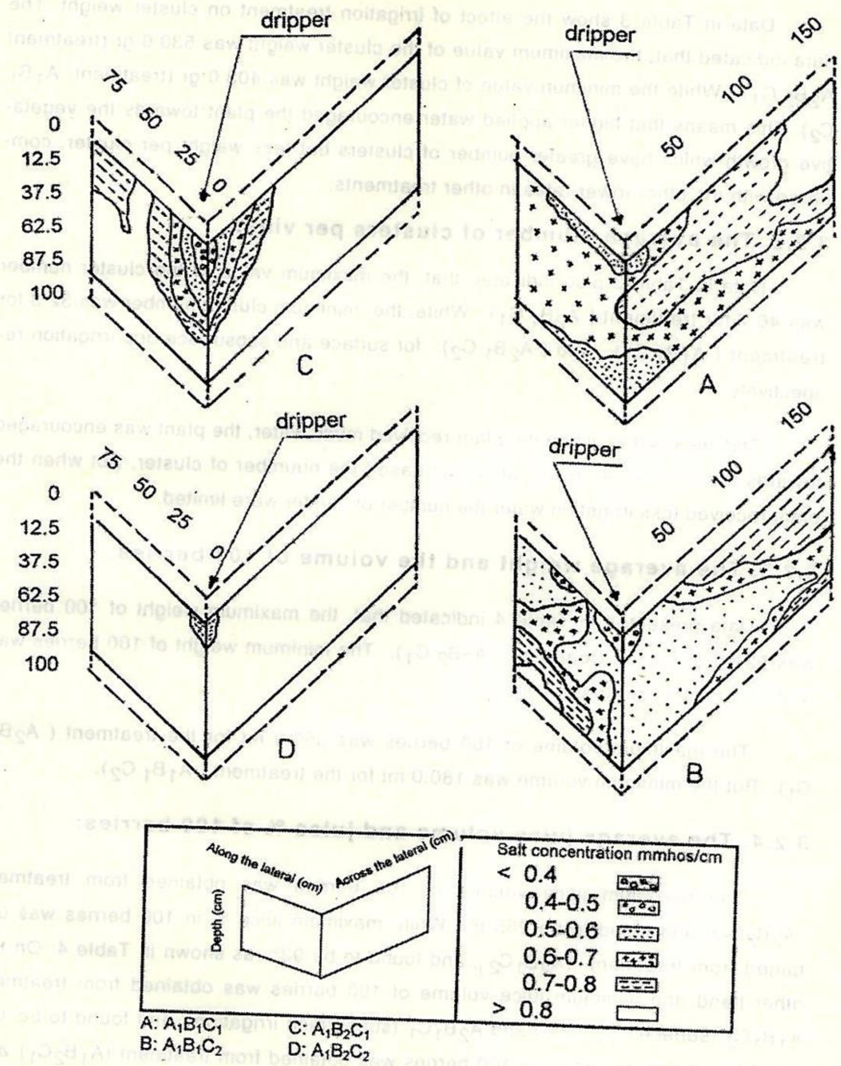


Fig. 6. Soil salinity distribution around dripper under surface drip irrigation system.

