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ABSTRACT

In general, irrigation by surface methods is the most common to supply crops with frequent application of water. Pressurized irrigation systems have been introduced in Egypt to develop new irrigation technology suited to limited water supply as well as to specific topographic and soil conditions. In this study, a field experiment was carried out in the Agricultural Experimental Station of the Desert Research Center, Maryut, Alex. Governorate during the two successive seasons of 2006 and 2007 .Five methods of irrigation were studied: , gated pipe(GP), surface drip irrigation, one line of drippers for one line of plants(D1:1) , surface drip irrigation ,one line of drippers for two lines of plants(D1:2), sub surface drip irrigation, one line drippers for one line of plants (SD1:1) and sub-surface drip irrigation, one line of drippers for two lines of plants (SD1:2) .The irrigation methods were conducted under three water quantities (100%,70% and50%) of reference ET_O calculated by modified Penman- Montieth equation ,with two soil water depletion levels (30% and 50%) of available water .The statistical analysis revealed highly significant increases in all the studied parameters with increasing water quantities. The maximum fresh weights i.e. ,41.73,41.51and39.66 ton/fed./ were obtained with SD1:1,D1:1and GP, respectively under water quantity 100% (Q1) and soil water depletion 30% (D1),in the year 2006 while the maximum dry masses of 8.23,8.2and 7.9 ton/fed. Respectively were achieved under SD1:1, D1:1and GP with Q1and D1 .In 2007, the maximum fresh masses were, 42.55, 41.85and 40.53 under D1:1, SD1:1 and GP, while the maximum dry weights were 8.4, 7.98 and 7.27 ton/fed respectively .under D1:1, GPand SD1:1 with Q1and D1. The study showed that water use efficiency decreased by increasing quantity of the applied water.

KW: WUE, Evapotranspiration, Sub-Surface Drip Irrigation (SDI), Drip Irrigation (DI), Gated Pipe (GP), Soil depletion.

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INTRODUCTION

Water is the most limiting factor for plant production in arid and semiarid regions ,and when the source of water is limited, the demand for water increases and water management will become an essential practice used by farmers .The relationships between yield and water consumption were established and the preferred irrigation programs to be used with surface irrigation were developed**(Tekinel et al.,1999)**, **(Fischbach and Somerholder1971)** found that an automatic surface irrigation system with gated pipe (GP) and reused system can be very efficient in applying irrigation water (91.9% efficiency) .Micro irrigation has been developed rapidly since the early 1960 .Some advantages of micro irrigation include improved water management and yield, .greater control of applied water resulting in less water and nutrient loss through deep percolation. **(Phene et al., 1987)** demonstrated that significant yield increases in tomatoes were achieved with the use of high frequency subsurface drip irrigation (SDI) and precise fertility management. **(Hutmacher et al.,1996)** demonstrated that yield of alfalfa production increased upon using SDI system buried at a depth of 0.7m .Cotton yield has also been improved using SDI system **(Smith et al.,1991)** and **(Ayars et al.,1998)**.Water use efficiency has been significantly improved through the use of subsurface drip irrigation SDI **(Phene et al.1986b)**.The objective of this study is to improve water management ,irrigation efficiency and water use efficiency with gated pipe (GP), surface drip irrigation (DI) and subsurface drip(SDI) irrigation systems.

MATERIALS AND METHODS

Afield experiment was carried out in Maryout Agricultural Research Station ((محطة التجارب الحقليى بمريوط, south west of Alexandria (elevation 12.75 m, latitude 31° 22 N and Longitude 29°27 E) during the two successive seasons 2006 and 2007.

The study was conducted under splet splet design with three replicates to evaluate the influence of pressurized irrigation systems (gated pipe, surface and subsurface drip irrigation) and water management practices

represented by the applied water depth and water distribution uniformity on

1- Consumptive use,

2- Water use efficiency,

3 production of sorghum represented by yield and yield components under calcareous soil condition.

1 Soils of the studied area.

The area of study was represented by a soil profile from which five depths were sampled i.e. (0 – 20, 20 – 40, 40 – 60, 60 – 80 and 80 – 100 cm). The soil samples were air dried, ground and sieved through a 2 mm screen to get the fine part of soil which is kept for analysis.

The chemical and physical properties of the collected soil samples were determined according to the standard methods outlined in the following:

-Particle size distribution by the pipette method as described by **(Klute, 1986)**.

- Particle density (dp) according to**(Richards, 1954)**.
- Bulk density (db) by soil cores method according to **(Richards, 1954)**.
- Porosity was calculated using the equation. Porosity% (n) = ((dP -db) / dP))×100.

- Calcium carbonate content was determined by Collin's calcimeter according to **Richards (1954)**.
- PF curves and soil moisture retention at 0.33 (corresponding to soil field capacity) and 15 bar (corresponding to soil wilting point) were determined in the undisturbed soil cores using the pressure cooker and pressure membrane, respectively, according to Singh (1980) and results obtained are presented in Table (2).
- The filtration rate was determined by using the double ring infiltrometer as described by Kohneke (1980).
- Cationic and anionic composition, p^H and EC of the soil saturation extract were determined according to Richards (1954)

Soil organic matter content was determined according to the method of Valklay and Black (Jackson, 1967)

Caution exchange capacity was determined using
NaOAc_ NH4OAC according **Richards (1954).** Exchangeable cautions were extracted using NH4 OAc method **(Jackson, 1973)** .and determined s outlined **by Black (1965)**

Data set out in Tables (1, 2, 3 and 4) reveal that the studied soil is enerally loamy - textured except for the surface (0-20 cm) and deepest 80-100cm) layers which are of a sandy –loam texture. Total calcium arbonate content increased slightly with depth and ranged from 28.5 % o 30.1%. Also, the soil bulk density increased with depth and varied etween 1.42 and 1.57 g/cm^3.

he soil reaction is moderately alkaline; where soil pH ranged from 7.5 o 7.7. Electrical conductivity of soil paste extract indicates that soil is ightly saline, where ECe values varied from 2.8 at (40-60cm depth) to .9 dSm^{-1} at the surface layer. The soil saturation extract showed that Na^+ nd Ca^{2+} were the dominant cautions while Cl^- was the dominant anion ollowed, by SO_2- and HCO_3^-.

