Zagazig J. Agric. Res., Vol. 35 No .(2) 2008 363-381

IMPACT OF FIELD IRRIGATION MANAGEMENT ON SOME IRRIGATION EFFICIENCIES AND PRODUCTIVITY OF WHEAT AND SOYBEAN CROPS

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Accepted 10/ 3/2008

ABSTRACT: Two field experiments were conducted at the Experimental Farm of Sakha Agric. Res. Station during the winter season (2005/2006) and summer season (2006). The work aimed to study the influence of different marwas (field ditch) options (Gated and Concrete pipes and traditional field ditch), border length (60 and 120 m) and width (12, 18 and 24 m) on some irrigation efficiencies and productivity of wheat and soybean crops.

Data showed that the grain yield of wheat and soybean crops were significantly increase with gated and concrete pipes and with shorter border length and width. Grain yield under gated and concrete pipes respectively, were higher than under traditional field ditch by about 8.0 and 3.0 % of wheat and 9.0 and 7.0 % of soybean. The corresponding values were 5.0 and 2.0 % in wheat straw yield. Border 60m length and 18m width were higher, respectively by about 5.0 and 19.73 % for wheat grain yield and 5.0 and 9.7 % for soybean seed yield than border 120m length and 24m width.

The interactions between field canal options and border length and between field canal options and border width and between border length and width were significant for the wheat grain and straw yields. The interactions between field canal options, border length and width were significant for the wheat straw yield. While, all interactions for all parameters studied under soybean crop were insignificant except that pods/plant which it was significant

Results showed that, the lowest amount of water applied, water consumptive use (m^3/fed) and water losses % and the highest values of field water use, crop water use efficiencies (kg/m^3) and water application

efficiency % were obtained under gated pipes, 60m border length and 12m border width. While, the highest amount of irrigation water, water consumptive use (m^3/fed) and application losses % and the lowest values of field water use and crop water use efficiencies (kg/m^3) and water application efficiency % were obtained under traditional field ditch, 120m border length and 24m width. Gated and concrete pipes could save irrigation water by 9.2 and 6.82% for wheat crop, while these values were 12.52, 5.81% for soybean crop, respectively, compared to traditional field ditch. Border 60m length and 12m width resulted in saving irrigation water over than 120m length and 24m width, respectively by 4.66 and 6.49 % under wheat cultivation, while under soybean, the water saving were 9.69 and 2.36 %.

Key words: Irrigation, gated pipes, concrete pipes, border length, border width, wheat, soybean.

INTRODUCTION

Egypt is almost solely dependent on The River Nile as the main water source. Approximately 96% of Egypt's water supply is from that main source. Nearly 85% of the available supply, (approximately 55.5 billion cubic meters annually) is consumed by the agriculture sector (Mona El-Kady and Sameh, 2003). The possibility to increase water supply is limited and conditioned. Moreover the competition for limited water resource is increasing among urban, industrial, and agricultural interests. An available alternative is to increase irrigation efficiency and minimize water losses under irrigation. Economic irrigation requires application of water at the proper time and suitable amount to meet the needs of the growth crop, to prevent salt accumulation in the soil and to prevent the excessive waste of water. Improving the irrigation system constitutes the key element in achieving the national goal of increasing irrigation efficiency and fulfilling the equity of water distribution among farmers in order to achieve the maximum crop yield (El-Mowelhi *et al.*, 1999a, Zein *et al.* and Abo Soliman *et al.*, 2005).

Wheat (*Triticum aestivum*) is the principal winter crop in Egypt and it is the most important grain crop in the world. The world production exceeds that of any other grain crop, and in many respects it is superior to any other human food. Wheat is the major

breadmaking cereal and Egypt has to supplement production by importing just over half of its needs to supply the annual demand. Soybean (*Glycine max L.*) is considered to be one of the most important protein and oil crops, introduced all over the world.

El-Mowelhi *et al.* (1999b) found that the highest wheat yield was obtained from combination among 100 m length, 5 m width, with slope precision land leveling. So, it could add about 600 L.E/fed for wheat crop as a net income to the farmer income. Osman, (2000) and Abo Soliman *et al.*, (2002) reported that, maximum crop was realized at irrigation the field crops using gated pipe compared with traditional system.