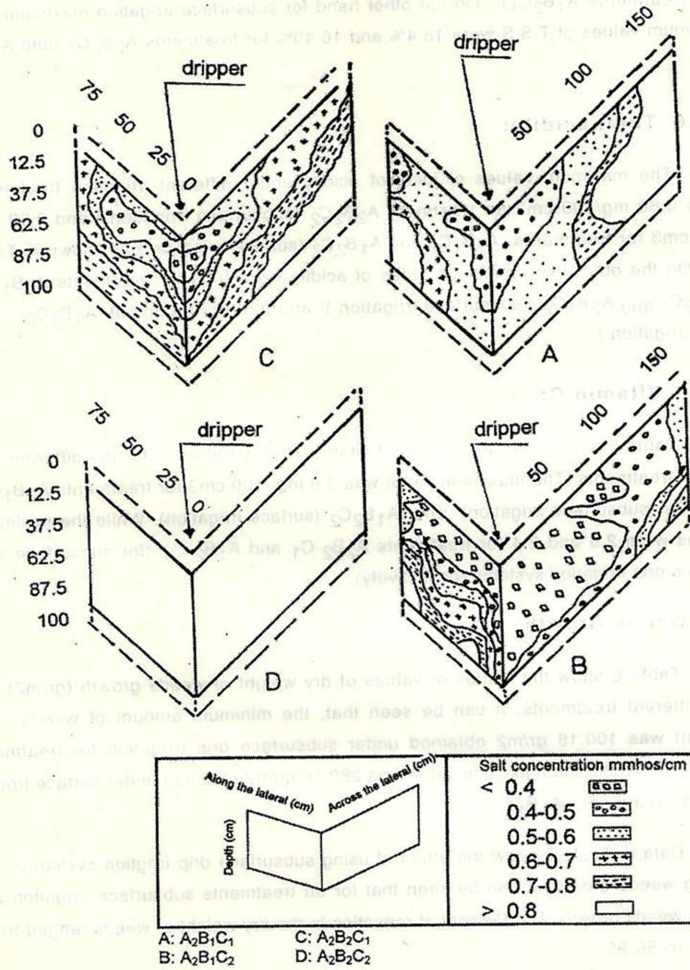


Fig. 7. Soil salinity distribution around dripper under subsurface drip irrigation system.

mum values of T.S.S. It can be seen that for surface drip irrigation treatment maximum and minimum values were 17.0% (for treatments $A_1B_1C_1$ and $A_1B_1C_2$). and16.5% (for treatments $A_1B_2C_1$). On the other hand for subsurface irrigation maximum and minimum values of T.S.S were 18.4% and 16.40% for treatments $A_2B_2C_1$. and $A_2B_2C_2$.

3.2.6. Total acidity:

The maximum values of juice of acidity under different irrigation treatmetns were 0.60 mg/100 cm3 for treatment $A_2B_2C_2$ (subsurface irrigation) and 0.58 mg/ 100 cm3 for treatments $A_1B_1C_1$ and $A_1B_2C_2$ (surface irrigation) as shown in Table (5). On the other hand minimum vales of acidity were 0.56 for treatments $A_2B_1C_1$, $A_2B_2C_1$ and $A_2B_1C_2$ (subsurface irrigation) and 0.56 for treatment $A_1B_1C_2$ (surface irrigation).

3.2.7. Vitamin C:

Table 5 also shows the values of vitamin C (mg/100 cm3) for the different irrigation treatments. The maximum value was 3.6 mg /100 cm3 for treatments $A_2B_1C_1$, $A_2B_2C_2$ (subsurface irrigation) and $A_1B_2C_2$ (surface irrigation). While the minimum values were 2.5 and 2.4 for treatments $A_2B_2C_1$ and $A_1B_2C_1$ (for subsurface and surface drip irrigation systems respectively).

3.3. Weeds Growth:

Table 6 show the values of values of dry weight of weeds growth (gr/m2) for the different treatments. It can be seen that, the minimum amount of weeds (dry weight) was 100.18 gr/m2 obtained under subsurface drip irrigation for treatment $A_2B_2C_1$. While, the maximum value was 280.16 gr/m2 obtained under surface irrigation for treatment $A_1B_1C_2$.

Data in Table 6 show the effect of using subsurface drip irrigtion system in reducing weeds growth. It can be seen that for all treatments subsurface irrigation reduced weeds growth. The Percent of reduction in the dry weight of weeds ranged from 20.35 to 56.95.

3.4. Water use Efficiency (WUE):

Higher grape yield (15624 kg/fed) and water use efficiency (6.18 kg/m3) were recorded for subsurface drip irrigation treatment (A_2B_2 C_1). While the lower grape yield and water use efficiency were recorded for surface drip irrigation treatment ($A_1B_1C_2$), it were 11544 kg/fed and 3.65 kg/m3 respectively as shown in Table (7).

Table (7) The effect of irrigation treatments on water use efficiency (WUE)

Irrigation water treatment		Average yield (kg/fed)	Amount of irrigation water (m3/fed)	WUE (kg/m^3)
Surface drip irrigtion	$A_1B_1C_1$	1240	3160	4.00
	$A_1B_2C_1$	14456	2528	5.75
	$A_1B_1C_2$	11544	3160	3.65
	$A_1B_2C_2$	12800	2528	5.06
Subsurface drip irrigtion	$A_2B_1C_1$	15408	3160	4.88
	$A_2B_2C_1$	15624	2528	6.18
	$A_2B_1C_2$	14824	3160	4.69
	$A_2B_2C_2$	14904	2528	5.90

3.5. Economic Costs-Benefit Analysis:

The highest value of net income of grape yield and the lower economic costs for grape yield were 12948 and 2640 L.E/feddan under subsurface drip irrigation.