<u>able (1) Some soil physical properties of the studied soil:</u>

Particle size distribution %				Textural class	Bulk density g.cm^{-3}	Particle density g.cm^{-3}	Porosity%	Infiltration Rate	
Coarse sand	Fine sand	Silt	Clay					cm.h^{-1}	class
3.10	49.10	32.10	19.40	S.L.	1.42	2.28	37.72		
3.60	44.00	30.30	22.10	L.	1.44	2.26	36.28		
4.00	42.40	29.60	24.00	L.	1.57	2.25	30.22	4.35	Moderate
2.90	40.10	30.90	25.10	L.	1.56	2.3	32.17		
1.60	37.50	34.30	26.60	S.L.	1.56	2.3	32.17		

S.L =sandy loam

L = loamy

Table (2): Soil moisture retention curve (pf) (w/w %) of the studied soil.

Soil depth (cm.)	Moisture retention (bar)								Available soil water (%)	Available soil water (mm/m)
	0.001	0.10	0.33	0.66	1.00	5.00	10.00	15.00		
0-20	50.42	27.38	26.32	23.37	20.65	17.24	15.11	13.23	13.09	185.8
20-40	50.49	27.51	26.61	23.29	20.72	17.31	15.22	13.47	13.14	189.2
40-60	50.54	28.11	27.23	23.41	20.83	17.35	15.37	14.03	13.20	207.2
60-80	50.63	28.26	27.43	23.83	20.75	17.51	15.43	14.21	13.22	206.2
80-100	50.63	28.26	27.43	23.83	20.75	17.51	15.43	14.21	13.22	206.2

Table (3): Some chemical properties of the soil under study

Soil depth (cm.)	Organic matter %	pH (soil water suspension)	EC,dS/m	Cations (m mol L^{-1})				Anions (m molL)			
				Na	[illegible]	[illegible]	[illegible]	CO	[illegible]	Cl	[illegible]
0-20	0.63	7.6	4.09	22.73	1.32	10.53	6.21	0	2.73	29.67	8.49
20-40	0.32	7.6	3.48	20.04	1.44	8.32	5.02	0	2.75	25.53	6.54
40-60	0.49	7.5	3.09	18.74	1.59	6.68	3.89	0	4.46	21.49	4.95
60-80	0.58	7.6	3.28	21.15	1.00	7.51	3.10	0	4.22	22.92	5.62
80-100	0.33	7.7	3.47	23.52	0.60	8.40	2.14	0	3.36	24.77	6.53

Table (4):$CaCO_3$ content, CEC and exchangeable Cations of the soil under study

Soil depth (cm.)	$CaCo^3$	CEC c mole kg^{-1}	Exchangeable Cations (c mole kg^{-1})			
			Na	K	Ca	Mg
0-20	28.50	20.06	7.15	1.42	8.36	2.93
20-40	28.90	19.42	7.11	1.31	8.13	2.87
40-60	29.80	19.62	7.48	1.37	7.87	2.9
60-80	29.90	20.24	8.07	1.23	8.21	2.71
80-100	30.10	20.24	8.07	1.23	8.21	2.71

2- Meteorological data.

Data in Table(5) through the summer season (Jun to Oct.) indicates that the average maximum air temperature value ranges between 27.00c° and 31.2c° while the minimum temperature value ranges from17c° in Oct to 24.4c° in September .

The relative humidity is nearly high and reaches its maximum value in July 70.0 %

The sunshine hours vary from 12.00h in July to 9.2h in October while the wind velocity ranges from 2.81 m/ sec in October to 3.92 m/sec in July.

The total rainfalls occurred through September and October months were 5.58 and 59.94 mm, respectively

Table (5): Meteorological data of Maryut area as average of 30 years

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
	17.50	17.50	22.50	25.00	27.50	30.00	30.00	32.50	30.00	27.50	23.00	20.00	25.25
	7.50	7.50	12.50	12.50	15.00	20.00	22.50	22.50	20.00	17.50	14.00	10.00	15.13
	12.50	12.50	17.50	17.50	21.25	25.0	26.25	27.50	25.00	22.50	18.50	1500	20.19
	70.00	70.00	60.00	60.00	60.00	60.00	70.00	70.00	70.00	70.00	70.00	70.00	66.67
eed	3.97	3.97	4.10	3.87	3.60	3.60	3.92	3.60	3.28	2.81	3.04	3.69	3.62
ur)	6.60	7.60	8.30	9.20	10.40	11.90	12.00	11.30	10.40	9.20	7.40	6.50	9.23
d)	11.60	15.00	18.80	22.40	25.30	27.90	27.80	25.70	22.20	17.70	12.90	10.90	19.85
)	0.35	0.00	0.70	0.18	0.35	0.53	0.18	0.18	0.35	0.35	0.56	0.49	0.00
	4.75	6.72	8.87	12.11	14.05	15.97	15.32	15.32	12.86	9.10	5.95	4.39	10.55
m)	50.00	25.00	15.00	5.00	1.00	0.00	0.00	0.00	1.00	10.00	20.00	35.00	162.0
	0.095	0.95	0.116	0.126	0.165	0.189	0.199	0.215	0.189	0.165	0.126	0110	0.149

RH: relative humidity %

Ra: net radiation at the crop surface ($MJ.m^{-2}.day^{-1}$)

G: soil heat flux density ($MJ.m^{-2}.day^{-1}$)

S: slope of the saturation vapor pressure curve (1.08:1.34) average1.26

Rs: solar radiation in equivalent evaporation (mm/day)

3- Irrigation systems.

Three irrigation systems were used to irrigate the grown plant. The system consists of a diesel pump ($18m^3/h$, flow rate), it takes water from open subsurface tank ($75m^3$) capacity through two filter units, the first one is a screen (130 meshes) and the other is a gravel filter.

