J. Agric. Sci. Mansoura Univ., 31 (2): 573 - 586 , 2006

EFFECT OF SOWING METHODS AND IRRIGATION INTERVALS ON SOME WHEAT VARIETIES GROWN UNDER SALINE CONDITIONS AT SOUTH SINAI.

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ABSTRACT

Two field experiments were conducted during 2003 / 2004 and 2004 / 2005 seasons, under saline conditions at Wadi Sudr Research Station, South Sinai, D.R.C., Egypt, to study the effect of irrigation intervals (7, 12 and 17 days), sowing methods (Broadcasting, rows and furrows) on yield and yield components of wheat varieties (Sakha, 93 and Sakha 69). The results could be summarized as follows :

1. Significant differences were detected between irrigation treatments. Irrigation every 7 days significantly increased wheat yield and its components.
2. Sowing methods showed a significant effect on all studied characters. Also, the salt tolerance of wheat increased by sowing grains on double sloping beds of furrows.
3. Wheat varieties markedly differed in their salt tolerance. Sakha 93 variety significantly surpassed Sakha 69 for all studied characters in both seasons except for plant height under saline irrigation.
4. Pseudo, No. of tillers / plant, spike length, no. of spike lets/ spike, No. of grains / spike, grain weight / spike, 1000-grain weight, No. of spike / m^2 and grain yield / fed. were significantly affected by the interaction between irrigation intervals and sowing methods in the first season. While No. of grains/ spike, No. of spikes / m2, biological yield / fed. and protein % were significantly affected by this interaction in the second season.
5. The effect of interaction between irrigation intervals and wheat varieties significantly affected No. of tillers / plant, No. of spikelets / spike, grain weight / spike, grain weight/ plant, 1000 grain weight, grain yield / fed., straw yield / fed., biological yield / fed. and protein % in the first season. Also, that interaction had a significant effect on plant height, grain weight / plant, grain yield / fed. straw yield / fed., biological yield / fed. and protein % in the second season.
6. The effect of interaction between sowing methods and wheat varieties had significant effect on No. of spikelets / spike, No. of grains / spike, 1000-grain weight and protein % in the first season. Similarly, plant height, grain weight / plant, straw yield / fed. and protein % were significantly affected in the second season
7. The second order interaction of irrigation intervals, sowing methods and wheat varieties was significant on No. of spikelets / spike grain weight / spike, grain weight / plant, 1000 – grain weight, straw yield / fed., biological yield / fed. and protein % in the first season. Plant height, straw yield / fed., biological yield / fed. and protein % were significantly affected by this kind of interaction in the second season . Moreover sowing wheat cultivars on furrows became more adapted to saline irrigation water.

Keywords: Wheat,Wadi Suder – South Sainai – Egypt, Saline conditions, Irrigation intervals, Sowing methods, Varieties, Yield and yield components –.

INTRODUCTION

Wheat is a staple feed in Egypt. Raising wheat production through increasing unit land area and increasing the cultivated area are the most important national targets to minimize the gap between the Egyptian

production and consumption. Increasing wheat yield per unit area can be achieved by breeding high yielding varieties. Salinity is considered of the major obstacles in Wadi Sudr to increase wheat production. However, there are ways to salinity control, in other words we can not erase salinity but we can live with it i.e. cultural practices, land smoothing or grading, grading seed bed improvement, irrigation intervals, sowing methods and cultivars selection. Most of these areas are desert and have limited quantity and quality of irrigation water. Many researchers have proved the importance of irrigation treatment to maximize wheat productivity. In Egypt, sowing wheat crop by broadcasting or drill in rows are common practices. Whereas, sowing wheat grains on sloping of furrows is not acquainted for Egyptian farmers to belief a busy word load. However, it may be needed under saline irrigation water to salinity control by salt immigration to the top or leaching of salts in the bottom of furrows which were discussed by World Farming (1971), Bernstein *et al.*, (1975) and Ayers and Westcot (1981). On the other hand, Sadek (2001) obtained the heighest grain yield from the shortest irrigation interval of 10 days which increased by 30% than that obtained by irrigation every 14 days during the growth season.

Considerable research has been conducted on the salt tolerance of various wheat cultivars, which differed in yield and its components [Francois *et al.*, (1986), Weimberg, (1987) Hassan (1989) and Hassan and Hassan (1994)]. The capability of crops to grow in saline soils varies among species and depends on the concentration of salts present in the root zone and on various environmental and cultural conditions (Shannon *et al.*, 1994). Excessive soil salinity (salt) reduces the yield of many crops. This may range from a slight loss to complete crop failure, depending on the crop and the severity of the salinity problem. Several treatments and management practices can reduce the salt level in the soil. The aim of this investigation is to study the response of some wheat varieties, yield and yield components, to sowing methods and irrigation intervals under saline conditions at Wadi Sudr, South Sinai.