Several factors (marwas or field ditch options and border length and width) affect the amount of water absorption along the furrow and water losses through runoff and percolation beyond the crop root zone. Fernandez *et al.*, (1996), Osman, (2000) and Abo Soliman *et al.*, (2002) found that, a feasible practice to attain water conservation and increase irrigation water use efficiency by using gated pipes for irrigation. Abd El-Hafez *et al.* (1984) found that a hundred meters irrigation run could be used under dead level practice and the long border 150 m or more could be used under the ground surface slope (0.1 % or more) to achieve a good water management for berseem. El-Mowelhi *et al.* (1999a) indicated that the less amount of irrigation water delivered to the fields was recorded under irrigation run length of 50 m and 5 m run width, while the highest amount was recorded under irrigation run length of 200 m and 15 m run width. Also, they found that the highest values of field water use and crop water use efficiencies were achieved under irrigation of 100 m run length and 10 m run width, while the lowest values were under 200 m run length and 15 m run width.

The aim of this work is to study the influence of some field ditch options and border lengths and widths on some irrigation efficiencies and productivity of wheat and soybean crops.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Sakha Agric. Res. Station during the winter season

(2005/2006) and summer season (2006). The aim of this work is to study the influence of three marwas (field ditch) options (Gated pipes, Concrete pipes and Traditional field ditch), two border length (60 m and 120 m) and three border width (12 m, 18 m and 24 m) on some irrigation efficiencies and productivity of wheat and soybean crops. The experiments were conducted in a split-split-plot design with four replicates. The main plots were assigned to irrigation marwa options, the sub-plot was to two border length and sub-sub plot was allocated to three border width.

In winter season, wheat (*Triticum aestivum*) Giza 168 variety was planted on November,20, 2005. All plots received a total of 75 Kg Ca-superphosphate/ fed. during cultivation. Nitrogen fertilizer in the form of urea was side dressed at a rate of 75 Kg N/fed., in two doses after 40 and 60 days from the planting. In addition to planting irrigation, all plots received four irrigations. Wheat was harvested on may,5, 2006 from all treatments. Yield components during the gowning season, straw and grain yield were determined.

In summer season, soybean (*Glycine max L.*) was planted on June, 15, 2006. All plots received a total of 50 Kg Ca-superphosphate/ fed, during cultivation. Nitrogen fertilizer in the form of urea was side dressed at a rate of 50 Kg N/fed, in two doses before the first and the third irrigation. In addition to planting irrigation, all plots received sex irrigations. Soybean was harvested on September,11, 2006 from all treatments. Yield components during the gowning season and seed yield were determined.

Amount of Water Applied

* Traditional field ditch: The irrigation water applied was measured by using a set of cut-throat flume (20×90cm), Early (1975).
* Gated and concrete pipe: The discharge through an orifice was determined from the following equation as described by (Brater and King, 1976).

$$Q = CA\,(2GY)^{1/2}$$

Where:

Q: Discharge (m^3/sec)

C: Coefficient of discharge ranges form 0.7 to 0.8

A: Area of orifice opening (m^2)

G: Accelerating of gravity (9.81m/sec.^{2})

Y: The head causing free flow where Y the upstream head measured from the center of the orifice opening.

Water Consumptive Use

(C.U) was calculated according to (Majumdar, 2002) as follows:

$$CU = \sum_{i=1}^{i=n} \frac{P_{w2} - P_{w1}}{100} * D_{bi} * D_i$$

Where:

C.U.: Water consumption use in cm.

Pw_2: Soil moisture percent after irrigation in the i th layer

Pw_1: Soil moisture percent before the next irrigation in the i th layer

D_{bi}: Bulk density g/cm^3 of the i th layer of the soil

D_i : Depth of the ith layer of the soil, cm

I: Number of soil layer sampled in the root zone depth (D).

Field water use efficiency: was calculated as follows:

FWUE kg/m^3 = Yield (kg/fed.)/ Amount of water applied (m^3/fed)

Water use efficiency (W.U.E) was calculated by using formula

W.U.E kg/m^3 = Yield (kg/fed)/ Seasonal water consumptive use (m^3/fed) (Micheal, 1978).

Water application efficiency is the ratio of the average depth of irrigation water infiltrated and stored in the root zone to the average depth of irrigation water applied, Micheal (1978).