The filtration system is controlled, by safety valve, relief valve, four control valves, pressure regulator unit, flow meter unit, air tank (balloon) unit, 6.4 mm pressure meter.

The manifold is 50 – mm PVC pipeline with 50 mm end plug for flushing. The drippers (emitters) were with a flow rate of 4L/h (GR) installed in 16 mm polyethylene laterals.

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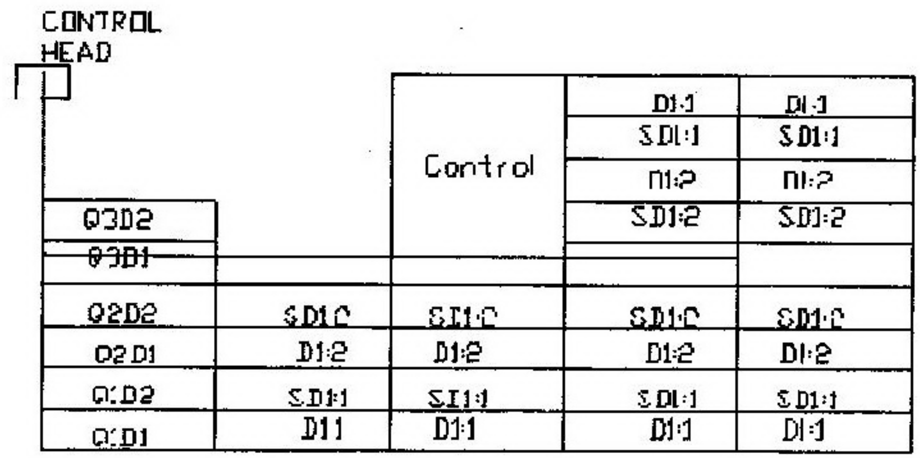


Fig (1): The irrigation system and treatments.

3-1 - Surface drip irrigation (two techniques)

a) One line of drippers (GR 4 l / hr and the distance between drippers is 50 cm) for one line of plants (D1:1).

b) One line of drippers for two lines of plants (D1:2).

3- 2 - Subsurface drip irrigation.

a) One line of drippers (GR 4 l / hr and the distance between drippers is 30 cm) for one line of plants (SD1:1).

b) One line of drippers for two lines of plants (SD1:2).

3- 3 – Gated pipes (GP).

160 mm in diameter aluminum pipes were used with gates located at 70 cm spacing .The one gate discharge is o.5L/s

The system consists of a diesel pump ($18m^3$/h, flow rate), it takes water from open subsurface tank (c$75m^3$) capacity through two filter units , the first one is a screen (130 mesh) and the other is a gravel filter .

4- Measuring of discharge (Q).

According to **Awady, (1978)** the discharge was measured by a direct method using volume and time. This is one of the simplest and most accurate methods, the equation is $Q = v / t$

Where

Q = discharge in (L/h)

V = volume in (liter)

t = time (hour)

RESULTS AND DESCUTION

1- Effect was studied of soil water depletion on fresh and dry masses (ton/fed.) of first and second cuts of the sorghum plants grown in the two studied seasons.

2- Results in illustrated graphically in Figs. 2 and 3 indicate that irrigation under 30% soil water depletion resulted in significantly higher values for fresh and dry weights of the sorghum plants in both cuts of both the two seasons of cultivation These results agree with those of **Byer and. Mcphphrsoh (1975),.Eck(1986)and Hawell et al. (1995)**

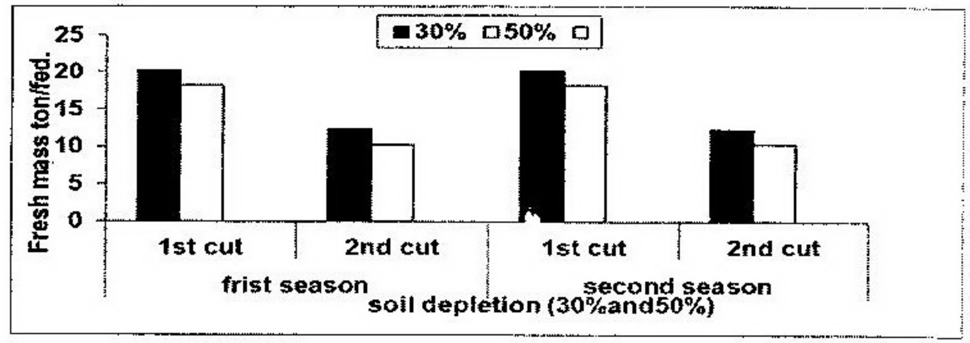


Fig (2): Effect of soil water depletion on fresh mass (ton/fed.) of first and second cuts of the sorghum grown in the two studied seasons

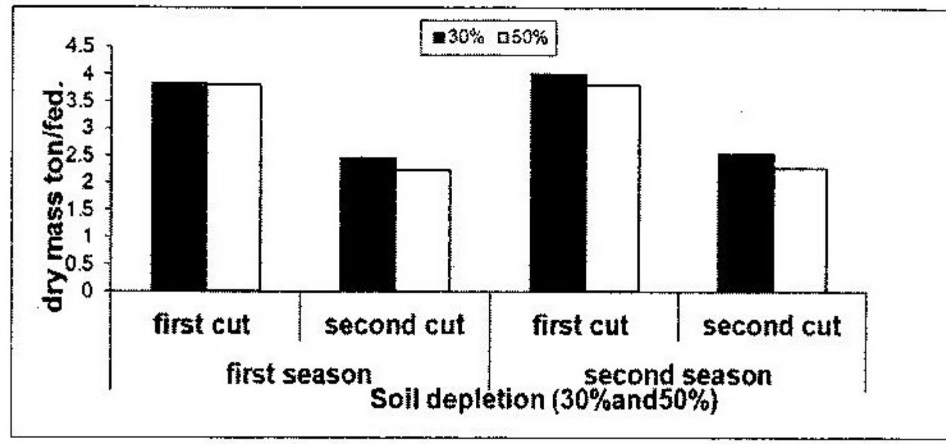
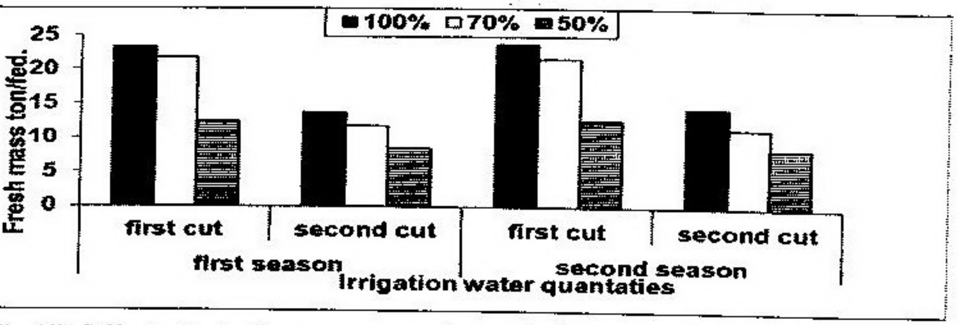