MATERIALS AND METHODS

Two field experiments were carried out at Wadi Sudr Research Stations, Desert Research Center, South Sinai, Egypt, during two successive seasons of 2003 / 2004 and 2004/ 2005. The aim of the study was investigate the irrigation intervals,(7, 12 and 17 days) sowing methods, (broadcasting, drilled in rows and on double row sloping bed of furrow) on yield and yield components of some wheat varieties, *(Triticum aestivum vulgar)* namely: Sakha 93 and Sakha 69 under saline conditions. Before sowing physical and chemical analysis of the soil were determined (Black 1965 and Jackson (1958), and the results are presented in (Table,1). Water analysis was performed to determine the used for irrigation (Table 2).Wheat grain were sown on 21 of November, 2003 and 24 of November, 2004 at seeding rate of 80 Kg/fed. for the two successive growth seasons, respectively . Grain of two wheat varieties were soaked with tap water for 12 hours before planting.

Table (1): Physical and chemical properties of the soils before and after sowing of the Experimental soil at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005).

A. Physical properties.

soil treatments	Mechanical composition (%)					Ec ds/m	pH	$CaCO_3$ %	O.M. (%)
	Depth soil (cm)	coarse sand	Fine sand	Silt	clay				
Before sowing	0-30	41.24	40.60	9.68	13.11	12.26	7.81	53.31	0.23
	30-60	38.31	44.31	12.83	8.17	11.40	7.93	52.24	0.21
After sowing B.castings	0-30	41.00	40.38	9.31	14.84	12.47	7.75	51.00	0.24
	30-60	38.11	43.75	12.74	9.75	11.83	8.21	49.34	0.20
After sowing Rows	0-30	39.83	40.52	10.80	13.63	13.91	7.90	50.24	0.23
	30-60	38.00	42.88	12.65	9.12	12.42	8.10	49.11	0.18
After sowing Furrows	0-30	41.73	40.35	9.45	13.00	10.35	7.88	51.35	0.24
	30-60	38.54	44.52	12.81	9.17	12.92	8.00	49.22	0.17

B. Chemical properties.

Soil treatments	Depth soil (cm)	Soluble cations (meq/L.)				Soluble anions (meq/L.)			
		Ca++	Mg++	Na+	K+	$Co3^-$	HCo_3^-	Cl^-	$SO4^-$
Before sowing	0-30	61.78	51.17	79.54	3.56	-	15.38	92.81	69.41
	30-60	19.34	12.78	41.70	1.53	-	2.33	30.42	48.30
After sowing B.castings	0-30	62.58	52.11	78.52	3.41	-	15.54	95.52	73.54
	30-60	18.73	11.24	42.74	1.61	-	2.33	31.84	48.21
After sowing Rows	0-30	63.41	53.30	80.83	4.84	-	14.87	97.32	71.82
	30-60	19.80	15.11	44.62	1.75	-	2.48	33.74	52.75
After sowing Furrows	0-30	58.20	46.73	61.79	3.32	-	15.19	78.27	61.88
	30-60	20.34	15.00	42.80	1.75	-	2.53	35.11	49.45

Table (2): Chemical properties of irrigation water at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005).

Seasons	Ec ds/m	pH value	SAR	T.D.S. (ppm)	Cations (meq/ L.)				Anione (meq/ L.)			
					Ca^{2+}	Mg^{2+}	Na^+	K^+	CO_3^-	Cl^-	HCo_3^-	SO_4^{-2}
2003/ 2004	5.72	7.93	8.33	3661	14.11	15.58	32.11	0.72	-	60.17	1.85	5.82
2004/ 2005	6.25	8.00	7.10	4000	17.20	19.11	30.27	0.30	-	62.10	1.73	3.62

Organic matter as farmyard manure (FYM) at the rate of $20m^3$/ fed. was mixed with the upper layer (30 cm depth) of the soil before cultivation, (Table 3). Calcium super phosphate (15.5% P_2O_5) was added at the rate of 150 kg/fed. during soil preparation. Nitrogen fertilization as ammonium nitrate (33.5% N) was applied at the rate of 100 kg N/fed.in three equal doses (at sowing, 30 and 45 days after sowing date), while potassium fertilization was applied at the rate of 24 kg K_2O/ fed. in two equal doses (after 30 and 45 days form planting date) .Split split plot design with four replicates was used in such experiments in both seasons. The main plots represented irrigation intervals, sub-plots represented treatments of sowing methods, while wheat varieties were allocated in sub-sub plots. The sub-sub plot area was $9m^2$ (3x 3 m) containing 10 rows (3m long and 30 cm apart) in the two former sowing methods.

Table (3): Chemical content of organic manure at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005) .

pH	Organic carbon %	Total nitrogen %	C/N Ratio	Total phosphorus %	Total potassium %	Total sulphate %
7.42	19.88	1.40	14.2	0.25	1.35	1.31

At harvest, after 165 days, plant height (cm) , No. of tillers/ plant, spike length (cm). No. of spikelets / spike, No. of grains / spike, grain weight / spike (g), grain weight / plant (g), 1000 – grain weight (g) No. of spikes / m^2 , grain yield, ton / fed., straw yield, ton / fed., biological yield , ton / fed., harvest index as well were recorded (fed. = 4200m^2). The micro-kjeldahl method was used to determine grain nitrogen content which was multiplied by factor 5.75 to obtain the percentage of crude protein according to A.O.A.C.(1980).

Data were statistically analyzed according to the methods of the analysis of variance. Least significant difference (LSD) was calculated as described by (Steel and Torrie, 1980) to detect the differences among treatment means.

