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EFFECT OF IRRIGATION SYSTEMS, RATES AND POLYMER ON WATER USE EFFICIENCY, YIELD AND FRUIT QUALITY OF GRAPE UNDER DESERT CONDITIONS

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ABSTRACT: This experiment was carried out during the two successive seasons 2020 and 2021 on Flame Seedless grapevines grown in sandy soil under drip irrigation system at EL-Tahrir, El Beheira Governorate. The aim of this research was to save irrigation water without any reduction of water use efficiency, yield and fruit quality of Flame Seedless grapevines under desert condition. The experiment design was arranged in a split- plot with three replications. The main plots were divided into three drip irrigation systems, i.e. surface drip irrigation, subsurface drip irrigation and Oscop drip irrigation either a solely form alone or in combined with three doses of polymer i.e. zero, 25 and 50g. The sub-plots were allocated to three irrigation levels (100%, 75% and 50% of water requirements). The obtained results cleared that Oscop drip irrigation with 50g of polymer under 75% of water requirements resulted in the best results in terms of increasing the yield and its components and ensuring the best physical and chemical properties of clusters and berries as well as improving the water use efficiency Flame Seedless grapevines in both seasons.

Key words: Grapevine, drip, subsurface drip, Oscope drip, polymer, water use efficiency

INTRODUCTION

Grapes are very popular fruit for their high nutritional and therapeutic value. In Egypt, grapes rank second among fruit crops while citrus being the first. A global increase in demand for high quality grape has prompted numerous researchers to find efficient and reliable ways to increase grape production and quality.

Irrigation is an effective way of regulating the availability of water for grapevines and consequently their yield. Stomatal closure seems to be the main cause of the decrease in the photosynthetic rate under mild drought conditions (Chaves *et al*., 2002). Water is the basic component of plant cell tissue. Most of the water absorbed by the plant comes from the soil. Nutrients present in the soil are dissolved in water, taken up by the roots to supply all of the plant organs through translocation. Water is needed by the plant for transpiration. A number of factors should to be taken into consideration, if irrigation is to be applied in a vineyard; the most significant factor is the amount of water that should apply and the season of application. With respect to the amount of water, several studies have shown that grapes quality falls if too much of water were supplied (Basile *et al.*, 2015).

Developed irrigation systems are very important for saving irrigation water which is the most limiting and most precious resources for agriculture today (Helweg, 1989). Drip irrigation systems are having an important priority in the new reclaimed area. Drip irrigation systems was found to result in 30 to 70% water savings in various orchards crops with 10 to 60% increases in yield as compared to conventional methods of irrigation. Surface and subsurface drip irrigation methods can play a significant role in overcoming the scarcity of water mostly in water shortage areas (Talat *et al*., 2012).

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Drip irrigation systems and subsurface drip irrigation has been part of the modern agriculture. Current commercial and grower interest levels indicate that future use of subsurface drip irrigation systems will continue to increase. Subsurface drip irrigation applies water below the soil surface, using buried drip tapes (ASAE, 2001). Subsurface drip irrigation uses buried lateral pipelines and emitters to apply water directly to the plant root zone.

Subsurface drip irrigation requires the highest level of management of all micro irrigation systems. The performance of the drip irrigation should be tested under adverse conditions of shallow water table and heavy soils. In addition, irrigation management is a tool whereby timely application of water can improve irrigation efficiencies and ultimately yields (Baille, 1997). Studies on the effects of furrow, micro-jet, surface drip, and sub-surface drip irrigation on vegetative growth and early production of `Crimson Lady' peach (*Prunus persica*) and also cluster weight, cluster length, cluster width, weight of 100 berries, and volume of 100 berries in two table grapes cultivars (*vitis vinifera* L.), namely Thompson seedless and Flame seedless. However, yield decreased with increasing water stress levels, while acidity increased with increasing water stress levels (Aggag and El-Sabagh, 2006). Subsurface drip irrigation was better than surface drip irrigation on Manfalouty pomegranate Cv. shrubs. In addition, sub surface drip irrigation gave the high leaf area, leaf chlorophyll, number of leaves/shoot, fruit length, fruit diameter, fruit weight, grains weight, TSS and total sugar content in both seasons. On the other side, surface drip irrigation gave the highest total acidity (El–Desouky and Abd El-Hameid, 2014).

Oscop is a subsurface irrigation system representing a new revolution in irrigation methods. It is a way of transporting water directly from the irrigation grid to the roots of trees without the passing water on the surface of the soil, in this method there is vial at whose bottom there is textured natural inert diet. This becomes dry immediately at the end of the irrigation process. This significantly limits the entry of the roots into the Oscop system making it last for long as well as achieving efficient irrigation up to 85% and dramatically reducing waste in water consumption in planting trees. The technological power in this system is in its simplicity, ease of use and its combination. This system enables agriculture in all types of soils and climates without exposure to waste water or evaporation. It holds an international patent and the patent of Cooperation Council for the six Arab Gulf States and has been studied and approved by the two largest offices to study inventions in the world which are the European Office and the Office of Austria who proved that Oscop conducts water and solvents to the roots directly without passing through the soil’s surface and prevents evaporation and the germination of weed thereby reducing the consumption of water and keeps the surface dry. This system allows the possibility of irrigation in different agricultural areas without exposure to waste or evaporation. In addition, there is no reason to worry about the amount of water flowing. This invention is very promising because it is related to a strategic issue, which is the rationalization of water consumption, for example, water consumption in Saudi Arabia is high and 90 % of it is directed to the agricultural sector.

Super absorbent polymers applications can play an important role in retain large quantities of water and nutrients when it incorporated with soil. Super absorbent polymers can hold 400-1500 g of water per dry gram of hydro gel (Boman and Evans, 1991). The use of super absorbent polymers has a great importance for their role in the increase of absorption capacity and retention of water in soil and for the fight against water shortage conditions and the decrease of bad effects of drought stress.

The aim of this research was to study influence of irrigation systems and rates and polymer on water use efficiency, yield and fruit quality of Flame Seedless grapevines under desert conditions.

MATERIALS AND METHODS

The trial was conducted during the two successive seasons 2020 and 2021 in a vineyard at EL-Tahrir, El Beheira Governorate, Egypt. The experiment design was arranged in a split-plot with three replications. The main plots were divided into three drip irrigation systems, i.e. surface drip irrigation, subsurface drip irrigation and Oscop drip irrigation either a solely form or in combined with three doses of polymer i.e. zero, 25 and 50g. The sub-plots were allocated to three irrigation levels (100%, 75% and 50% of water requirements).

Vines under investigation were grown in a sandy soil (Table 1). The selected vines were7-years old uniform in vigor, planted at 1.5x3 meters. The vines trained according to the double cordon system. Pruning was carried out at the first week of January by leaving 60-65 buds per vine (30 fruiting spurs × 2-3 buds / spur).