Fig (3): Effect of soil water depletion on dry mass (ton/fed.) of first and second cuts of the sorghum grown in the two studied seasons.

3- Effect of irrigation water quantity on fresh and dry masses (ton/fed.) of first and second cuts of the ,orghum grown in the two seasons.

Fig (4 and 5) indicate that water quantities had significant effects on fresh and dry weights of the first and second cuts of the sorghum plants grown in the two seasons .The highest values of yield were noticed under the applied irrigation water quantity (100%) of reference evapotranspiration (ET_O).These results stand in well agreement with those of (**Neelan and Rajput, 2007**) who found that irrigation levels resulted in significant differences in both years on yield and its component



ig (4): Effect of irrigation water quantity on fresh mass (ton/fed.) of the first and second cuts at the two studied seasons

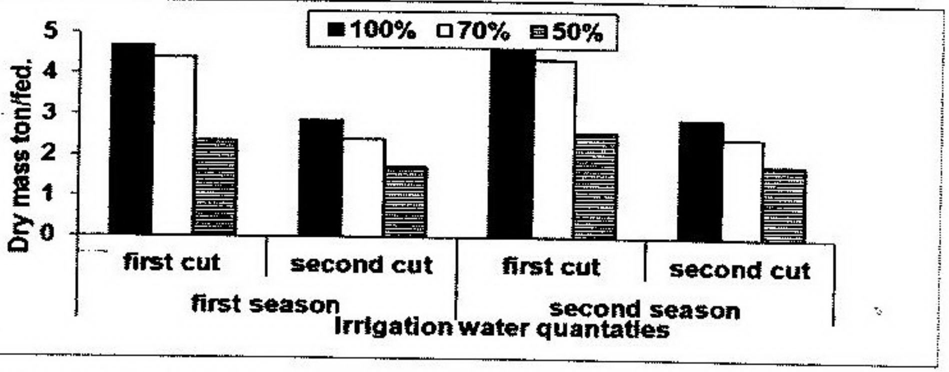


Fig (5): Effect of irrigation water quantity on dry mass (ton/fed.) of the first and second cuts of the sorghum plants in the two studied seasons.

Effect of the irrigation system on fresh and dry masses (ton/fed.) the first and second cuts of the sorghum plants in the two studied asons.

g (6) indicates that non of the used irrigation methods (surface and bsurface drip irrigations) could result in a significant difference on eld. However SD1:1 method resulted in higher fresh weight than GP, :2and SD1:2, for first cut in season 2006 .On the other hand, D1:1 sulted in the highest yields in the second season for both the first and cond cuts, D1:1 resulted in the highest dry weight for the first cut, ere as SD1:1 resulted in the highest dry yield of the second cut. The me results were noticed at the second season .These results agree with se of (Phene et al., 1987) who demonstrated significant yield increases

with the use of high frequency SDI. (Hutmatcher et al., 1996) demonstrated yield increases in alfalfa production using SDI.

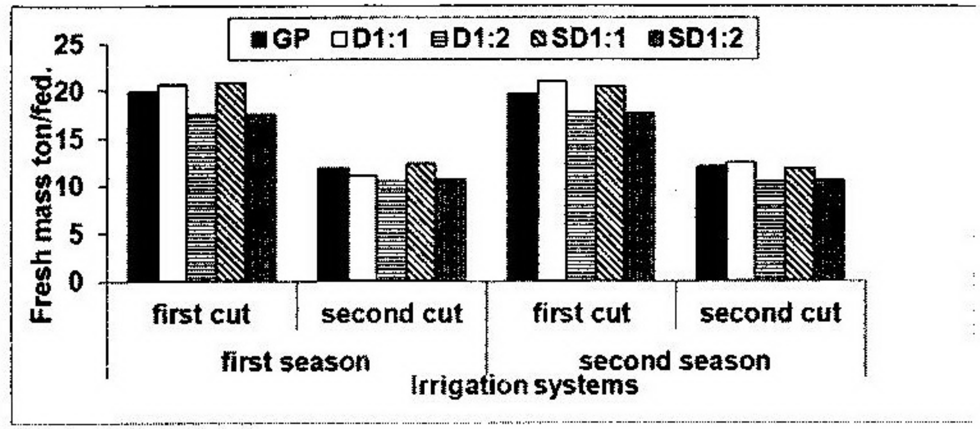


Fig (6): Effect of irrigation system on fresh mass (ton/fed.) of the first and second cuts of sorghum grown in the two studied seasons