Irrigation water losses: consists of deep percolation and runoff, as follows:

Loss % = 100 − Water application efficiency %

Infiltration rate (IR) was determined using double cylinder infiltrometer as described by Garcia (1978). Soil bulk density was determined according to Klute (1986) and other soil properties were analyzed before planting and are presented in Table 1.

RESULTS AND DISCUSSION

Wheat Crop

Data in Table 2 showed that there was a significant increase in the grain and straw yields and 1000 grain weight with various field canal options (gated and concrete pipes). Whereas grain yield under gated pipes and concrete pipes were higher by about 8.0 and 3.0%,

Table 1. Chemical and physical properties for the soil of the experimental field

Soil depth	Particle size distribution			Texture	Bulk density	O.M	EC	Soil moisture characteristics			I R
(cm)	Sand%	Silt%	Clay%	grade	g/cm^3	%	(dS/m)	FC%	WP%	AW%	(cm/hr)
0--15	9.14	33.75	57.11	Clayey	1.14	1.89	1.3	40.4	22.02	18.38	
15--30	9.55	33.14	57.31	Clayey	1.18	1.02	1.3	42.95	23.32	19.63	
30--60	8.98	38.49	52.53	Clayey	1.26	0.76	1.5	36.25	19.7	16.55	
60--90	9.21	39.05	51.74	Clayey	1.26	0.45	1.5	37.76	20.69	17.07	1.35

EC=Electrical conductivity FC=Field capacity WP=Wilting point AW= Available water IR= Infiltration rate

Statistical analysis: Data are subjected to statistical analysis according to Snedecor and Cochran (1980).

Table 2. Wheat yield and its components as affected by various options of marwas (field canal), border lengths and widths

Treatments	Parameters						
	Grain yield (kg/fed)	Straw yield (kg/fed)	Plant height (cm)	Panicle length (cm)	Tillers per plant	Spiklets pea spike	1000 grain weight (gm)
Field canal options							
Gated pipes	3227.92	4287.42	114.61	9.07	7.16	54.64	49.69
Concrete pipes	3086.83	4187.63	112.63	9.01	6.79	54.39	46.83
Traditional field ditch	2983.87	4101.88	111.82	8.73	6.68	53.73	45.93
F-test	**	**	**	**	**	**	*
L.S.D. 0.05	15.43	20.35	1.14	0.22	0.21	0.24	1.3
L.S.D. 0.01	21.85	28.49	1.96	0.37	0.44	0.83	2.73
(Border length(m							
(L1 (60 m	3170.14	4241.42	113.51	9.12	7.03	55.08	49.14
(L2 (120 m	3028.94	4143.19	112.53	8.75	6.73	52.76	45.82
F-test	**	**	*	**	*	**	**
(Border width(m							
(W1 (12 m	3175.92	4188.33	113.27	8.94	7.72	54.55	47.66
(W2 (18 m	3336.21	4333.58	114.79	9.18	8.33	56.59	48.7
(W3 (24 m	2786.5	4055	110.99	8.69	6.73	50.61	46.09
F-test	**	**	**	**	**	**	**
L.S.D. 0.05	12.9	18.74	2.11	0.27	0.62	1.61	1.23
L.S.D. 0.01	17.29	25.13	2.83	0.42	0.83	2.16	1.99
Interactions							
O × L	**	**	Ns	**	Ns	**	*
O × W	**	**	Ns	Ns	**	**	Ns
L × W	**	**	*	**	Ns	Ns	Ns
O × L × W	Ns	**	Ns	**	Ns	**	Ns

respectively than under traditional field ditch. The corresponding values were 5.0 and 2.0 % in straw yield and were 3.8 and 0.9 (gm) in 1000 grain weight. Data also revealed that plant height and panicle length (cm) take the same trend of wheat yield with various field canal options Table 2. Results also showed that, number of tillers/plant spiklets/spike gave significant increase with various field canal options (gated pipes and concrete pipes). The mean values were 7.16, 6.79 and 6.68 tillers/plant and 54.65, 54.39 and 53.73 spiklets/ spike for gated pipes, concrete pipes and traditional field ditch, respectively. This may be due to that improved surface irrigation practices such as precision land leveling and using gated pipe distributed water more efficiently. Similar trend were obtained by Osman, (2000) and Abo Soliman *et al.* (2002).