Irrigation system:

The irrigation system consisted of the following components:

Control head:

Control head consisted of centrifugal pump 5 /5 inch (20m lift and 80 m3/h discharge), driven by diesel engine (50 Hp), pressure gauges, control valves, inflow gauges, water source in the form of an aquifer, main line then lateral lines and dripper lines. For traditional drip irrigation, Gr dripper was used by 8 l/h/m, discharge. two, three, four hoses for one tree row. While two Oscop for one tree was used by 32 l/h/m.

Irrigation requirements:

Irrigation water requirements for Grapevines were calculated according to the local weather station data at El- Beheira Governorate, belonged to the Central Laboratory for Agricultural Climate (C.L.A.C.), Ministry of Agriculture and Land Reclamation.

Irrigation process was done by calculating crop consumptive use (mm/day) according to (Doorenobs and Pruitt, 1977).

As shown in Tables (2 & 3), water requirements for Grapevines were calculated according to the following equation as recommended by (Keller and Karmeli, 1975).

$$IR = \left[\frac{K_c \times Et_o \times A \times C_F}{10^7 \times Ea} \right] + LR$$

Where:

IR = Irrigation water requirements, m^3/ha/day,
E to = Potential evapotranspiration, mm day^{-1}
Kc = Crop factor of Grapevine,
A = Area irrigated, (m^2),
Ea. = Application efficiency, %, where 90% drip irrigation,
LR = Leaching requirements and
CF = Covering factor, for Grapevines 35%.

The crop factor of Grapevine was used to calculate Et crop values, according to (FAO, 1984).

Soil measurements:

Soil samples were taken by a screw auger at three spaces from beginning of the drip main line, the space between samples were 20cm, and at three depths (20,40, 60, 80 and 100cm) at two direct X and Y where the horizontal and vertical space of the sample was 20 cm. Samples were analyzed for determining soil moisture. The results were drawn by SURFER, ve. 11 under on a color scale for soil moisture 0-30, under windows program, and the "Kriging" regression method as the base model for analysis and contour map development.

Table (1): Some physical and chemical properties of the experimental orchard soil.

Particle size distribution (%)			Texture Soil	Ec ds/m	pH	Soluble cation meq/L				Soluble Anions meq/L			
Sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{++}	K^{+}	CO_3	HCO_3	Cl^-	SO_4
91.72	6.15	2.13	sandy	0.93	8.4	1.96	1.52	5.68	.13	--	1.4	5.9	2.0

Table (2): Calculated consumptive use (mm/day) of Flame Seedless grapevines

Growth stage	month	ET_o mm/day	K_c	Eta mm/day	W_t (L/tree/ day)	W_d (m^3/fed/ day)
	January	1.5	-	-	-	-
Initial	February	2	-	-	-	-
	march	2.6	0.25	0.65	2.9	2.72
Mid-season	April	3.5	0.45	1.575	7.1	6.61
	May	4.4	0.6	2.64	11.9	11.09
	June	5.4	0.7	3.78	17.0	15.88
	July	6.7	0.7	4.69	21.1	19.70
Season end	Augusts	6.3	0.65	4.095	18.4	17.20
	September	5.6	0.55	3.08	13.9	12.93
	October	4.6	0.45	2.07	9.3	8.69
	November	3.5	-	-	-	-
	December	2.3	-	-	-	-
Total (Ws)	3840.84 (m^3/fed/season).					
Total Ir	4267.60 (m^3/fed/season).					

Where:

W_t = Water requirements for tree per day (L/tree/day),

W_d = Water requirements for feddan per day (L/fed/day),

W_s = Water requirements for feddan per season (m^3/fed/season) and

I_r = Irrigation requirements for feddan per season (m^3/fed/season)

Table (3): Calculated water amounts versus irrigation systems for grapevines.

Characters	Irrigation requirements per season for ha (m^3/fed/season)*
100% ETa = (W1)	4267.60
75% ETa = (W2)	3200.70
50% ETa = (W3)	2133.80

The following parameters were measured for both seasons:-

Yield and its components

Cluster weight (g): it was determined using 10 clusters per replicate and weighed

Number of clusters: it was recorded

Total yield (kg/vine): The average weight of cluster at harvest date (commercial maturity TSS ≥ 16º brix) (Champa, 2013) and the yield /vine was expressed as follows:

Vine yield (kg) =average weight of cluster (g) x number of cluster per vine.

Physical properties of clusters and berries

Cluster length and width (cm)

At harvesting, two clusters were taken at random from each vine to determine cluster traits such as cluster length and width according to Winkler *et al.* (1974).

Weight and size of 100 berries

Weight of 100 berries (g) was determined using digital balance and the size (cm^3) was determined by the water displacement method.

Chemical properties of berries

Total soluble solids (TSS%)

It was determined as percentage in juice by means of hand refractometer apparatus according to (A.O.A.C., 1990).

Titratable acidity (%)

Fruit juice acidity was determined by using 5 ml of fruit juice and titrated against 0.1N sodium hydroxide, using phenol naphthalene indicator according to the official methods (A.O.A.C. 1990).

TSS/acid ratio

From data of TSS% and that of acidity%, the TSS/acid ratio was calculated.

Water use efficiency

The crop water use efficiency (WUEc) was calculated as the ratio between yield expressed as (kg) and the amount of water applied to each plot (m3) as reported by Medrano *et al*. (2015).

Water use efficiency = Yield weight (kg/tree) / Total applied water (m^3 /tree)

Statistical analysis

The experiment design was arranged in a split- plot. The statistical analysis was carried out according to (Snedecor and Cochran, 1990). The data were subjected to analysis of variance and Duncan's multiple range tests was used to differentiate means as described by Duncan (1955).

RESULTS AND DISCUSSION

Soil moisture distribution

Surface drip irrigation:(for 75% of ETa)

Data showed that 7.32 percent was the lowest value and 24.71 percent was the highest for soil moisture contents**.**

It is important to note that excessive water under the emitter vertically, especially when the water amount is increasing, leads to water and nutrient loss by deep-percolation, which pollutes the underground water with N and pesticides. Surface drip irrigation is one of the most widely used systems in Egypt.

As for deeper soil layers, water was migrating downward from 0 to 90 cm with constant increases in its values, reaching a moisture content of 24.71 percent for soil depths of 90 cm. The variability in the aggregate potential can be credited with the majority of the increase in the water content in the top layers 0–20 cm and the constant increase in its incentive inside the levels 20–40 cm.

Prior to this, evaporation losses caused the soil moisture levels to drop as soil depth increased in accordance with the direction that water moved under gravity (Fig. 1).

Subsurface drip irrigation: (for 75% of ETa)

Data cleared that the highest values of soil moisture contents is 29.8 %, while the lowest value is 11.90%.