RESULT AND DISCUSSION

1. Effect of irrigation intervals :

Data in Table (4) revealed that studied characters i.e. plant height, No. of tillers / plant , spike length, No. of spikelets/ spike, No. of grains / spike, grain weight / spike, grain weight / plant, 1000 – grain weight, No. of spike / m^2, grain yield / fed., straw yield / fed. biological yield / fed. and harvest index were significantly affected by irrigation intervals under saline conditions at Wadi Sudr in the two seasons. The decrease in grain yield / fed. due to irrigation every 12 and 17 days compared with 7 days , were 23.5% and 39.7% in 2003 / 2004 season being 21.6% and 36.5% in 2004/ 2005 season, respectively. Increasing irrigation intervals to 17 days reduced the different growth characters and grain yield. This may by reduce the capacity of plant in building up metabolites and this might account in turn to depression of photosynthetic efficiency of the leaves with consequent reduction in yield of wheat and its components. So, irrigation must take place at 7 days intervals to remove salt ions from the upper layer of the soil. Similar results were reported by Abd El-Rahim *et al.*, (1989), Fardad and Passarakli (1995) and Sadek (2001) .

2. Effect of sowing methods :

Data in Table (5) indicated that, the effect of sowing methods on yield and yield components. All the studied parameter were positively and significantly. Sowing wheat grain on sloping of furrows or rows significantly increased spike length, No. of spikelets / spike, No., of grains / spike, grain weight / spike , 1000-grain weight, No. of spikes / m^2 , grain yield / fed., straw yield / fed., biolcgical yield / fed., harvest index and protein %. On the other hand, sowing wheat grains on sloping of furrow or broadcasting significantly increased plant height , No. of tillers, / plant and grain weight / plant for both seasons. The highest biological yield (grain yield and straw yield) was obtained with sowing wheat grains on sloping of furrows.

Table (4): Yield and yield components of wheat as influenced by irrigation intervals under saline conditions at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments / Irrigation intervals	Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
First Seasons (2003/ 2004)														
7 days	72.5	3.45	9.1	16.3	41.5	1.56	3.54	39.60	474.4	1.508	2.453	3.961	0.381	13.48
12 days	67.0	3.32	8.6	14.3	37.4	1.35	2.78	37.22	435.6	1.182	2.061	3.243	0.364	12.42
17 days	64.5	3.10	7.7	12.8	35.4	1.25	2.35	36.72	385.3	0.942	1.747	2.689	0.350	10.88
L.S.D.	2.721	0.153	0.402	0.108	0.645	0.029	0.228	0.174	36.880	0.082	0.179	0.262	0.009	0.124
Second Seasons (2004/ 2005)														
7 days	66.2	2.91	8.2	15.9	36.8	1.42	4.15	39.03	422.0	1.483	2.337	3.820	0.388	12.84
12 days	62.0	2.69	7.6	14.2	32.5	1.15	3.12	36.31	384.8	1.135	1.944	3.079	0.369	11.71
17 days	59.0	2.46	6.5	12.3	30.4	1.07	2.66	35.38	334.2	0.894	1.627	2.521	0.355	10.30
L.S.D.	2.667	0.319	0.741	0.812	2.143	0.072	0.340	1.100	38.420	0.083	0.178	0.190	0.003	0.029

L.S.D.at 0.05 level.

Table (5): Yield and yield components of wheat as influenced by sowing methods under saline conditions at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments / Sowing methods	Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
First Seasons (2003/ 2004)														
Furrows	63.5	3.40	8.7	15.4	41.2	1.54	3.40	39.70	458.8	1.395	2.377	3.772	0.370	12.75
Rows	68.0	2.94	8.6	14.6	38.0	1.37	2.40	37.50	430.4	1.209	2.079	3.288	0.368	12.25
B. casting	72.6	3.53	8.2	13.8	35.2	1.25	2.87	36.34	406.1	1.028	1.804	2.833	0.361	11.77
L.S.D.	1.826	0.109	0.122	0.0851	0.469	0.007	0.156	0.211	11.209	0.051	0.097	0.144	0.007	0.060
Second Seasons (2004/ 2005)														
Furrows	58.4	2.61	7.6	15.1	36.5	1.39	3.66	38.26	407.6	1.345	2.260	3.605	0.373	12.08
Rows	62.1	2.46	7.5	14.1	33.1	1.21	2.95	36.76	379.3	1.164	1.963	3.127	0.372	11.61
B. casting	66.7	3.00	7.1	13.3	30.2	1.05	3.31	35.71	354.8	0.984	1.684	2.668	0.369	11.16
L.S.D.	1.322	0.164	0.122	0.380	0.785	0.040	0.529	0.460	11.400	0.056	0.097	0.151	0.002	0.002

L.S.D.at 0.05 level.