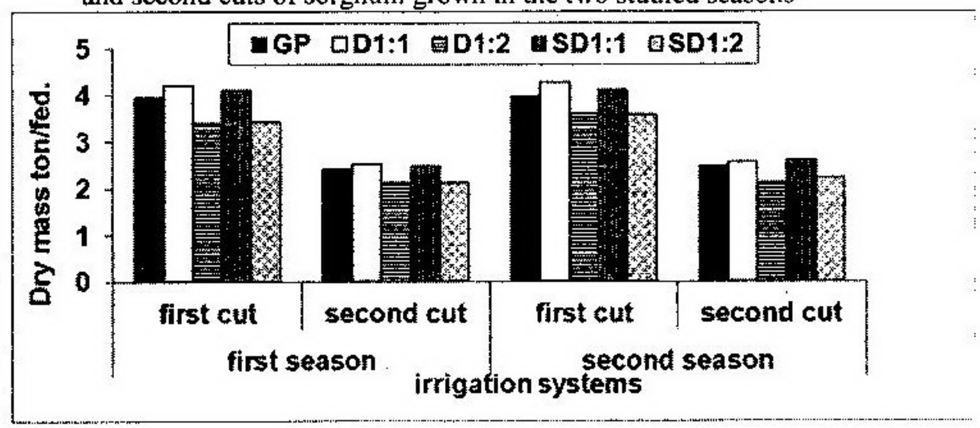
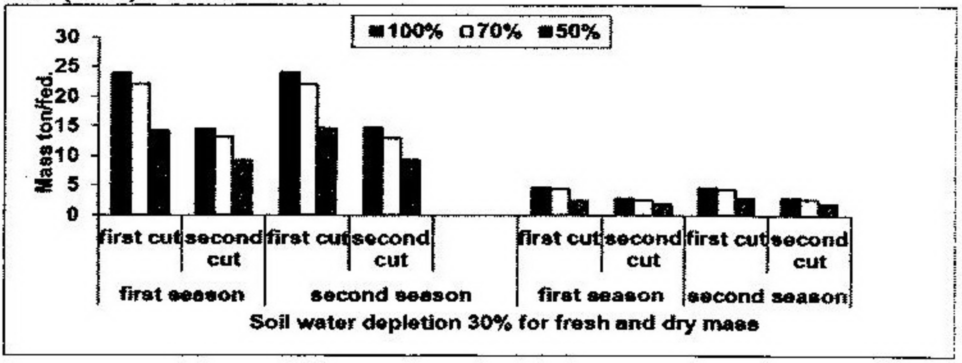


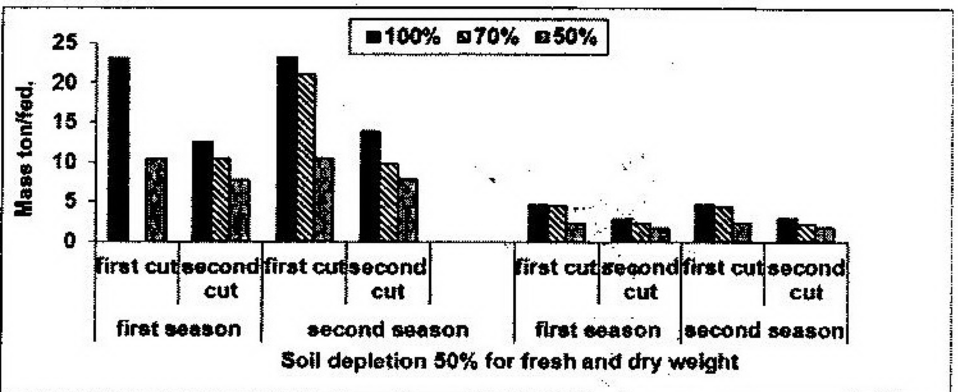
Fig (7): Effect of irrigation system on dry mass (ton/fed.) of the first and second cuts of sorghum grown in the two studied seasons.

5- Effect of interaction between soil water depletion and irrigation water quantity on fresh and dry masses (ton/fed.) of first and second cuts in the two studied seasons

Data of interaction effect between soil water depletion and water quantities on fresh and dry weights at the two studied seasons indicated that, increasing water quantities together with 30%soil water depletion resulted in highly significant increases in both fresh and dry yields of the 1st and 2nd cuts in both the two successive cultivation seasons. On the other hand decreasing applied water quantities with increasing soil water depletion caused fresh and dry weights of the first and second cuts in the two successive seasons to decrease .These results coincide with those of **Eck (1986)**



Fig(8):Effect of interaction between soil water depletion (30%) and irrigation water quantity on fresh and dry mass (ton/fed.) of the first and second cuts of sorghum grown the two successive seasons.



Fig(9):Effect of interaction between soil water depletion (50%) and irrigation water quantity on fresh and dry mass (ton/fed.) of the first and second cuts of sorghum grown in the two successive seasons.

6- Effect of interaction between soil water depletion and irrigation system on fresh and dry mass (ton/fed.) of the first and second cuts of sorghum grown in the two successive seasons

Data presented in Table (11) and illustrated graphically in Figs. (10) and (11) reveal the interaction effect between soil water depletion and irrigation systems on fresh and dry weights of the first and second cuts in both studied seasons . The interaction between soil water depletion 30% and the SD1:1 system resulted in the maximum values of both fresh weights of the two cuts in the first seasons .However, D1:1 system resulted in the highest fresh weight values of the first and second cuts in the second seasons beside of the highest dry weight of the first and second cuts in the first and second seasons. The results obtained herein are in agreement with those of **(Eck, 1986)**