According to the high temperatures and low humidity that encourage evaporation losses from plants and soil surface, the subsurface irrigation system is the most effective for the climate in Egypt. It implies that because the cappillary in sandy soil is so weak, buring the drip tube will cause the water to travel down and slightly up, reducing evaporation losses without adding any further expenditures (Fig. 2).

Oscope drip irrigation: (for 75% of ETa)

Data cleared that the highest values of soil moisture contents is 31.63%, while the lowest value is 12.12%. It's clear that the highest average of soil moisture values are found under Oscop drip absolutely.

The maximum output was obtained not only when using Oscop drip irrigation but also when the irrigation process was well-managed and scheduled. It is noticeable that Oscop drip irrigation with 50g of polymer under 75% of water requirements had the maximum yield and quality, whereas Oscop drip irrigation with 50g of polymer under 100% of water requirements had a substantial difference. This is because irrigation at 100% of water requirements had too much water, which led to nutrient losses through deep percolation and seepage to the undersurface layer, which reduced plant nutrient uptake. Contrarily, irrigation at 75% of water requirements provides the plant with the precise right amount of water in these circumstances, giving it more time and a better chance to absorb nutrients (Fig. 3).

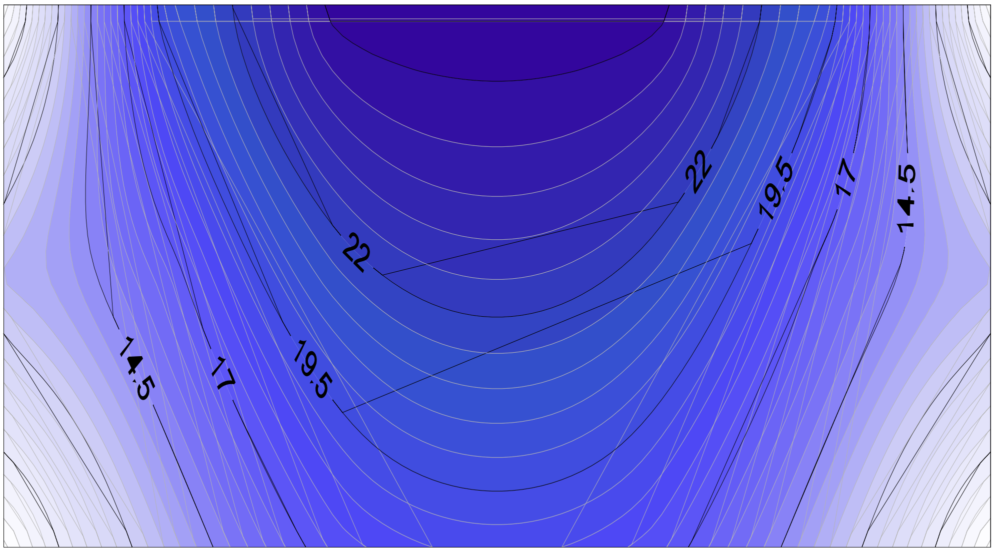

Fig 1: Surface drip irrigation

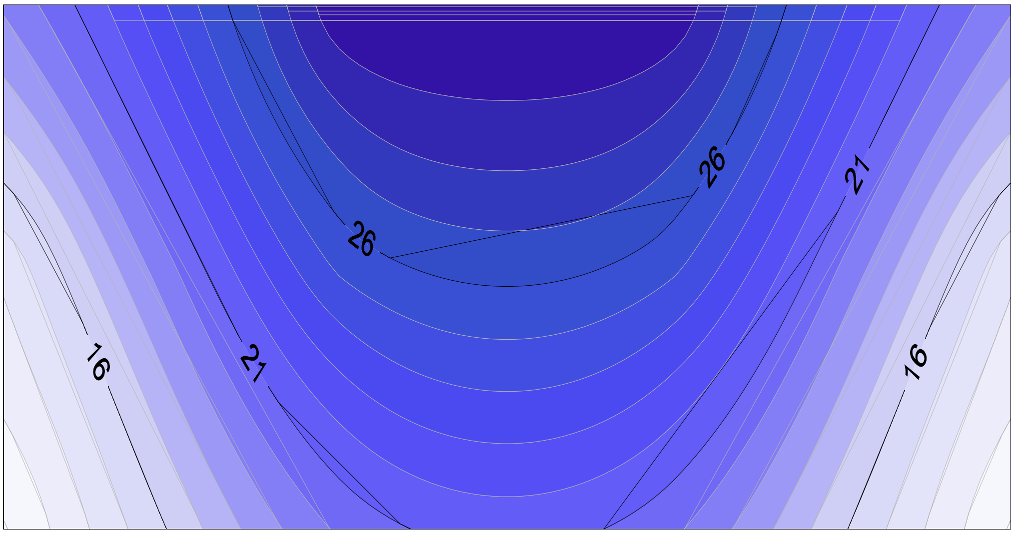

Fig 2: Sub-Surface drip irrigation

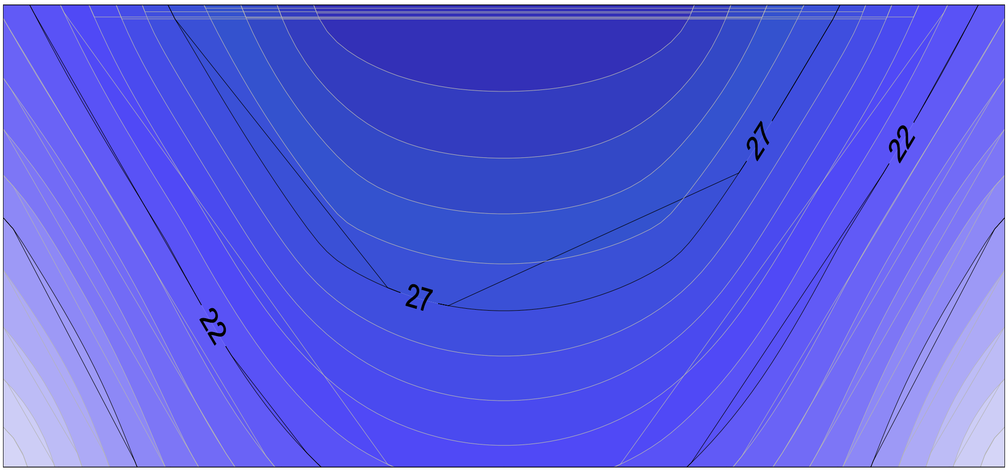

Fig 3: Oscope drip irrigation

Yield and its components

Number of clusters and cluster weight

Data presented in (Table, 4) show that irrigation levels significantly increased number of clusters and weight of cluster. Irrigation at 75% of water requirements gave the highest values in both seasons followed by irrigation at 100% of water requirements, but irrigation at 50% of water requirements gave the lowest values in both seasons.