B. casting = Broad casting

Which was increased by 10.80%, 35.70 % and 14.33%, 31.76 in first season as well as15.55%, 36.69% and 10.13%, 34.20% in second season for grain yield and straw yield than of rows and broadcasting treatments respectively. While, No. of plants m^2 was decreased significantly with planting on rows and broadcasting. These results are in harmony with those obtained by Zeidan *et al.*(1990) and Maheshwari and Sharma(2002). It can be noticed that the most spikes, in case of furrows methods were produced from the main stem , whereas, in case of broadcasting they were produced from tillers. This indicate that the salt tolerance of wheat was increased with sowed grains on double sloping beds of furrows. Hassan and Hassan (1994) found that the salt tolerance of wheat increased with sowed grains on the double sloping beds of furrows.

3. Effect of wheat varieties :

Data in Table (6) show that studied characters were significantly affected by different varieties (Sakha 93 and Sakha 69) in both seasons. The highest values for No. of tillers / plant , spike length, No of spikelets/ spike, No. of grains / spike, grain weight / spike, grain weight / plant, 1000-grain weight , No. of spikes / m^2, grain yield / fed., straw yield / fed., biological yield / fed., harvest index and protein % were produced by sakha 93 variety. It could be noticed that grain and straw yield / fed. of Sakha 93 were increased by 14.4% and 11.4% respectively over sakha 69 in first season being 14.1% and 10.7% in second season respectively. These results may be due to the differences among studied cultivars in growth habit i.e., plant elongation and tillering which reflects on plant height, No. of tillers / plant and No. of spikes/ m2. The present findings may explain the genetic variability among studied cultivars and response of each one to environmental conditions during growing season. These results are in a full agreement with Duwayrie (1984) who Studied the yield of wheat CVs. "Hourant, wascana, and stroks" and spring wheat CV. "Pvan 76"under salinity and found that C.V. "Strok" produced the highest grain yield while C.V. "Hourant" produced the lowest grain yield. Francois *et al.*, (1986), found that grain yield of one semidwarf wheat variety (Northrup king probred) and two durum cultivars (Westbred 1000-D and Northrup king Aldura) were not affected by soil salinity up to 8.6 and 5.9 ds/m, while Hassan and Hassan (1994) working on four wheat varieties, Sakha 8, Sakha 92, Sohag1 and Sohag2, reported that Sohag 1 and Sohag 2 were more salt tolerant than those of Sakha 8 and Sakha 92 as indicated from their vegetative growth characters, yield and yield attributes. Generally, in the two seasons, Sakha 93 were more salt tolerant than Sakha 69 as indicated from yield and yield components. Sakha 93 gave significantly higher grain yield than Sakha 69. Differences in yield among the varieties were due to plant height, No. of tillers/plant, 1000- grain weight and No. of spikes /m^2.

4.Effect of the interaction between irrigation intervals and sowing methods :

The results in Table (7) indicate that, the interaction between irrigation intervals (7, 12 and 17 days) and the different sowing methods (Furrows, rows and Broadcasting) increased significantly.

Table (6): Yield and yield components of wheat as influenced by wheat varieties under saline conditions at Wadi Sudr during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments Wheat varieties	Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight/ spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
First Seasons (2003/ 2004)														
Sakha 69	68.9	3.21	8.3	14.2	37.1	1.33	2.63	37.20	420.4	1.131	1.982	3.113	0.363	12.11
Sakha 93	67.1	3.37	8.6	15.0	39.2	1.44	3.15	38.49	443.1	1.290	2.192	3.482	0.588	12.45
L.S.D.	1.405	0.078	0.096	0.082	0.237	0.006	0.040	0.151	5.050	0.025	0.025	0.047	0.006	0.014
Second Seasons (2004/ 2005)														
Sakha 69	63.7	2.62	7.3	13.7	32.2	1.15	3.07	36.22	369.2	1.087	1.863	2.950	0.368	11.44
Sakha 93	61.0	2.76	7.5	14.6	34.3	1.27	3.54	37.60	391.9	1.244	2.075	3.319	0.375	11.79
L.S.D.	0.387	0.082	0.106	0.161	0.286	0.018	0.044	0.344	5.036	0.025	0.031	0.069	0.006	0.002

L.S.D.at 0.05 level.