Data in Table 2 showed that there was a highly significant increase in the grain and straw yields, 1000 grain weight, panicle length and spiklets/spike with decreasing border length. The values were higher under 60 m than 120 m by about 5.0 and 2.0%. for grain and straw yields, respectively and about 0.37(cm) for panicle length, 3.32 (gm) for 1000 grain weight and 2.32 spiklets/spike. Results also showed that, plant height and number of tillers/plant gives significant increase with decreasing border length. The mean values of plant height were 113.51 and 112.53 (cm) and were 7.03 and 6.73 tillers/ plant for 60 and 120 m, respectively. Similar results were obtained by El-Mowelhi *et al.* (1999b)

Data in Table 2 showed that there was a highly significant increase in the grain and straw yields, 1000 grain weight, plant height, panicle length, number of tillers/plant and spiklets/spike with decreasing border width. The values were higher with 12 and 18 m than 24 m, respectively by about 13.97 and 19.73% for grain yield, 3.29 and 6.87% for straw yield, 2.28 and 3.80 (cm) for plant height, 0.25 and 0.49 (cm) for panicle length, 1.57and 2.61 (gm) for 1000 grain weight, 1.0 and 1.6 tillers/plant and about 4.0 and 6.0 spiklets/spike. Similar results were obtained by El-Mowelhi *et al.* (1999b)

These decrements in production of wheat crop could be attributed to that under traditional field ditch and border length (120 m) and width (24 m), the chance for more leaching downward for

both water and its load of fertilizers could be happened. On the other hand, under gated and concrete pipes and border length (60 m) and width (12 m) which accompanied with less water content, more energy is forced to extract more water with its content of fertilizers, which in turn resulted in deceasing the withdrawn of fertilizers. Similar results were obtained by El-Hamdi and Knany (2000).

Interactions

The interactions between field canal options and border length (O×L), results in Table 2 showed that there were significant differences in the grain and straw yields, 1000 grain weight, spiklets/spike, panicle length, while, plant height, number of tillers/plant were insignificant. Results also showed that there were significant effects on the grain and straw yields, spiklets/spike and number of tillers/plant. While there were insignificant effects on plant height, 1000 grain weight, and panicle length with interaction between field canal options and border width (O× W).

Regarding to the interaction between border length and width (L×W) results also showed that, there were significant effects on the grain and straw yields, plant height, and panicle length and insignificant effects on number of tillers/plant, spiklets/spike and 1000 grain weight. The interactions between field canal options, border length and border width (O×L×W) results in Table 2 showed that there were significant effects on straw yield, panicle length and spiklets/spike. While, there were insignificant effects on the grain yield, plant height, number of tillers/plant and 1000 grain weight.

Water Measurements

Total amount of water applied (m^3/fed.) including rainfall (168 m^3) of wheat crop was shown in Table 3. It has been noticed that gated pipes, 60 m border length and 12 m border width received the lowest amount of irrigation water. While, traditional field ditch, 120 m border length and 24 m border width received the highest amount of irrigation water but, concrete pipes and 18 m border width display an intermediate case. Similar results were obtained by Shawky and El-Kashef (2004) and Abo Soliman *et al.* (2005). Water consumptive use (m^3/fed) generally behaved the same trend of total water amount.

Table 3. Some water measurements as affected by various options of marwas, border lengths and widths under wheat crop

Treatments	Water applied (m^3/fed)	F.W.U.E. (kg/m^3 water)		C. U. (m^3/fed)	C.W.U.E. (kg/m^3 water)		Water application efficiency %	Losses %
		grains	Straw		grains	Straw		
Field canal options								
Gated pipes	2296.4	1.41	1.87	1863.42	1.73	2.30	78.10	21.90
Concrete pipes	2401.4	1.29	1.74	1902.60	1.62	2.20	75.82	24.18
Traditional ditch	2540.0	1.17	1.61	2151.40	1.39	1.91	68.90	31.10
Border length (m)								
L 1 (60 m)	2180.3	1.45	1.95	1806.77	1.75	2.35	79.43	20.57
L 2 (120 m)	2517.4	1.20	1.65	1959.25	1.55	2.11	74.77	25.23
Border width (m)								
W 1 (12 m)	2116.8	1.50	1.98	1756.65	1.81	2.38	80.45	19.55
W 2 (18 m)	2343.2	1.42	1.85	1888.90	1.77	2.29	77.03	22.97
W 3 (24 m)	2586.6	1.08	1.57	2003.48	1.39	2.02	73.96	26.04

Field water use and crop water use efficiencies (kg/m^3) for grain and straw yields Table 3 generally take the same trend; the highest values were achieved under gated pipes, 60 m border length and 12 m border width, while the lowest values were achieved under traditional field ditch, 120 m border length and 24 m border width. Similar results were obtained by Abd El-Hafez *et al.* (1984) and El-Mowelhi *et al.* (1999a).