Treatment with Oscop drip irrigation with 50g of polymer gave the highest number and weight of cluster in the both seasons, while surface drip irrigation gave the lowest values.

The interaction between irrigation level and irrigation systems showed that the highest values of number of clusters and weight of cluster were noticed with Oscop drip irrigation with 50g of polymer under 75% of water requirements followed by Oscop drip irrigation with 25g of polymer under 75% of water requirements, while, surface drip irrigation under 50% of water requirements gave the lowest values in both season.

Yield

Concerning the results in (Table, 5) yield was significantly affected by the all different irrigation level in both seasons. However, irrigation at 75% of water requirements gave the best yield on both seasons (16.4 kg in 1^{st} season and 17.0 kg in 2^{nd} seasons). While, irrigation at 50% of water requirements gave the lowest yield (9.5 kg in 1^{st} season and 9.9 kg in 2^{nd} seasons)

Different irrigation systems were affected significantly of yield in both seasons. Furthermore, Oscop drip irrigation with 50g of polymer produced the highest yield comparing with other systems used in both seasons. However, irrigation with surface drip irrigation produced the lowest yield on both seasons

The interaction between irrigation level and irrigation systems cleared that, yield were the highest with Oscop drip irrigation with 50g of polymer under 75% of water requirements. However, surface drip irrigation under 100% of water requirements recorded the lowest yield in both seasons followed by surface drip irrigation with 25gm polymer under 100% of water requirements.

It's note that the significant yield is due to the excessive water in irrigation at 100% of water requirements which cause the nutrient losses by deep percolation and seepage to the underground layer which reduce the plant usage of nutrient, On the contrary, irrigation at 75% of water requirements is the exactly perfect water amount under these conditions and provide the plant with more time and chance to have the benefits of nutrients. Furthermore, subsurface drip irrigation allows uniform soil moisture; minimize the evaporative loss and delivery water directly to the plant root zone which increases yield (Kramer and Boyer 1995). In addition, the increase of cluster weight and yield observed in irrigation treatment can be interpreted in view of the fact these treatments led to the increase in photosynthetic rate of leaves then cluster enhanced.

The obtained results agree with (Aggag and El-Sabagh, 2006) found that, increasing water stress levels the yield will decrease (Bryla *et al.*, 2003). Irrigation Florida prince peach trees with (80% of Eta) gave the best yield.

Table 4: Effect of irrigation systems, rate and polymer on number of clusters/Vine and cluster weight (g) of Flame Seedless grapevines at 2020 and 2021 seasons.

Number of clusters/Vine								
Treat*	**2020**				**2021**			
	Rate irrigation				**Rate irrigation**			
	W1	**W2**	**W3**	**mean**	**W1**	**W2**	**W3**	**mean**
T1	31.3 gh	32.6 d-g	25.3 n	29.8 EF	32.0 gh	33.3 ef	26.0 n	30.1 F
T2	32.3 efg	30.6 hi	25.6 mn	29.6 F	32.6 fg	32.0 gh	26.3 mn	30.4 F
T3	32.3 efg	32.0 fgh	27.0 lm	30.4 DE	33.0 f	33.0 f	27.3 kl	31.1 E
T4	34.0 bcd	33.0 c-f	26.6 lmn	31.2 CD	34.3 cd	34.0 de	27.0 lm	31.7 D
T5	34.3 bc	34.0 bcd	27.6 kl	32.0 BC	34.3 cd	35.0 bc	28.0 jk	32.4 BC
T6	34.0 bcd	34.0 bcd	27.3 l	31.8 BC	34.3 cd	34.6 bcd	27.6 jkl	32.2 CD
T7	34.0 bcd	34.3 bc	28.0 jkl	32.1 B	34.3 cd	35.0 bc	28.3 j	32.5 BC
T8	33.6 bcde	34.63 b	29.0 jk	32.4 AB	34.0 de	35.3 b	29.6 i	33.0 B
T9	34.0 bcd	36.3 a	29.3 ij	33.2 A	34.6 bcd	37.3 a	30.3 i	34.1 A
mean	33.3 A^{-}	33.5 A^{-}	27.3 B^{-}		33.7 A^{-}	34.3 A^{-}	27.8 B^{-}	

Cluster weight (g)								
Treat*	**2020**				**2021**			
	Rate irrigation				**Rate irrigation**			
	W1	**W2**	**W3**	**mean**	**W1**	**W2**	**W3**	**mean**
T1	430.0 h	446.6 gh	333.3 l	403.3 G	433.3 i	451.6 h	336.6 n	407.22 G
T2	460.0 fg	466.6 ef	335.0 kl	420.6 F	463.3 gh	473.3 fg	340.0 mn	425.56 F
T3	473.3 def	476.6 de	346.7 jkl	432.2 E	478.3 ef	485.0 def	351.6 lm	438.33 E
T4	473.3 def	480.0 de	350.0 ijk	434.4 DE	480.0 ef	488.3 de	356.6 kl	441.67 DE
T5	480.0 de	486.6 cd	350.0 ijk	438.9 CD	486.6 de	495.0 cd	356.6 kl	446.11 CD
T6	480.0 de	500.0 bc	350.0 ijk	443.3 BC	490.0 de	510.0 b	360.0 jkl	453.33 B
T7	476.7 de	500.0 bc	360.0 ij	445.6 B	481.6 ef	503.3 bc	363.3 jkl	449.44 BC
T8	476.7 de	503.3 b	350.0 ijk	443.3 BC	483.3 def	508.3 b	365.0 jk	452.33 BC
T9	486.7 cd	530.0 a	363.3 i	459.8 A	490.0 de	543.33 a	371.6 j	468.33 A
mean	470.6 B^{-}	487.9 A^{-}	348.7 C^{-}		476.30 B^{-}	495.37 A^{-}	355.74 C^{-}	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.

* W1:100% Eta -W2:75% Eta -W3:50% Eta. While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer, T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation with 50gm polymer).

Table 5: Effect of irrigation systems, rate and polymer on yield (kg/vine) of Flame Seedless grapevines at 2020 and 2021 seasons.

Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	**W2**	**W3**	**mean**	**W1**	**W2**	**W3**	**mean**
T1	13.5 j	14.6 hi	8.4 o	12.2 F	13.9 j	15.0 i	8.7 n	12.5 G
T2	14.9 ghi	14.3 i	8.5 o	12.6 E	15.1 i	14.8 i	9.0 n	12.9 F
T3	15.3 fg	15.2 fgh	9.4 mn	13.3 D	15.8 h	16.0 gh	9.6 m	13.8 E
T4	16.1 e	15.8 ef	9.3 n	13.8 C	16.4 efg	16.6 ef	9.6 m	14.2 D
T5	16.4 cde	16.5 cde	9.7 lmn	14.2 B	16.7 ef	17.4 cd	9.9 lm	14.6 C
T6	16.3 de	17.0 bcd	9.6 lmn	14.3 B	16.8 def	17.7 bc	9.9 lm	14.8 Bc
T7	16.2 e	17.2 bc	10.0 klm	14.4 B	16.5 ef	17.6 bc	10.3 l	14.8 Bc
T8	16.1 e	17.4 b	10.1 kl	14.5 B	16.4 fg	18.0 b	10.8 k	15.1 B
T9	16.5 cde	19.3 a	10.7 k	15.5 A	17.0 de	20.3 a	11.3 k	16.2 A
mean	15.7 B-	16.4 A-	9.5 C-		16.0 B-	17.0 A-	9.9 C-	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.
* W1:100% Eta -W2:75% Eta -W3:50% Eta. While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer, T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation with 50gm polymer).

Physical properties of clusters and berries

Cluster length and width

Length and width of cluster were significantly affected by all treatments in both seasons, as shown in (Table 6). Length and width of cluster were significantly increased by irrigation at 75% of water requirements followed by irrigation at 100% of water requirements, while irrigation at 50% of water requirements gave the lowest values in both seasons.

Oscop drip irrigation with 50g of polymer gave highest significant cluster length and width of comparing with surface drip irrigation in both seasons.

The interaction between irrigation level and irrigation systems showed that Oscop drip irrigation with 50g of polymer under 75% of water requirements treatment gave the highest significant Length of cluster (27.0 in the 1st and 28.0 cm in the 2nd season) and width of cluster (17.3 in the 1st and 18.0 cm in the 2nd season) comparing with surface drip irrigation under 50% of water requirements treatment which recorded the lowest cluster length (18.6 in the 1st and 19.0 cm in the 2nd season) and cluster width (10.0 in the 1st and 10.3 cm in the 2nd season).

Weight and size of 100 berries

Data shown in (Table 7) weight and size of 100 berries were significantly affected by all treatments. In both seasons, vines irrigated with 75% of water requirements obtained the highest weight of 100 berries (302.4 in 1^{st} season and 310.0 in 2^{nd} season) and volume (cm^3) of 100 berries (270.0 in 1^{st} season and 281.3 in 2^{nd} season), while the lowest weight of 100 berries achieved with irrigation at 50% of water requirements (251.6 in 1^{st} season and 256.3 in 2^{nd} season) and lowest size of 100 berries (231.5 in 1^{st} season and 236.9 in 2^{nd} season),

Oscop drip irrigation with 50g of polymer gave highest significant values weight and size of 100 berries followed by Oscop drip irrigation with 25g of polymer and T6 comparing with control in both season.

Chemical properties of berries

Table (8), cleared that TSS, acidity and TSS/acid ratio were significantly affected by the all irrigation level in both seasons. However, irrigation at 75% of water requirements gave the highest TSS and TSS/acid ratio in both seasons followed by irrigation at 100% of water requirements, while irrigation at 500% of water requirements gave the lowest TSS and TSS/acid ratio in both seasons. On the other hand, irrigation at 75% of water requirements gave the lowest acidity in both seasons, while irrigation at 50% of water requirements gave the highest acidity in both seasons.

Table 6: Effect of irrigation systems, rate and polymer on cluster length and width of Flame Seedless grapevines at 2020 and 2021 seasons.

Cluster length								
Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	W2	W3	mean	W1	W2	W3	mean
T1	22.6 fgh	22.3 ghi	18.6 j	21.2 G	23.0 hij	23.7 fgh	19.0 m	21.8 G
T2	22.6 efg	23.3 efg	21.6 hi	22.6 F	23.0 hij	23.7 fgh	21.3 l	22.7 F
T3	23.3 efg	24.3 bcde	21.3 i	23.0 EF	23.7 fgh	24.7 cde	21.7 kl	23.3 E
T4	23.7 def	24.6 bcd	23.3 efg	23.8 BC	24.0 efg	25.0 cd	23.7 fgh	24.2 BCD
T5	24.0 cde	24.0 cde	22.3 ghi	23.4 CDE	24.3 def	24.7 cde	22.5 ijk	23.8 CDE
T6	25.0 bc	25.3 b	21.6 hi	24.0 B	25.3 bc	26.0 b	22.2 jkl	24.5 B
T7	23.3 efg	24.0 cde	22.3 ghi	23.2 DE	24.0 efg	24.3 def	22.7 ij	23.7 DE
T8	24.0 cde	24.3 bcde	22.6 fgh	23.7 BCD	24.7 cde	25.3 bc	23.3 ghi	24.4 BC
T9	24.6 bcd	27.0 a	22.6 fgh	24.7 A	25.3 bc	28.0 a	23.3 ghi	25.6 A
mean	23.7 B-	24.3 A-	21.9 C-		24.1 B-	25.0 A-	22.1 C-	
Cluster width								
Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	100%	75%	50%	mean	100%	75%	50%	mean
T1	11.3 jk	11.0 kl	10.0 l	10.8 F	11.6 k	12.0 jk	10.3 l	11.3 G
T2	12.0 hijk	12.3 ghij	11.3 jk	11.9 E	12.0 jk	12.6 hij	11.6 k	12.1 F
T3	12.7 ghi	13.0 fgh	12.0 hijk	12.6 D	12.6 hij	13.3 gh	12.3 ijk	12.8 E
T4	15.0 bcd	14.7 bcd	12.3 ghij	14.0 B	15.0 cde	15.3 cd	12.6 hij	14.3 BC
T5	13.3 efg	14.7 bcd	11.6 ijk	13.2 C	13.6 fg	14.8 de	12.0 jk	13.5 D
T6	14.3 cde	15.7 b	12.3 ghij	14.1 B	14.7 de	16.3 b	13.0 ghi	14.7 B
T7	14.0 def	15.0 bcd	12.3 ghij	13.8 BC	14.3 ef	15.3 cd	12.7 hij	14.1 C
T8	14.6 bcd	15.3 bc	13.0 fgh	14.3 B	14.7 de	15.7 bc	13.3 gh	14.6 BC
T9	15.3 bc	17.3 a	13.0 fgh	15.2 A	15.7 bc	18.0 a	13.7 fg	15.8 A
mean	13.6 B-	14.3 A-	12.0 C-		13.8 B-	14.8 A-	12.4 C-	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.

* W1:100% Eta -W2:75% Eta -W3:50% Eta.While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer, T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation with 50gm polymer).

Table 7: Effect of irrigation systems, rate and polymer on 100 berry weight and size (cm^3) of Flame Seedless grapevines at 2020 and 2021 seasons.