From the previos conclusion, it is clear that, the response of using subsurface drip irrigation for irrigating grape was high.

CONCLUSION

The following conclusions may be drawn:

*** Soil moisture distribution and soil salinity:**

- Siol moisture distribution increases under the emitters.

- Soil moisture distribution pattern was affected by the vertical up and downward movement under subsurface drip irrigation, while it was affected by vertical downward movement under surface drip irrigation.

- The salt content increases with depth and the distance from emitters in both systems.

- Salt movement depends on the amount of water applied and its interval.

*** Grape yield:**

- Higher grape yield, maximum volume of juice and maximum value of T.S.S. were obtained under subsurface drip irrigation system (treatment $A_2B_2C_1$).

*** Weeds growth:**

The minimum value of dry weight (gr/m2) of weeds growth was also obtained under the same treatment ($A_2B_2C_1$). In general one may say that subsurface drip irrigation system reduced the weeds growth compared with surface drip irrigation system.

*** Water use efficiency:**

The highest value of water use efficiency was obtained under subsurface drip irrigation system (treatment $A_2B_2C_1$). While the minimum value of it was obtained under surface irrigation (treatment $A_1B_1C_2$).

In general, the results showed that the highest value of net income and the lower economic costs were 12948 and 2640 L.E/fed. under subsurface drip irrigation. It also showed that, the response of using subsurface drip irrigation for irrigating grape was high.

REFERENCES

1. Abdel-Razek, A.A., A.A. Wahdan; E.E. Kaoud and A.M. Adbel-Shafi. (1992). Soil Moisture and Salt Distribution Patterns in Clay Soils as Affected Irrigation System. Egypt J. Soil. Sci., 32, No. 3: 343-360.
2. A.O.A.C.(1990). Official Methods of Analysis. 15 th Ed. Association of Official Analytical Chemists. Washington DC. USA.
3. Awady, M.N., G.W. Amerhom and M.S. Zaki (1975). Trickle Irrigation Trial on Pea in Conditions Typical of Qalubia. Annals of Agric. Sci., Moshtohor, Vol. 4:235-244.
4. Bakeer, G.A.; F.G. El-Ebabi and A.M. El-Berry (1996). Subsurface Drip Irrigation Management for Vagetable production at North Sinai. Misr. J. Ag. Eng., Cairo Univ. Irrig. Cont., 509-521.
5. Black, C.A. (1965). Method of Soil and Water Analysis. Part 2: Madison, Wisconsin. U.S.A.
6. Bondok, M.Y. (1998). Management of Subsurface Irrigation Under Egyptian Conditions. M. SC. Th., Fac. Agric., Mansoura Univ. Egypt.
7. El-Banna, Gh. I. (1968). Effect of Some Cultural Treatments on Yield, Fruit Quality and Storage Life of Grapes. Ph. D.Th., Fac. of Agric., Ain Shams Univ., Cairo., A.R.E.
8. El-Gindy, A.M. (1988). Modern Chemigation Technique for Vegetable Crops under Egyptian Condition. Misr J. Agric. Eng., 5 (1): 99-111.
9. El-Morsy, E.A. (1996a). An Approach for Optimizing Trickle Irrigation on Sloping Land. Misr J. Agric. Eng., 13 (1) :3 -17.
10. El-Morsy, E.A. (1996 b). Tomatoes Response to Subsurface Leakage Irrigation with Saline Water. Misr J. Agric. Eng.; Cairo Univ. Irrigation Conf. 3-4 April, p. 166-184.
11. FAO (1996). FAO Production Yearbook, Vol. 50 P. 150.
12. Ranganna, S. (1979). Manual of Analysis of Fruit and Vegetable Products. Central Food Technology Res. Ins. Mysora Publishing Company Limited New-Delhi.
13. Hanafy, M. (1993). Effect of Lowable Soil-Water and Installation Depth on Drip Irrigation Tomatoes in Sandy Soils. Misr J. Agric. Eng.,10 (3): 628-642.
14. Ismail, E.E.S.; A.S. El-Sayed and Abdel-Maksoud (1994). A Compartive Study Between Two Drip Irrigation Regimes Under Condition of Old Lands in Egypt. Misr J. Agric. Eng., 11 (1): 148-162.
15. James, L.G. (1988). Principles Farm Irrigation System Design. Jahn, Wiley &Sons, Inc. 260-263.