With regard to water application efficiency % it is worthy to mention that the gated pipes achieved the highest value (78.10%) followed by concrete pipes (75.82%), while the lowest values (68.90%) was achieved under the traditional field ditch. Concerning the border length and width it is clearly that, water application efficiency % were decreased with increasing border length and width. Results revealed that the mean values of water losses at on Farm level % were 21.90, 24.18 and 31.10 % for gated pipes, concrete pipes and traditional field ditch respectively. Similar results were obtained by Shawky and El-Kashef (2004) and Abo Soliman *et al.* (2002 and 2005). Ley *et al.* (1984) indicated that, 40% of water might be lost from unimproved field ditches. The primary disadvantage of open irrigation ditches, is that the water used remains open to the air for long periods of time, and the water in the ditches does not flow much. Great water losses can occur due to evaporation enroute to the field. Also, water generally flows into the fields and seeps into the ground slowly, remaining exposed. Application losses % were increased with increasing border length and width. Water losses % were 20.57 and 25.23% for 60 and 120 m border length and were 19.55, 22.97 and 26.04% for 12, 18 and 24 m border width, respectively.

Soybean Crop

Results in Table 4 showed that there were highly significant increases with various field canal options (gated and concrete pipes) for the seed yield, plant height, seed weight/pod, pods/plant and seeds number/pod and a significant increase for 100 seed weight. The values were higher under gated pipes and concrete pipes, respectively than traditional field ditch by about 9.0 and 7.0 %, for seed yield. The corresponding values were 0.65 and 3.04 (gm) for seed weight/pod, 14.84 and 16.49

Table 4. Soybean yield and its components as affected by various options of marwas (field canal), border lengths and widths

Treatments	Parameters					
	Seed yield (kg/fed)	Plant height (cm)	Pods per plant	Number of seeds per pod	Seeds weight per pod (gm)	100 seed weight (gm)
Field canal options						
Gated pipes	1388.79	84.21	73.67	3.03	22.43	18.64
Concrete pipes	1374.38	75.93	75.32	2.84	20.04	18.64
Traditional field ditch	1278.96	68.07	58.83	2.81	19.39	17.76
F-test	**	**	**	**	**	*
L.S.D. 0.05	61	3.44	1.45	0.103	0.88	0.67
L.S.D. 0.01	92.88	5.22	5.89	0.157	1.33	1.02
Border length (m)						
L1(60 m)	1381.92	78.46	71.35	2.94	21.29	18.36
L2 (120 m)	1312.78	73.68	67.18	2.85	19.95	18.32
F-test	**	**	ns	*	**	ns
Border width (m)						
W1 (12 m)	1350.21	76.75	68.55	2.87	20.4	18.4
W2 (18 m)	1407.96	78.3	72.88	3.05	22.12	18.76
W3 (24 m)	1283.96	73.16	66.39	2.76	19.35	17.88
F-test	**	**	*	**	**	**
L.S.D. 0.05	39.65	2.61	1.58	0.068	0.64	0.52
L.S.D. 0.01	53.17	3.49	4.19	0.091	0.85	0.7
Interactions						
O × L	ns	ns	**	ns	ns	ns
O × W	ns	ns	**	ns	Ns	Ns
L × W	ns	ns	**	ns	Ns	Ns
O × L × W	ns	ns	**	ns	Ns	Ns

for pod/plant, 0.03 and 0.22 for seeds number/pod, 16.14 and 7.86 (cm) for plant height and 0.88 and 0.88 (gm) for 100 seed weight, respectively.

Data in Table 4 showed that there was a significant increase with decreasing border lengths for the seed yield, plant height, grain weight/pod and seeds number/pod. While, there were insignificant effects on 100 seed weight and pods/plant with various border lengths. The mean values were 1382 and 1313 kg/fed of seed yield, 78.5and 73.7(cm) of plant height, 2.94 and 2.85 of seeds number/pod and 21.3 and 20 (gm) of seeds weight/pod, for 60 m and 120 m, respectively.