Weight of 100 berries (g)								
Treat*	**2020**				**2021**			
	Rate irrigation				**Rate irrigation**			
	W1	**W2**	**W3**	**mean**	**W1**	**W2**	**W3**	**mean**
T1	256.6 jkl	260.0 ijkl	233.3 n	250.0 F	260.0 k	265.0 jk	235.0 l	253..3H
T2	265.0 hijk	268.3 ghij	238.3 mn	257.2 EF	270.0 ij	275.0 i	241.6 l	262.2 G
T3	273.3 gh	280.0 fg	240.0 mn	264.4 E	278.3 hi	286.6 gh	243.3 l	269.4 F
T4	303.3 cd	313.1 c	260.0 ijkl	292.2 C	308.3 de	320.0 c	265.0 jk	297.8 C
T5	296.6 de	306.7 cd	253.3 kl	285.5 C	303.2 e	313.3 cd	258.3 k	291.6 D
T6	326.6 b	330.0 b	266.6 hij	307.8 B	330.0 b	336.7 b	271.6 ij	312.8 B
T7	286.6 ef	290.0 ef	253.3 kl	276.6 D	293.3 fg	300.0 ef	256.6 k	283.3 E
T8	333.3 b	326.7 b	250.0 lm	303.3 B	336.6 b	336.7 b	260.0 k	311.1 B
T9	330.0 b	346.6 a	270.0 ghi	315.5 A	336.6 b	356.7 a	275.0 i	322.8 A
mean	296.8 B-	302.4 A-	251.6 C-		301.8 B-	310.0 A-	256.3 C-	

Size of 100 berries (cm^3)								
Treat*	**2020**				**2021**			
	Rate irrigation				**Rate irrigation**			
	W1	**W2**	**W3**	**mean**	**W1**	**W2**	**W3**	**mean**
T1	246.6 gh	250.0 fg	206.6 j	234.4 E	248.3 klm	253.3 jk	208.3 p	236.6 G
T2	253.3 efg	256.6 defg	213.3 j	241.1 DE	256.6 ijk	261.6 hij	216.6 op	245.0 F
T3	256.6 defg	263.3 de	213.3 j	244.4 D	261.6 hij	268.3 gh	220.0 o	250.0 F
T4	260.0 def	266.6 cd	233.3 i	253.3 C	268.3 gh	275.0 fg	236.6 n	260.0 E
T5	280.0 b	280.0 b	246.6 gh	268.8 AB	285.0 cde	290.0 bc	251.6 kl	275.5 BC
T6	276.7 bc	280.0 b	246.6 gh	267.8 AB	286.6 cd	296.6 b	251.6 kl	278.3 B
T7	263.3 de	263.3 de	236.6 hi	254.4 C	276.6 efg	280.0 def	243.3 lmn	266.6 D
T8	280.0 b	280.0 b	246.6 gh	263.3 B	286.6 cde	290.0 bc	240.0 mn	272.2 CD
T9	276.6 bc	293.3 a	253.3 efg	274.4 A	288.3 bcd	316.6 a	263.3 hi	289.4 A
mean	265.9 B-	270.0 A-	231.5 C-		273.2 B-	281.3 A-	236.9 C-	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.

* W1:100% Eta -W2:75% Eta -W3:50% Eta. While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer, T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation with 50gm polymer).

Table 8: Effect of irrigation systems, rate and polymer on Total soluble solids (TSS%) of Flame Seedless grapevines at 2020 and 2021 seasons.

TSS (%)								
Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	W2	W3	mean	W1	W2	W3	mean
T1	16.5 l	17.0 k	16.0 m	16.5 H	16.6 n	17.2 m	16.1 o	16.6 H
T2	17.1 k	17.2 jk	16.2 lm	16.8 G	17.2 m	17.5 klm	16.4 no	17.0 G
T3	17.5 hij	17.5 hij	16.3 lm	17.1 F	17.7 ijk	17.9 hij	16.4 no	17.3 F
T4	17.8 gh	18.1 fg	17.1 jk	17.7 E	18.0 hi	18.5 fg	17.3 lm	17.9 E
T5	18.3 ef	18.5 de	17.4 ijk	18.1 D	18.5 ef	19.0 d	17.6 jkl	18.4 D
T6	18.7 cde	19.2 b	17.9 gh	18.6 B	18.9 de	19.8 b	18.0 h	18.9 B
T7	18.8 bcd	19.1 bc	17.3 jk	18.4 C	19.0 d	19.4 bc	17.5 klm	18.6 C
T8	19.1 bc	19.1 bc	17.1 jk	18.5 Bc	19.4 bc	19.6 bc	17.4 klm	18.8 Bc
T9	19.2 b	19.7 a	17.7 ghi	18.9 A	19.3 c	20.4 a	18.2 gh	19.3 A
mean	18.1 B^-	18.4 A^-	17.0 C^-		18.3 B^-	18.8 A^-	17.2 C^-	
Acidity (%)								
Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	W2	W3	mean	W1	W2	W3	mean
T1	0.58 cd	0.57 d	0.63 ab	0.59 A	0.58 c	0.56 cd	0.63 a	0.59 A
T2	0.57 d	0.57 d	0.63 a	0.59 A	0.55 d-g	0.55 defg	0.61 b	0.57 B
T3	0.55 e	0.55 efg	0.62 b	0.57 B	0.54 ghi	0.54 fghi	0.56 cde	0.56 C
T4	0.54 fghi	0.54 efgh	0.57 d	0.55 C	0.54 g-j	0.54 ghij	0.56 cdef	0.55 D
T5	0.52 j-m	0.52 klm	0.59 c	0.54 C	0.53 h-k	0.52 jkl	0.55 defg	0.54 E
T6	0.52 j-m	0.51 lmn	0.55 ef	0.53 D	0.52 k-m	0.50 n	0.55 efgh	0.52 F
T7	0.52 ijkl	0.52 j-m	0.53 ghij	0.53 D	0.53 k-m	0.51 mn	0.53 ijkl	0.52 F
T8	0.52 j-m	0.51 mn	0.55 efg	0.52 D	0.52 lm	0.49 no	0.54 ghi	0.52 F
T9	0.50 no	0.49 o	0.53 hijk	0.51 E	0.48 o	0.45 p	0.52 klm	0.48 G
mean	0.54 B^-	0.53 C^-	0.58A^-		0.53 B^-	0.52 C^-	0.57 A^-	
TSS/acid ratio								
Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	W2	W3	mean	W1	W2	W3	mean
T1	28.4 k	29.5 jk	25.5 l	27.8 G	29.0 m	30.4 l	25.7 o	28.3 G
T2	29.6 jk	29.8 j	25.6 l	28.3 F	30.8 jkl	31.5 ijk	27.0 n	29.8 F
T3	34.5 h	31.8 gh	26.5 l	29.9 E	32.6 ghi	32.7 gh	27.2 n	30.9 E
T4	33.0 fg	33.3 f	29.9 ij	32.1 D	33.3 fg	34.3 ef	30.7 kl	32.8 D
T5	35.0 e	35.6 de	29.4 jk	33.3 C	34.6 e	36.1 d	31.8 hij	34.2 D
T6	35.8 de	37.4 bc	32.4 fgh	35.2 B	36.1 d	39.5 b	32.8 gh	36.2 B
T7	36.0 de	36.4 cd	32.2 fgh	34.8 B	36.2 d	38.1 c	32.8 gh	35.7 B
T8	36.5 cd	37.5 bc	31.1 hi	35.1 B	37.4 c	39.4 b	32.0 hi	36.3 B
T9	38.1 b	40.5 a	33.2 f	37.3 A	40.0 b	45.3 a	34.7 e	40.0 A
mean	33.7 B^-	34.6 A^-	29.5 C^-		34.4 B^-	36.4 A^-	30.5 C^-	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.