Table (7): Effect of the interaction between irrigation intervals and sowing methods on yield and yield components of wheat under saline conditions at Wadi Surd during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments Irrigation intervals	Sowing methods	Plant height (cm)	No. of tillers / plant	Spike length (cm)	No.of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No.of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
First Seasons (2003/ 2004)															
7 days	Furrows	69.40	3.49	9.1	17.0	45.3	1.74	4.12	40.80	498.82	1.726	2.776	4.502	0.383	13.94
	Rows	71.68	3.02	9.5	16.3	41.5	1.55	2.91	39.57	466.42	1.537	2.494	4.021	0.380	13.44
	B.casting	76.35	3.83	8.8	15.6	37.8	1.40	3.60	38.43	457.97	1.271	2.088	3.359	0.380	13.04
12 days	Furrows	61.35	3.43	8.9	15.7	40.38	1.51	3.31	39.68	475.13	1.381	2.392	3.773	0.366	12.92
	½ Rows	68.28	2.94	8.6	14.6	37.3	1.32	2.28	36.42	431.88	1.162	2.012	3.175	0.366	12.42
	B.casting	71.47	3.59	8.2	13.9	34.7	1.22	2.75	35.57	399.68	1.002	1.777	2.779	0.360	11.91
17 days	Furrows	59.65	3.27	8.0	13.6	38.0	1.37	2.78	38.62	402.60	1.077	1.962	3.040	0.355	11.40
	½ Rows	64.03	2.85	7.7	12.9	35.0	1.25	2.01	36.52	392.80	0.937	1.731	2.668	0.353	10.88
	B.casting	69.92	3.17	7.5	12.0	33.0	1.12	2.25	35.02	360.50	0.812	1.548	2.360	0.345	10.36
L.S.D.		N.S.	0.281	0.208	0.652	1.355	0.068	N.S	0.789	19.609	0.097	N.S.	N.S.	N.S.	N.S
Second Seasons (2004/ 2005)															
7 days	Furrows	63.1	2.57	8.5	16.7	39.0	1.53	4.11	39.98	447.0	1.682	2.660	4.342	0.387	13.30
	Rows	65.5	2.56	8.1	15.8	36.7	1.42	2.91	38.96	414.9	1.483	2.378	3.861	0.384	12.84
	B.casting	70.0	2.83	7.9	15.2	32.7	1.22	3.60	38.16	406.0	1.227	1.972	3.199	0.383	12.37
12 days	Furrows	58.4	2.48	7.9	15.3	35.7	1.33	3.31	37.81	424.4	1.330	2.275	3.605	0.369	12.20
	Rows	62.1	1.94	7.6	14.1	32.0	1.13	2.28	36.18	381.0	1.118	1.896	3.014	0.371	11.71
	B.casting	65.7	2.59	7.2	13.3	29.9	1.01	2.75	34.95	349.0	0.957	1.661	2.618	0.365	11.24
17 days	Furrows	53.7	2.27	6.7	13.2	32.7	1.19	2.78	36.98	351.4	1.033	1.846	2.879	0.359	10.74
	Rows	58.8	1.85	6.5	12.3	30.5	1.05	2.01	35.13	341.8	0.891	1.614	2.505	0.356	10.28
	B.casting	64.5	2.34	6.2	11.5	28.0	0.950	2.25	34.03	309.3	0.767	1.420	2.187	0.351	9.86
L.S.D.		N.S	N.S.	N.S.	N.S.	1.368	N.S.	N.S.	N.S.	19.810	N.S.	N.S.	0.261	N.S.	0.008

L.S.D.at 0.05 level B. casting = Broad casting

Pseudo, No. of tillers/ plant, spike length, No. of spikelets/ spike , No. of spikes/ m^2, and grain yield / fed. in the first season. Also, the same results were found concerning No. of grain / spike, No. of spike/m^2, biological yield / fed. and protein % in the second season. The greatest grain yield / fed. was obtained by irrigation intervals 7 days and sowing method of furrows. Favorable soil moisture (7day irrigation interval) increased the number of functioning green leaves and the amounts of metabolites synthesized by plants as well as the potentiality of plants in shifting metabolites to the growing areas which mostly accompanied with an increase in the number and width of the translocated vascular elements. Moreover sowing wheat on furrows become more adapted to saline irrigation water. These results may be attributed to improvement of seed bed and / or more tolerate to saline irrigation water.

5. Effect of the interaction between irrigation intervals and wheat varieties .

Data represented in Table (8) indicate that the effect of the interaction between irrigation intervals and wheat varieties on yield and yield component. It can be noticed that, in the first season, it's clear that significantly in all of the studied traits except plant height, spike length, No. of grains / spike , No. of spikes/ m^2, harvest index and protein %. While, the second season, plant height, grain weight / plant, grain yield/fed., straw yield/ fed., biological yield / fed. and protein % were significantly increased in wheat varieties Sakha 93 and sakha 69. On the other hand, No. of tillers / plant, spike length, No. of spikelets / spike, No. of grains / spike, grain weight / spike ,1000-grain weight, No. of spikes / m^2 and harvest index don't affected significantly by this interaction. Therefore, the highest values of such parameters were attained at 7 days irrigation intervals and Sakha 93 in the first season, 71.18 tillers/plant, 16.48 spikelets/ spike, 1.63 (g) grain spike, 3.88 (g) grain plant, 40.08 (g) 1000 – grain weight 1.62 ton, grain yield/fed., 2.60 ton, straw yield /fed. and 4.22 ton, biological yield /fed. As well as characters,65.0 (cm) plant height, 4.44 (g) grain plant, 1.57 ton grain/fed. 2.49 ton, straw yield /fed. and 4.06 ton, biological yield /fed. In the second season. It could be concluded that in sandy soils under salinity conditions of Wadi Sudr increasing irrigation intervals 7, 12 and 17 days reduced the vegetative growth and grain yield, so, irrigation must take place at 7 days intervals to remove salt ions from the upper layer of the soil. While, these differences between varieties under different irrigation intervals treatments may be due to the differences in their genotypes, Sakha 93 cultivar to salt tolerance more than Sakha 69. These results are in harmony with those recorded by Blum *et al.*, (1989) and Bakheit *et al.*, (1994).

6. Effect of interaction between sowing methods and Wheat varieties :

Data recorded in Table (9) represent the effect of the interaction between sowing methods and wheat varieties. Wheat grains on sloping of furrows significantly increased No. of spikelets / spike, No. of grains / spike and 1000-grain weight and protein % were increased in the first seasons, while, plant height, grain weight / plant, straw yield / fed. and protein % were increased in the second season.