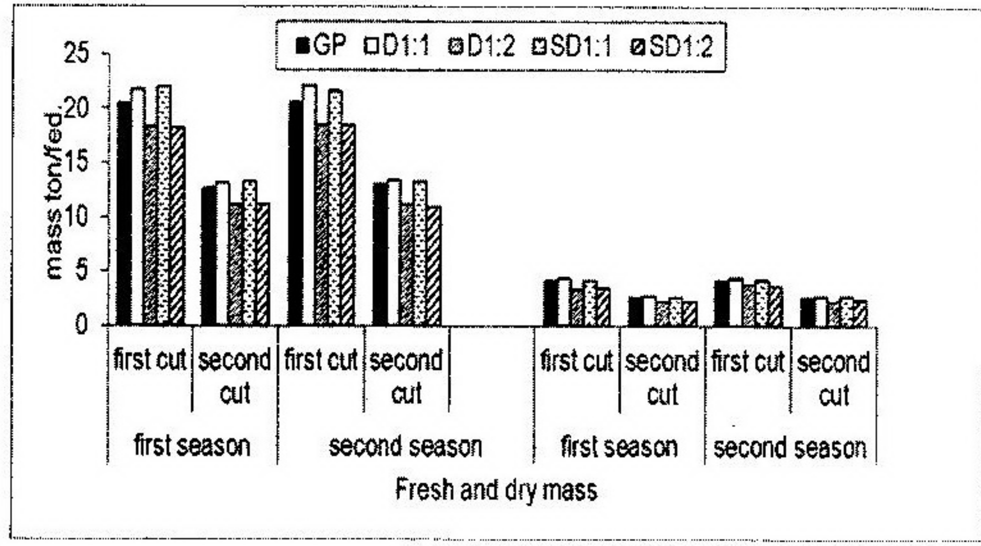


Fig (10): Effect of interaction between soil water depletion (30%) and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts of the sorghum grown in the two seasons

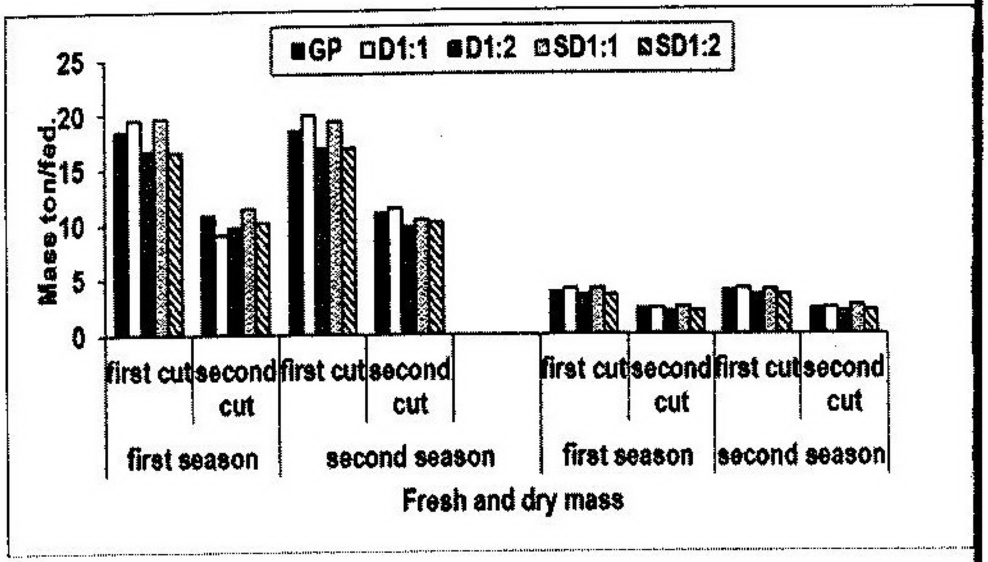


Fig (11): Effect of interaction between soil water depletion (50%) and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts of the sorghum grown in the two seasons

7- Effect of the interaction between irrigation water quantity and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts of the sorghum grown in the two successive seasons

The interaction effects between water quantities and irrigation systems on fresh and dry weights for two cuts in the two seasons are presented in Table(6).The interaction between water quantity applied at 100% ET and the irrigation systemsD1:1 and SD1:1 seemed to be of the highest significant effect on fresh and dry weights of the first and second cuts of sorghum grown in both the studied two seasons.

Table (6): Effect of irrigation water quantity and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts at the two successive seasons.

Treatments		Fresh mass (ton/fed.)				Dry mass (ton/fed.)			
Water use	Irri. System	1st season		2nd season		1st season		2nd season	
		1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
100 %	GP	23.72	14.63	23.83	14.98	4.79	2.94	4.77	3.01
	D 1:1	25.20	11.54	25.61	15.29	5.06	2.99	5.16	3.08
	D 1:2	21.65	13.00	21.87	13.01	4.20	2.62	4.39	2.61
	SD 1:1	25.14	15.04	25.18	15.09	5.05	3.14	5.05	3.20
	SD 1:2	21.66	13.64	21.71	13.48	4.37	2.76	4.36	2.73
70 %	GP	21.33	11.94	21.41	12.15	4.34	2.44	4.35	2.53
	D 1:1	22.93	12.43	22.96	12.53	4.66	2.55	4.66	2.60
	D 1:2	20.80	10.94	20.82	10.81	4.21	2.25	4.24	2.23
	SD 1:1	22.73	12.49	21.68	10.87	4.62	2.55	4.40	2.62
	SD 1:2	20.61	10.90	20.66	10.59	4.20	2.23	4.20	2.40
50 %	GP	13.39	8.85	13.41	8.92	2.73	1.88	2.80	1.90
	D 1:1	13.77	9.38	14.37	9.49	2.95	2.03	3.00	2.01
	D 1:2	9.98	7.17	10.24	7.32	1.73	1.52	2.14	1.56
	SD 1:1	14.37	9.36	14.41	9.43	2.62	1.72	2.84	2.01
	SD 1:2	9.96	7.29	10.26	7.35	1.71	1.40	2.13	1.57
LSD	0.05	1.64	1.34	1.87	1.42	0.32	0.24	0.41	0.31
	0.01	2.19	1.79	2.49	1.89	0.42	0.32	0.54	0.41

8- Effect of the interaction between soil water depletion, irrigation water quantity and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts of sorghum grown in the two seasons

The results presented in Table (7) indicated that the maximum values of fresh and dry masses were noticed under the interaction between 100%ET and soil water depletion 30% with D1:1 irrigation system.

Table (7): Effect of soil water depletion, irrigation water quantity and irrigation system on fresh and dry masses (ton/fed.) of the first and second cuts at two seasons.