* W1:100% Eta -W2:75% Eta -W3:50% Eta. While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer, T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation

Regarding to irrigation systems effect, TSS, acidity and TSS/acid ratio were affected significantly by different irrigation systems in both seasons. In addition, Oscop drip irrigation with 50g of polymer produced the highest TSS and TSS/acid ratio in both seasons comparing with others irrigation systems used, while, surface drip irrigation gave the lowest TSS and TSS/acid ratio in both seasons. On the other hand, Oscop drip irrigation with 50g of polymer gave the lowest acidity in both seasons, while surface drip irrigation gave the highest acidity in both seasons.

The obtained data from the interaction between irrigation level and irrigation systems cleared that, Oscop drip irrigation with 50g of polymer under 75% of water requirements recorded the highest TSS and TSS/acid ratio (19.7 in the 1st and 40.4 in the 2nd season) (40.5 in the 1st and 45.3 in the 2nd season), respectively. In addition, surface drip irrigation under 50% of water requirements gave the lowest TSS and TSS/acid ratio (16.0 in the 1st and 16.1 in the 2nd season) (25.5 in the 1st and 25.7 in the 2nd season), respectively. On the other hand, Oscop drip irrigation with 50g of polymer under 75% of water requirements recorded the lowest acidity (0.49 in the 1st and 0.45 in the 2nd season). In addition, surface drip irrigation under 50% of water requirements gave the highest acidity (0.63 in the 1st and 0.63 in the 2nd season).

Deficit irrigation is based on the fact that crop sensitivity to water stress varies along the growth cycle and because discontinuous water deficits during specific periods may increase water savings and improves berry quality (Cameron *et al*., 2006).

The obtained results are agreement with **Abd EL-Maksoud, (2009),** found that TSS was decreased by increasing irrigation level on Chardonnay grapevines. **Wei *et al.* (2017),** who found that irrigation level treatments at 65% significantly improved all fruit chemical quality in both seasons.

Water use efficiency

Data in Table (9) presented that, water use efficiency was significantly affected by irrigation level in two seasons. However, irrigation at 75% of water requirements achieved the high water use efficiency in both seasons.

The overlap among irrigation systems, water use efficiency was affected significantly by different irrigation systems in both seasons. Oscop drip irrigation with 50g of polymer achieved the highest water use efficiency comparing with surface drip irrigation in both seasons. Moreover, surface drip irrigation gave the lowest water use efficiency in both seasons.

The interaction between irrigation level and irrigation systems cleared that, Oscop drip irrigation with 50g of polymer under 75% of water requirements achieved the highest water use efficiency (5.35 in the 1st and 5.63% in the 2nd season). However, surface drip irrigation under 50% of water requirements recorded the lowest water use efficiency (2.80 in the 1st and 2.88% in the 2nd season).

These results may be due to that subsurface drip irrigation allows uniform soil moisture, minimize the evaporative loss and delivery water directly to the plant root zone which increases use efficiency (Kramer and Boyer 1995).

This result agreement with Gaser *et al.* (2018) who showed that water use efficiency (WUE)was significantly affected by different levels of irrigation in 2016 and 2017 seasons of this study. It was found that vines irrigated with 4000m3 /Fadden had significant values of this parameter followed by 4500m3 /fadden, while 5000m3 /fadden ranked the third position. On the other hand, vines irrigated with 3500m3 /fadden had significant decreased in both seasons on Flame seedless grapevines. Also, Wei et al. (2017) found that irrigation level treatments at 65 % significantly improved water use efficiency.

Table 9: Effect of irrigation systems, rate and polymer on water use efficiency (kg/m^3) of Flame Seedless grapevines at 2020 and 2021 seasons.

Treat*	2020				2021			
	Rate irrigation				Rate irrigation			
	W1	W2	W3	mean	W1	W2	W3	mean
T1	2.80 m	4.05 gh	3.51 ij	3.46 E	2.88 q	4.18 ij	3.65 lm	3.57 F
T2	3.09 l	3.97 h	3.58 i	3.55 E	3.15 p	4.12 jk	3.73 l	3.66 E
T3	3.19 kl	4.23 efg	4.68 bc	4.04 BC	3.29 op	4.44 gh	4.80 cd	4.18 C
T4	3.35 jk	4.40 def	3.88 h	3.88 D	3.43 no	4.61 ef	4.01 k	4.02 D
T5	3.43 ij	4.59 cd	4.03 gh	4.02 C	3.48 n	4.81 cd	4.16 ijk	4.15 C
T6	3.40 ij	4.72 bc	3.98 h	4.03 BC	3.50 mn	4.91 bc	4.15 ijk	4.19 C
T7	3.38 ijk	4.76 bc	4.20 fg	4.11 BC	3.44 no	4.89 bc	4.28 hi	4.21 C
T8	3.34 jk	4.84 b	4.23 fg	4.13 B	3.42 no	4.99 b	4.51 fg	4.30 B
T9	3.44 ij	5.35 a	4.44 de	4.41 A	3.54 mn	5.63 a	4.70 de	4.62 A
mean	3.27 C$^-$	4.55 A$^-$	4.06 B$^-$		3.35 C$^-$	4.73 A$^-$	4.22 B$^-$	

Means having the same letter (s) in each column, row or interaction are not significantly different at 5% level.

* W1:100% Eta -W2:75% Eta -W3:50% Eta. While, T1: surface drip irrigation, T2: surface drip irrigation with 25gm polymer, T3: surface drip irrigation with 50gm polymer, T4: subsurface drip irrigation, T5:subsurface drip irrigation with 25gm polymer, T6: subsurface drip irrigation with 50gm polymer T7:oscop drip irrigation,T8:oscop drip irrigation with 25gm polymer and T9: oscop drip irrigation with 50gm polymer).

Conclusion

It can be concluded from the aforementioned results, that application Oscop drip irrigation system with 50 gm polymer under 75% of Eta significantly enhanced yield and fruit quality under desert condition. Also, it improves water use efficiency. On the other side, it decreased total acidity in berry juice of Flame Seedless grapes under desert condition.