Table (8): Effect of the interaction between irrigation intervals and wheat varieties on yield and yield components of wheat under saline conditions at Wadi Surd during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments		Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
Irrigation intervals	Wheat varieties														
First Seasons (2003/ 2004)															
7 days	Sakha69	73.8	3.33	9.0	16.1	40.6	1.50	3.21	39.12	461.3	1.399	2.303	3.702	0.378	13.35
	Sakha93	71.2	3.56	9.3	16..5	42..5	1.63	3.88	40.08	487.5	1.617	2.603	4.220	0.384	13.61
12 days	Sakha69	67.0	3.20	8.4	14..2	36..3	1.30	2.51	36.66	423.2	1.104	1.971	3.075	0.358	12.26
	Sakha93	67.0	3.44	8.7	15..3	38..5	1.40	3.05	37.79	447.9	1.259	2.150	3.409	0.369	12.57
17 days	Sakha69	66.1	3.10	7.5	12..3	34..3	1.20	2.18	35.82	376.6	0.890	1.673	2.563	0.348	10.59
	Sakha93	63.0	3.10	7.9	13..4	36.4	1.30	2.53	37.61	394.0	0.994	1.822	2.816	0.352	11.17
L.S.D.		N.S.	0.142	N.S.	0.279	N.S.	0.031	0.076	0.596	N.S.	0.043	0.054	0.120	N.S.	0.076
Second Seasons (2004/ 2005)															
7 days	Sakha69	67.4	2.33	8.1	15.5	35.7	1.35	3.86	38.28	376.3	1.355	2.187	3.542		12.69
	Sakha93	65.0	2.56	8.3	16.3	37.9	1.48	4.44	39.80	402.4	1.573	2.487	4.06	0.387	12.98
12 days	Sakha69	63.1	2.20	7.4	13.7	31.4	1.11	2.87	35.27	339.2	1.060	1.855	2.915	0.346	11.57
	Sakha93	61.1	2.44	7.7	14.8	33.6	1.21	3.36	36.87	363.7	1.210	2.034	3.244	0.373	11.86
17 days	Sakha69	60.9	2.10	6.3	11.8	29.5	1.01	2.48	34.62	290.1	0.849	1.548	2.394	0.355	10.06
	Sakha93	57.1	2.21	6.7	12.9	31.4	1.12	2.83	36.15	309.6	0.949	1.705	2.654	0.357	10.53
L.S.D.		0.678	N.S.	N.S.	N.S.	N.S.	N.S.	0.077	N.S.	N.S.	0.044	0.054	0.121	N.S.	0.003

L.S.D.at 0.05 level

Table (9): Effect of the interaction between sowing methods and wheat varieties on yield and yield components of wheat under saline conditions at Wadi Surd during the two seasons (2003/ 2004 and 2004/ 2005).

Treatments		Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
Sowing methods	Wheat varieties														
First Seasons (2003/ 2004)															
Furrows	Sakha69	63.7	3.31	8.5	15.1	40.4	1.49	3.13	39.20	446.4	1.320	2.292	3.612	0.365	12.59
	Sakha93	63.3	3.49	8.8	15.7	42.0	1.59	3.67	40.20	471.3	1.470	2.462	3.932	0.374	12.92
Rows	Sakha69	69.1	2.84	8.5	14.2	37.0	1.32	2.17	36.72	421.0	1.127	1.978	3.105	0.363	11.99
	Sakha93	66.9	3.03	8.7	15.1	39.0	1.43	2.63	38.28	439.7	1.291	2.180	3.471	0.372	12.51
Broad	Sakha69	74.1	3.49	8.0	13.3	33.9	1.89	2.58	35.68	393.8	0.947	1.676	2.623	0.361	11.62
casting	Sakha93	71.1	3.57	8.3	14.3	36.5	1.30	3.16	37.00	418.3	1.110	1.932	3.042	0.365	11.92
L.S.D.		N.S.	N.S.	N.S.	0.279	0.496	N.S.	N.S.	0.596	N.S.	N.S.	N.S.	N.S.	N.S.	0.076
Second Seasons (2004/ 2005)															
Furrows	Sakha69	59.6	2.31	7.6	14.7	35.5	1.35	3.13	37.69	359.9	1.269	2.175	3.444	0.368	11.92
	Sakha93	57.2	2.47	7.8	15.5	37.4	1.46	3.67	38.83	386.7	1.421	2.345	3.766	0.377	12.24
Rows	Sakha69	63.1	1.84	7.3	13.6	32.1	1.17	2.17	36.07	336.6	1.083	1.862	2.945	0.368	11.35
	Sakha93	61.0	2.03	7.5	14.6	34.1	1.28	2.63	37.46	355.6	1.245	2.064	3.309	0.376	11.87
Broad	Sakha69	68.5	2.49	7.0	12.8	29.1	1.03	2.58	34.91	309.1	0.902	1.553	2.455	0.367	11.04
casting	Sakha93	64.9	2.69	7.3	13.9	31.4	1.16	3.15	36.52	333.8	1.065	1.816	2.881	0.370	11.27
L.S.D.		0.677	N.S.	N.S.	N.S.	N.S.	N.S.	0.077	N.S.	N.S.	N.S.	0.054	N.S.	N.S.	0.003