16. Lamm, F.R.; H.L. Manges; L.R. Stone; A.H. Khan and D.H. Rayers (1995). Water Requirement of Subsurface Drip-Irrigated Corn in Northwest KANSAS. Transaction of the ASAE, vol. 38 (2): 441-448.

17. Saad, J.C.C. and J.A. Frizzonet (1996). Design and Management Optimization of Trickle Irrigation Systems Using Non-linear Programming. J. Agric. Eng. Res. 64, 109-118.

18. Turner, J. H. and G.L. Anderson (1980). Planning for an Irrigation System. Second Edition, the American Association for Vocational Instructional Materials, AAVIM,: 45.

19. Zambre, M.K. (1989). Role of Drip Irrigation in Ground-Water Management in Basaltic Terrain: A Case Study of Solapur Dist. Appropriate methologies for development and management of ground-water resources in developing countries. Proceedings of an International Workshop Held February 28, March 4:969-978.

إستجابة محصول العنب للرى تحت السطحى فى الوادى القديم

أحمد محمود معتوق [1] عبد الغنى محمد الجندى [2]
محسن عبد السلام العدل [3] محمد يسرى بندق [4]

١ *أستاذ الهندسة الزراعية - كلية الزراعة - جامعة المنصورة*
٢ *أستاذ الهندسة الزراعية - كلية الزراعة - جامعة عين شمس*
٣ مدرس *الميكنة الزراعية - كلية الزراعة - جامعة المنصورة.*
٤ مهندس *زراعى بمعهد بحوث الهندسة الزراعية.*

أجريت هذه الدراسة على محصول العنب البناتى (صنف كنج روبى) خلال عامى ١٩٩٦ ، ١٩٩٧ فى منطقة الدلتا بهدف معرفة مدى إستجابة المحصول لنظام الرى بالتنقيط التحت سطحى ومدى تأثيره على الإنتاجية وذلك مقارنة بإستخدام نظام الرى بالتنقيط السطحى . وقد تم دراسة تأثير نظام الرى المستخدم على :

-توزيع الرطوبة والملوحة فى التربة .

- كمية المحصول الناتج وجودته .

- نمو الحشائش .

- كفاءة إستخدام مياه الرى .

- التكلفة .

وقد أظهرت النتائج ما يلى :

- إرتفاع نسب الرطوبة تحت النقاطات فى كلا النظامين .

- تأثر توزيع الرطوبة فى التربة بالحركة الرأسية لأعلى ولأسفل بإستخدام نظام الرى بالتنقيط التحت سطحى بينما تأثر بالحركة الرأسية لأسفل بإستخدام الرى بالتنقيط السطحى .

- أعلى إنتاجية لمحصول العنب تم الحصول عليها بإستخدام نظام الرى بالتنقيط التحت سطحى والتى تروى بإستخدام ٨٠٪ من كمية مياه الرى المستخدم فى المزرعة على دفعة واحدة .

-إنخفضت نسبة نمو الحشائش بصفة عامة تحت نظام الرى بالتنقيط التحت سطحى مقارنة بنظام الرى بالتنقيط السطحى .

- كانت أعلى القيم المتحصل عليها لكفاءة إستخدام مياة الرى مع الرى المعاملة التى تروى بنظام الرى بالتنقيط التحت سطحى بمعدل ٨٠٪ من كمية مياه الرى المستخدم فى المزرعة دفعة واحدة .

- كذلك أعطت معاملة الرى بالتنقيط التحت سطحى بمعدل ٨٠٪ من كمية مياه الرى دفعة واحدة أعلى ربحية بالمقارنة ببقية المعاملات .

مما سبق يمكن القول أن إستجابة محصول العنب عالية للرى بإستخدام نظام الرى بالتنقيط التحت سطحى أكثر منها بالمقارنة بنظام الرى بالتنقيط السطحى.