REFERENCES

A.O.A.C. (1990). Official methods of analysis, 16th ed. Association of Official Analytical Chemistry, Arlington, Virginia USA.

Abd El-Maksoud, M.M. (2009). Some new methods for saving irrigation water for grapevines. PhD Thesis, Institute of Environmental studies and research, Ain Shams University

Aggag, A.M. and El-Sabagh, A.S. (2006). Impact of deficit irrigation and ant transpiration on water use efficiency, yield and fruit quality of two grapevine cultivars. J. Agaric. & Env. Sci. Alex. Univ., Egypt Vol.5 (2): 124-143.

Gaser, A.S.A., Abo EL-Wafa, Th.S.A. and Abd El-Hameed, A.M. (2018). Effect of Decreasing Water Irrigation Quantity on Growth and productivity of Flame Seedless Grapevines in Clay Soils Conditions. J. Plant Production, Mansoura Univ., Vol. 9 (1): 51 – 58.

American Society of Agricultural Engineering (ASAE). (2001). ASAE standards S526.2, JAN01, Soil and Water terminology, ASAE, St. Joseph, Michigan.

Baille, A. (1997). Principles and methods for predicting crop water requirement in greenhouse environments. CIHEAM, Cahiers Options Mediterranean's, 31, pp. 177-187.

Basile, B., Marsal, J.; Mata, M.; Valiverdu, X.; Belivert, J. and Girona, J. (2015). Phenological sensitivity of Cabernet Sauvignon to water stress: Vine physiology and berry composition. Am. J. Enol. Vitic.62, 452-46 1.

Boman, D.C. and R.Y. Evans (1991). Calcium inhibition of polyacrylamide gel hydration is partially reversible by potassium. Hortic. Sci. 26: 1063-1065.

Bryla, D.R.; Trout, T.J. and Ayars, J.E. (2003). Growth and production of young peach trees irrigated by furrow, microjet, surface drip, or subsurface drip systems. Hort. Science, 38(6), pp.1112-1116.

Cameron, K.D.; Teece, M.A. and Smart, L.B. (2006). Increased accumulation of cuticular wax and expression of lipid transfer protein in response to periodic drying events in leaves of tree tobacco. Plant Physiol., 140:176–183.

Champa. W.A. (2013). Effect of Brassinosteriods, Salicylic acid and Polyamines on quality and storage life of grapes (Vitis vinefera L.) cv. Flame Seedless. Ph.D. Thesis, Punjab Agricultural University Ludhiana.

Chaves, M.M.; Pereira, J.S.; Maroco, J.; Rodrigues, M.L.; Ricardo, C.P.P. and Osório, M.L. (2002). How plants cope with water stress in the field: photosynthesis and growth, Annals of Botany, 89: 907-916.

Doorenobs, J. and Pruitt, W.O. (1977). Guidelines for predicting crop water requirements. FAO Irrigation. And Drainage. Paper 24. Rome, Italy: p 156.

Duncan, D.B. (1955). Multiple ranges and multiple F Test. Biometrics, 11: 1-42.

FAO (1984). Guidelines for predicting crop water requirements. FAO Irrigation and Drainage paper No.24.

Helweg, O.J. (1989). Evaluating the traveling trickle center pivot. ICID-Bulletin 38(1):13-20.

Keller, J. and Karmeli, D. (1975). Trickle irrigation design rain bird sprinkler manufacturing crop. Glendor Calfi, 91740 USA: 24-26.

Kramer, P.J. and Boyer, J.S. (1995). Water relations of plants and soils. Academic Press, San Diego.

El–Desouky, M.I. and Abd El-Hameid, Sh.A. (2014). Improving Growth and Productivity of Pomegranate Fruit Trees Planted On Sandy Dunes Slopes at Baloza District (N. Sinai) Using Different Methods of Drip Irrigation, Organic Fertilization, and Soil Mulching IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). Volume 7, Issue 12 Ver. II PP 86-97

Medrano, H.; Tomás, M.; Martorell, S.; Escalona, J.M.; Pou, A. and Fuentes, S. (2015). Improving water use efficiency of vineyards in semi-arid regions. a review. Agron. Sustain. Dev. 35, 499–517. doi: 10.1007/s13593-014-0280-z

Snedecor, G.W. and Cochran, W.G. (1990). In "Statistical Methods".7th ed., Iowa State Univ. Press. Ames. Iowa, U.S.A., pp 593.

Talat, F.A., Hashim, N.H.; Abdul Razzaq, G. and Sheikh, A.A. (2012). Performance assessment of surface and subsurface drip irrigation system for date palm fruit trees. African Journal of Agricultural Research Vol. 7(10), pp. 1542-1549.

Wei, J.; Liu, G.; Liu, D. and Chen, Y. (2017). Influence of irrigation during the growth stage on yield and quality in mango (Mangifera indica L). PLoSONE 12(4): e0174498.

Winkler, A. (1974). General viticulture. Univ. Calif. Press Berkely and Los Angele.

تأثير نظم ومعدلات الري والبوليمر علي كفاءة استخدام المياه والمحصول وجوده ثمار العنب تحت الظروف الصحراوية

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الملخص العربى

أجريت هذه التجربة خلال الموسمين المتتاليين ٢٠٢٠ و ٢٠٢١ على أشجار العنب الفليم سيدلس المزروعة في التربة الرملية بنظام الري بالتنقيط في التحرير بمحافظة البحيرة. كان الهدف من هذا البحث هو توفير مياه الري دون أي تقليل في كفاءة استخدام المياه، والمحصول وجودة ثمار العنب تحت الظروف الصحراوية. تم تصميم التجربة تحت نظام القطع المنشقة. تم تقسيم القطاع الرئيسي إلى ثلاثة أنظمة للري بالتنقيط وهى الري بالتنقيط السطحي والري بالتنقيط تحت السطحي والري بالقوارير إما بشكل منفرد أو بالاشتراك مع ثلاث جرعات من البوليمر وهى صفر و ٢٥ و ٥٠ جرام. تم تخصيص القطاع الفرعي لثلاثة مستويات ري (١٠٠٪ ، ٧٥٪ و ٥٠٪ من الاحتياجات المائية). أوضحت النتائج المتحصل عليها أن الري التنقيط بالقوارير مع ٥٠ جم من البوليمر تحت ٧٥٪ من الاحتياجات المائية أعطت أفضل النتائج من حيث زيادة المحصول ومكوناته وضمان أفضل الخواص الطبيعية للعناقيد والحبات وكذلك تحسين كفاءة استخدام مياه الرى لكرمات العنب الفليم سيدلس في كلا الموسمين.

الكلمات الدالة: العنب ، التنقيط ، التنقيط تحت السطحى ، التنقيط بالقوارير، البوليمر ، كفاءة استخدام مياه الرى