L.S.D.at 0.05 level B. casting = Broad casting

Sakha 93 were more salt tolerant than Sakha 69 as indicated from yield and yield components. Moreover sowing wheat cultivars on furrows become more adapted to saline irrigation water under saline conditions Whereas, No. of spikes / m^2 decreased significantly with broadcasting. On the other hand, sowing Sakha 93 in furrows produced the highest values of grain and straw yields/fed. under saline conditions. These findings may be due to the competition between plants under furrows sowing method and / or the short period of plant development of Sakha 93, especially under saline conditions. This result is similar with that obtained by Francois *et al.*, (1986), Weimberg, (1987) and Hassan and Hassan (1994) .

7.Effect of the interaction between irrigation intervals, sowing methods and wheat varieties:

Results in Table (10) indicate that the studied traits were significantly affected by the interaction between irrigation intervals, sowing methods and wheat varieties. In the first season, characters of No. of spikelets/ spike, grain weight / spike, grain weight / plant, 1000-grain weight / straw yield /fed., biological yield / fed. and protein % . were significantly affected by this interaction. While the characters of plant height, straw yield/ fed., biological yield /fed. and protein % were significantly affected in the second season. The greatest grain and straw yields / fed. were obtained by drilling Sakha 93 grains at irrigation intervals every 7 days and planting on furrows. It could be concluded that, in sandy soils under saline conditions in Wadi Sudr, increasing irrigation intervals from 7 days and slopping of furrows reduced vegetative growth and grain yield of wheat, so, irrigation should take place at 7days intervals to remove salt ions from the upper layer of the soil. Generally, higher mean values for all characters were detected in first season. It could be concluded that the increase in grain yield /fed in the first season may be due to the increase of No. of tillers /plant, 1000 grain weight and No. of spikes /m^2.This result may be due to increase of with drawer of underground water and perception in the first year than the second.

Recommendation

From all previous results, it appears clearly that Sakha 93 wheat cultivars with irrigation intervals 7 days and sowing methods, furrows could be recommended as the best treatment for raising wheat production under saline conditions at Wadi Sudr, South Sinai.

Table (10): Effect of interaction among irrigation intervals, sowing methods and wheat varieties on yield and yield components of wheat under saline conditions at Wadi Sudr during the two seasons (2003/2004 and 2004/ 2005).

Treatments			Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
Irrigation intervals	Sowing methods	Wheat varieties														
First Seasons (2003/ 2004)																
7 days	Furrows	Sakha69	70.8	3.36	9.0	17.0	17.00	1.70	3.77	40.30	487.4	1.628	2.674	0.378	4.302	13.92
		Sakha93	68.0	3.62	9.2	16.9	16.93	1.78	4.46	41.30	510.3	1.825	2.878	0.388	4.703	13.97
	Rows	Sakha69	72.8	2.93	9.4	16.1	16.10	1.49	2.66	39.10	452.5	1.432	2.373	0.376	3.805	13.11
		Sakha93	70.6	3.11	9.6	16.5	16.50	1.61	3.17	40.03	480.4	1.623	2.615	0.383	4.238	13.78
	B.casting	Sakha69	77.8	3.71	8.7	15.2	15.20	1.31	3.20	37.97	444.2	1.139	1.862	0.379	3.001	13.01
		Sakha93	74.9	3.95	9.0	16.0	16.00	1 49	4.00	38.90	471.8	1.403	2.315	0.377	3.718	13.07
12 days	Furrows	Sakha69	59.2	3.32	8.8	15.1	15.13	1.45	3.00	39.07	456.8	1.306	2.318	0.360	3.624	12.89
		Sakha93	63.5	3.54	9.0	16.2	16.23	1.57	3.62	40.30	493.5	1.456	2.466	0.371	3.922	12.95
	Rows	Sakha69	69.5	2.84	8.5	14.0	14.03	1.28	2.07	35.90	424.4	1.071	1.906	0.360	2.977	12.01
		Sakha93	67.1	3.04	8.7	15.1	15.13	1.35	2.49	36.93	439.5	1.254	2.119	0.372	3.373	12.84
	B.casting	Sakha69	72.4	3.44	8.0	13.4	13.40	1.17	2.49	35.00	388.5	0.937	1.688	0.357	2.625	11.88
		Sakha93	70.5	3.74	8.4	14.5	14.47	1.27	3.05	36.13	410.9	1.067	1.866	0.372	2.933	11.94
17 days	Furrows	Sakha69	61.3	3.24	7.8	13.2	13.17	1.32	2.63	38.23	394.9	1.026	1.883	0.353	2.909	10.97
		Sakha93	58.3	3.31	8.2	14.1	14.07	1.43	2.94	39.00	410.3	1.129	2.042	0.356	3.171	11.83
	Rows	Sakha69	65.1	2.76	7.6	12.3	12.33	1.19	1.80	35.17	386.2	0.880	1.655	0.347	2.535	10.85
		Sakha93	62.9	2.95	7.9	13.5	13.53	1.31	2.22	37.87	399.4	0.995	1.807	0.355	2.802	10.92
	B.casting	Sakha69	72.0	3.31	7.2	11.4	11.43	1.08	2.10	34.07	348.6	0.764	1.480	0.340	2.244	9.96
		Sakha93	69.8	3.03	7.7	12.6	12.57	1.15	2.41	35.97	372.4	0.860	1.616	0.347	2.476	10.76
L.S.D.			N.S.	N.S.	N.S.	0.483	N.S.	0.054	0.132	1.032	N.S.	N.S.	0.093	0.208	N.S.	0.132

Table (10): B.