Results in Table 4 showed that there was a significant increase in the seed yield, plant height, seed weight/pod, pod/plant and seeds number/pod, 100 seed weight with decreasing border width. The values of seed yield were lower with 24 m than 12 m and 18 m, respectively by about 5.2 and 9.7%. The corresponding values were 5.4 and 14.3 in seed weight/pod, 3.3 and 9.8 for pod/plant, 4.0 and 10.5 for seeds number/pod, 1.0 and 1.5 for plant height and 2.9 and 4.9 for 100 seed weight.

These increments in production of soybean crop could be attributed to that under gated and concrete pipes and border length (60 m) and width (12 m) which accompanied with less water content which improves soil properties, affects water-air relationships in the root zone, and increase the amount of available nutrients, which leads to more nutrients absorption, which causes more vegetative growth and subsequently produces a higher yield. These results are in agreement with those obtained by Balasubramanian and Chari (1983).

Interactions

Table 4 show the interactions between field canal options and border length (**O×L**), field canal options and border width (**O×W**), border length and width (**L×W**) and field canal options and border length and width (**O×L×W**). Soybean crop Results, were realized insignificant effects for all parameters (Seed yield, plant height, seed weight/pod, seeds number/pod and 100 seed weight) of the studied with all interactions except that pods per plant.

Water Managements

Table 5 show that the lowest amount of water applied and water

Table 5. Some water measurements as affected by various options of marwas, border lengths and widths under soybean crop

Treatments	Water applied (m^3/fed)	F.W.U.E. (kg/m^3water)	C. U. (m^3/fed)	C.W.U.E. (kg/m^3water)	Water application efficiency %	Losses %
Field canal options						
Gated pipes	2483.6	0.56	1879.5	0.74	79.37	20.63
Concrete pipes	2864.3	0.48	1919.4	0.72	72.66	27.34
Traditional field ditch	3074.0	0.42	1986	0.64	66.85	33.15
Border length						
L 1 (60 m)	2459.0	0.56	1858.9	0.74	80.09	19.91
L 2 (120 m)	2993.9	0.44	1985.8	0.66	70.40	29.60
Border width						
W 1 (12 m)	2539.9	0.53	1806.6	0.75	76.79	23.21
W 2 (18 m)	2656.6	0.53	1902.9	0.74	76.25	23.75
W 3 (24 m)	2825.4	0.45	1988.8	0.65	74.43	25.57

consumptive use (m^3/fed) were found under gated pipes, 60 m border length and 12 m border width. While, traditional field ditch, 120 m border length and 24 m border width received the highest amount of irrigation water and water consumptive use (m^3/fed). Concrete pipes and 18 m border width display an intermediate case. Field water use and crop water use efficiencies (kg/m^3), seed yield generally take the same trend. Gated pipes achieved the highest values followed by concrete pipes, while the lowest values were achieved under the traditional field ditch. Field and crop water use efficiencies (kg/m^3) for seed yield were decreased with increasing border length and width. Similar results were obtained by Abd El-Hafez *et al.* (1984) and El-Mowelhi *et al.* (1999a)

Water application efficiency % was higher under gated pipes (79.37%) followed by concrete pipes (72.66%) and traditional field ditch was the lowest one (66.85%). It was expected that, water application efficiency would improve with gated and concrete pipe due to uniform water distribution from the outlets compared to traditional field ditch, which reduces the percolation losses (Fernandez *et al.*, 1996). Concerning border length and width, it is clearly that, water application efficiency % was decreased with increasing border length and width. Results revealed that the mean values of water losses at on farm level % were 20.63, 27.34 and 33.15 % for gated pipes, concrete pipes and traditional field ditch respectively. In this concern, Osman (2000) reported that, water saving was (12 and 29.2%) for cotton and wheat by using gated pipe irrigation technique compared with traditional system. Water losses % were increased with increasing border length and width, the values were 19.91 and 29.60 % for 60 and 120 m border length and were 23.21, 23.75 and 25.57 % for 12, 18 and 24 m border width, respectively.