Treatments			Fresh mass (ton/fed.)				Dry mass (ton/fed.)			
			1st season		2nd season		1st season		2nd season	
Depletion	Water quantity	Irri. system	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
30 %	100 %	GP	24.14	15.52	24.43	16.10	4.80	3.06	4.79	3.19
		D 1:1	25.82	15.69	26.02	16.32	5.09	3.11	5.16	3.24
		D 1:2	21.97	13.16	22.21	13.26	4.00	2.60	4.38	2.60
		SD 1:1	25.86	15.87	25.87	15.98	5.08	3.15	5.08	3.16
		SD 1:2	21.95	12.92	21.98	12.58	4.32	2.57	4.33	2.50
	70 %	GP	22.00	13.16	22.08	13.27	4.36	2.64	4.37	2.75
		D 1:1	23.50	13.67	23.50	13.72	4.66	2.76	4.66	2.83
		D 1:2	21.11	12.64	21.15	12.43	4.17	2.57	4.20	2.55
		SD 1:1	23.31	13.66	22.17	13.71	4.62	2.75	4.41	2.86
		SD 1:2	20.93	12.49	21.00	11.91	4.16	2.52	4.18	2.86
	50 %	GP	15.35	9.62	15.42	9.76	3.10	1.99	3.11	2.02
		D 1:1	15.82	10.26	16.70	10.31	3.33	2.12	3.36	2.13
		D 1:2	11.80	7.71	11.99	7.77	1.67	1.59	2.42	1.61
		SD 1:1	16.62	10.18	16.91	10.14	2.47	1.76	3.08	2.10
		SD 1:2	11.82	8.03	12.11	8.09	1.66	1.36	2.42	1.68
50 %	100 %	GP	23.29	13.73	23.23	13.87	4.78	2.81	4.75	2.84
		D 1:1	24.59	7.38	25.20	14.25	5.04	2.88	5.16	2.93
		D 1:2	21.33	12.83	21.53	12.76	4.39	2.64	4.41	2.62
		SD 1:1	24.43	14.21	24.48	14.19	5.01	3.13	5.01	3.23
		SD 1:2	21.38	14.37	21.44	14.38	4.41	2.94	4.39	2.96
	70 %	GP	20.65	10.72	20.73	11.03	4.31	2.23	4.32	2.30
		D 1:1	22.36	11.18	22.42	11.33	4.66	2.33	4.66	2.37
		D 1:2	20.49	9.25	20.48	9.18	4.24	1.93	4.27	1.91
		SD 1:1	22.14	11.33	21.19	8.03	4.62	2.36	4.38	2.37
		SD 1:2	20.29	9.32	20.32	9.26	4.23	1.94	4.23	1.94
	50 %	GP	11.43	8.08	11.39	8.09	2.37	1.76	2.48	1.77
		D 1:1	11.71	8.50	12.03	8.66	2.56	1.94	2.64	1.89
		D 1:2	8.15	6.62	8.49	6.86	1.78	1.45	1.86	1.50
		SD 1:1	12.13	8.54	11.92	8.73	2.77	1.68	2.60	1.92
		SD 1:2	8.10	6.55	8.40	6.61	1.77	1.43	1.83	1.46
LSD	0.05		2.32	1.90	2.64	2.01	0.45	0.34	0.57	0.44
	0.01		3.09	2.53	3.52	2.68	0.59	0.46	0.76	0.59

Table (8): Average WUE for sorghum crop (dry weight kg/m^3)

WQ	D	GP	D1:1	D1:2	SD1:1	SD1:2
Q1	D1	3.32	3.86	3.19	3.73	3.61
	D2	3.55	4.18	3.68	3.97	3.99
Q2	D1	4.29	4.84	4.39	4.86	4.48
	D2	4.23	5.1	4.54	5.12	4.62
Q3	D1	4.17	4.91	3.38	4.59	3.4
	D2	3.6	4.28	3.17	4.38	3.2

Data presented in Table (8) reveal that mean values of water use efficiency seemed to be dependent on quantity of the irrigation water, type of the irrigation system and soil water depletion percentage. Application of the irrigation water at 70% of ET resulted in higher values of WUE than the other applied quantities i.e. 100% and 50% of ET did , where , irrigation at 50% depletion of the available water resulted in higher values of WUE under the all used irrigation systems and all rates of the applied water except when irrigation water was applied at its lowest ratio i.e. 50% of ET .Also the irrigation system SD1:1 resulted in the highest mean values of WUE , as compared with the other studied systems . However the interaction between water applied at a rate of 70% of ET and 50% depletion of available water under D1:1 irrigation system seemed to be of the highest effect on average value of WUE.

CONCLUSION

The crop yield is significantly affected by both of applied water quantity and soil water depletion where it was found that decreasing quantity of the applied water significantly decreased crop yield. Centray to that, crop yield in creases by decreasing soil available water deplation. On the other hand, variation in irrigation water system did not significantly affect crop productivity.

REFRENCES

Ayares, J.E., Schoneman, R.A., Soppe.R.W., Med.R.M.(1998) Irrigation cotton in the presence of shallow ground water .Drainage in the Zist century :food production and the environment, Proc. 7th. Int. Drainage Symp. . ASAE,Orlando,FL,March,:p.82-89

Black, J. N. (1967) The inter relation ship of solar radiation and leaf area index in determining the rate of dry matter production of swards of sub terranean clover (Trifolium sub terranean). Abs. J. Agric. Res., 14:20-38.

Black, J. N. (1965) Method of soil analysis, part 2.No. (9) .Am. Soc. Agron. Inc. pub., Mad., Wise., U.S.A.

Camp, C.R.(1998) Surface drip irrigation : review, Trans. of ASAE 41(5): 1353-1367

Eltantawy,M.T.,H.E.Osman.S.S.,Hassan ,and S.I.EL-Khatb(2000) Evaluation of surface Irrigation under perforated pipe on sugarcane in old valley Egypt 8th C. of Misr Soc.,Agr. Eng. 25-26 Oct.:23-33

Jackson, R. D. (1973) Diurnal changes in soil water content. In Field soil water regime. Soil Sci. Soc. Am. Proc. 37: 811, special publication. 5 Sept. – Oct.