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تأثير إدارة الرى الحقلى على بعض كفاءات الري والإنتاجية لمحصولي القمح وفول الصويا

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أجريت تجربتين حقليتين فى المزرعة التجريبية بمحطة البحوث الزراعية بسخا خلال الموسم الشتوى ٢٠٠٦/٢٠٠٥ والموسم الصيفى٢٠٠٦ وذلك لدراسة تأثير نماذج مختلفة من المراوى الحقلية (المواسير المبوبه و الأسمنتية والقنوات الحقلية التقليدية) وطول الشريحه (٦٠ و ١٢٠ متر) وعرض الشريحة (١٢ و١٨ و ٢٤ متر) على بعض الكفاءات والإنتاجية لمحصوليى القمح وفول الصويا. وصممت التجربة بطريقة القطع المنشقه مرتين واربع مكررات.

وتشير النتائج الى زيادة إنتاج محصوليى القمح وفول الصويا من الحبوب نتيجة استخدام المواسير المبوبة والأسمنتية فى الرى وايضا نتيجة النقص فى طول وعرض الشريحة. حيث زاد إنتاج الحبوب مع المواسير المبوبه والأسمنتية على التوالي بمقدار ٨,٠ ، ٣,٠% لمحصول القمح وبمقدار ٩,٠ ، ٧,٠% لمحصول فول الصويا مقارنة بالقنوات الحقلية التقليدية. وكانت القيم المماثله فى إنتاج قش القمح ٥,٠ ، ٢,٠%. وتشير النتائج ايضا ان طول الشريحة ٦٠ متر وعرض الشريحة ١٨ متر على التوالى أدى إلى زيادة إنتاج حبوب القمح بمقدار ٥,٠ ، ١٩,٧٣% وزيادة إنتاج بذور فول الصويا بمقدار ٥,٠ ، ٩,٧% مقارنة بطول الشريحة ١٢٠ متر وعرض الشريحة ٢٤ متر.

أما نتيجة التفاعل المشترك بين نماذج القنوات الحقلية وطول الشريحه وأيضا التفاعل بين نماذج القنوات الحقلية وعرض الشريحة وأيضا التفاعل بين طول وعرض الشريحة كانت معنوية فى إنتاج القمح من الحبوب والقش. ونتيجة التفاعل المشترك بين كل من نماذج القنوات الحقلية وطول وعرض الشريحة كانت معنويه فى إنتاج القمح من

القش. امابالنسبة لمحصول فول الصويا وجد أن جميع التفاعلات المشتركة لكل المكونات المدروسة غير معنوية فيما عدا عدد القرون للنبات حيث كانت معنوية.

وتشير النتائج الى ان اقل الكميات في مياه الري المضافة إلى الحقل وفى الاستهلاك المائي وفى الفواقد المائية على مستوى الحقل وجدت مع المواسير المبوبه وطول الشريحة ٦٠ متر وعرض الشريحة ١٢ متر. وأيضا أعلى قيم لكفاءات مياه الرى المضافة والمستهلكة بواسطة النبات واعلى نسبه منوية لكفاءة الري التطبيقية تحققت مع المواسير المبوبه وطول الشريحة ٦٠ متر وعرض الشريحة ١٢ متر. بينما القنوات الحقلية التقليدية وطول الشريحة ١٢٠ متر وعرض الشريحة ٢٤ متر أخذت أعلى الكميات في مياه الري المضافة وفى الاستهلاك المائي وفى ألنسبه المنوية للفواقد المائية على مستوى الحقل. وأيضا اقل قيم لكفاءات المياه المضافة والمستخدمة بواسطة النبات وكفاءة الري ألتطبيقيه تحققت مع القنوات الحقلية التقليدية وطول الشريحة ١٢٠ متر وعرض الشريحة ٢٤ متر. وأوضحت النتائج أن استخدام المواسير المبوبة والأسمنتية فى رى القمح أدى إلى توفير مياه الرى بمقدار ٩,٢ ، ٦,٨٢ % بينما كان التوفير في مياه الري ٥.٨١،١٢,٥٢ % لمحصول فول الصويا على التوالى مقارنة بالقنوات الحقلية التقليدية. وطول الشريحة ٦٠ متر وعرض ١٢ متر أدى إلى توفير ٤,٦٦، ٦,٤٩ % في مياه الري مع محصول القمح مقارنة بطول الشريحة ١٢٠ متر وعرض الشريحة ٢٤ متر على التوالي بينما مع محصول فول الصويا كان مقدار التوفير في مياه الري حوالي ٩,٦٩، ٢,٣٦%.