Hassan, S.S.A, (1990). The performance of perforated tubes for surface irrigation in small holdings in Egypt, M.Sc.Th., Agric. Eng. Dept., Cairo Univ.

Hutmacher,R.B.,Mead,R.M.,Shouse,P,(1996) Subsurface drip :Improving alfalfa irrigation in the west, Irrg. J.:45.48-52

Kincaid, D.C. (1984) Cablegation.V. : Dimensionless design relation.Tran. Of the ASAE 27(3):679-722

Kohnke, H. (1980) Soil physics soil scientist. Purdue Univ. TATA. Mc Graw Hill. Publishing company Ltd., New Delhi. India., 28-34

Neelan, T.B.S. Rajput (2007) Effect of tape placement depth and irrigation level on yield potato. Agricultural water management 88 : 209-223 Science Direct

Osman ,H.E.(2000) Gated pipes techniques for improved surface irrigation ,8th con. Agric. Dev. Res.Agric., Ain Shams Univ. Cairo November 20-22, 2000 145-155p.

Phene.C.J.,Humatcher,R.B.,McCormick,R.L.,(1987) Advantages of subsurface drip irrigation for processing tomatoes .Acta Hortic.2000.:101-113.

Phene.C.J.,Hutmacher.R.B.,Davis,K.R.,McCormick,R.L.,Meek,D.W. ,(1986) Managementand response of surface drip irrigated

tomatoes ,Proc. Int: Round 155 Conf. Micro-irrigation ,vol.111Budapest Hungary ,pp.49-56

Richards, L. A. (1954) Diagnosis and improvement of Saline and Alkali soils U.S. salinity lab. Staff. Washington. D. C., U.S.A., Agric. Hand Book No. 60

Smith,R.B.,Oster, J.D.,,Phene.C.J.,(1991) Subsurface drip produced the highest net return in the west lands study area. Cal. Agric.45 :8-10.

Tekinel,O., Kanber, R.,Koksal,H.,(1999). Irrigationof cotton: Turkish experience .In: proceedings of the first symposium on cotton Agricultural fiber Technology and Textile in Turkish world .Kahramanmar as Turkey.

الملخص العربى

خدمة الرى وانتاجية السورجم تحت ظروف الاراضى الجيرية

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الرى السطحي هو أكثر طرق الرى المستخدمه لامداد المحصول باحتياجاتة المائية انتشارا وشيوعا على مستوى مصر ولكن مع النيادة المستمرة للسكان ونيادة الفجوة الغذائية ومع ندرة المياة كان لابد من الاتجاة الى تطوير الرى وادخال تقنيات حديثة تمكن من الاستخدام الامثل لنقطة المياة وامداد المحصول بالاحتياجات الفعلية من المياة دون اهدار وكذلك عدم تعريض المحصول لشد رطوبى يؤثرعلى انتاجيتة لذلك اجريت تلك الدراسة بمحطة بحوث مريوط بمحافظة الاسكندرية التابعة لمركز بحوث الصحراء خلال عامى ٢٠٠٦و٢٠٠٧ حيث تم اختبار ٥ تقنيات للرى

١- الرى بالانابيب المبوبة GP
٢- الرى بالتنقيط السطحى D
أ- خط رى لكل خط نبات D1:1
ب- خط رى لكل خطين نبات D1:2
٣-الرى بالتنقيط التحت سطحىSD
ا-خط رى لكل خط نبات SD1:1
ب-خط رى لكل خطين نبات SD1:2

١- مركز بحوث الصحراء – المطرية – القاهرة ٢- قسم الهندسة الزراعية – كلية الزراعة – جامعة بنها

أوضحت نتائج التحليل الإحصائى زيادة عالية المعنوية في جميع المعايير موضع الدراسة بزيادة كمية مياه الري المضافة. تم الحصول علي أعلي قيم للوزن الطازج وهي ٤١,٧٣ ، ٤١,٥١ ، ٣٩,٦٦ طن / فدان مع المعاملات ،

SD1:1 ، D1:1 ، GP علي الترتيب وكذلك عند إضافة ١٠٠ % من الإحتياجات المائية وعند إستنفاذ ٣٠ % من الماء الميسر في التربة وذلك خلال عام ٢٠٠٦ في حين أن أعلي قيم للوزن الجاف وهي ٨,٢٣ ، ٨,٢٠ ، ٧,٩ طن / فدان تم الحصول عليها بإتباع المعاملات SD1:1 ، D1:1 ، GP تحت ١٠٠ % من الإحتياجات المائية وعند استنفاذ ٣٠ % من الماء الميسر.وخلال عام ٢٠٠٧ كانت أعلي قيم للوزن الطازج هي ٤٢,٥٥ ، ٤١,٨٥ ، ٤٠,٥٣ طن / فدان وذلك للمعاملات D1:1 ، SD1:1 ، GP علي الترتيب في حين أن أعلي قيم للوزن الجاف وهي ٨,٤ ، ٧,٩٨ ، ٧,٢٧ طن / فدان تم التوصل إليها في ظل المعاملات SD1:1 ، D1:1 ، GP تحت ١٠٠ % من الإحتياجات المائية وعند استنفاذ ٣٠ % من الماء الميسر. كذلك أوضحت الدراسة أن كفاءة استخدام الماء WUE تقل بزيادة كمية الماء المضاف.

التوصيات

تمت الدراسة تحت ثلاث كميات من المياة ١٠٠%-٧٠% و٥٠% من كمية المياة المحسوبة من معادلة بنمان مونتيث المعدلة مع نسبتى استنفاذ ٣٠% و ٥٠% من الماء الميسر المتاح بمنطقة الجزورز

وأظهرت النتائج أن

١- يتاثر انتاج المحصول معنويا بكل من كميات المياة ونسبة الاستنفاذ، حيث انة بنقص كمية المياة يحدث نقص معنوى فى المحصول . على العكس من ذلك يذيد المحصول بنقص نسبة الاستنفاذ ، فى حين اناختلاف نظم الرى لم يكن له تاثير معنوى على انتاجية المحصول