Treatments			Plant height (cm)	No. of tillers / plant	Spike length (cm)	No. of spikelets / spike	No. of grains /spike	Grain weight / spike (g)	Grain weight / plant (g)	1000 – grain weight (g)	No. of spikes/ m^2	Grain yield ton/ fed.	Straw yield ton/ fed.	Biological yield ton/ fed.	Harvest Index %	Protein%
Irrigation intervals	Sowing methods	Wheat varieties														
Second Seasons (2004/ 2005)																
7 days	Furrows	Sakha69	64.3	2.36	8.4	16.4	40.3	1.57	3.77	39.27	402.6	1.583	2.558	0.382	4.141	13.27
		Sakha93	61.9	2.88	8.6	17.0	41.6	1.68	4.46	40.70	424.9	1.781	2.762	0.392	4.542	13.34
	Rows	Sakha69	66.7	1.93	8.0	15.5	35.6	1.34	2.66	38.43	367.5	1.387	2.257	0.381	3.644	12.48
		Sakha93	64.3	2.11	8.2	16.2	37.8	1.47	3.17	39.50	395.7	1.579	2.499	0.387	4.078	13.21
	B.casting	Sakha69	71.3	2.71	7.8	14.7	31.3	1.15	3.20	37.13	358.8	1.095	1.745	0.385	2.840	12.33
		Sakha93	68.7	2.95	8.0	15.6	34.2	1.33	4.00	39.20	396.6	1.358	2.199	0.382	3.557	12.41
12 days	Furrows	Sakha69	59.3	2.32	7.8	14.8	34.4	1.27	3.00	37.40	372.8	1.262	2.202	0.364	3.464	12.16
		Sakha 93	57.5	2.54	7.9	15.8	36.9	1.39	3.62	38.23	409.3	1.398	2.349	0.373	3.747	12.23
	Rows	Sakha69	63.2	1.84	7.5	13.5	31.0	1.08	2.07	35.60	340.2	1.026	1.790	0.364	2.816	11.31
		Sakha93	61.1	2.04	7.7	14.7	33.0	1.20	2.49	36.77	355.2	1.210	2.003	0.376	3.213	12.10
	B.casting	Sakha69	66.7	2.44	7.0	12.8	28.9	0.990	2.45	34.30	304.6	0.892	1.572	0.362	2.464	11.23
		Sakha 93	64.7	2.74	7.4	13.9	30.9	1.08	3.05	35.60	326.7	1.023	1.750	0.369	2.773	11.24
17 days	Furrows	Sakha69	55.3	2.24	6.5	12.8	31.9	1.14	2.63	36.40	304.4	0.982	1.766	0.357	2.748	10.34
		Sakha 93	52.2	2.31	6.9	13.6	33.6	1.25	2.94	37.57	325.8	1.085	1.925	0.360	3.010	11.15
	Rows	Sakha69	59.8	1.76	6.3	11.7	29.7	1.01	1.80	34.17	302.0	0.836	1.538	0.352	2.374	10.26
		Sakha 93	57.7	1.95	6.6	13.0	31.4	1.12	2.22	36.10	315.0	0.947	1.690	0.359	2.637	10.30
	B.casting	Sakha69	67.6	2.31	6.0	10.9	26.9	0.88	2.10	33.27	264.0	0.719	1.341	0.349	2.060	9.58
		Sakha 93	61.4	2.36	6.5	12.1	29.1	1.00	2.40	34.8	288.0	0.815	1.499	0.352	2.314	10.15
L.S.D.			1.174	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.094	0.210	N.S.	0.005

L.S.D.at 0.05 level

B. casting = Broad casting

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تأثير طرق الزراعة وفترات الرى على بعض أصناف القمح تحت ظروف الملوحة بجنوب سيناء

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قسم الإنتاج النباتي- مركز بحوث الصحراء- القاهرة.

أقيمت تجربتان حقليتان فى محطة بحوث راس سدر بمحافظة جنوب سيناء والتابعة لمركز بحوث الصحراء خلال موسمي ٢٠٠٣/ ٢٠٠٤، ٢٠٠٤/ ٢٠٠٥ لدراسة تأثير طرق الزراعة (بدار – تسطير – خطوط) وفترات الرى (٧- ١٢- ١٧ يوم) على صنفي القمح سخا ٩٣، سخا ٦٩ تحت ظروف الرى بالمياه المالحة الناتجة من الآبار الموجودة بالمحطة البحثية.

وكانت أهم النتائج المتحصل عليها فيما يلي:

١- أظهرت النتائج تفوق الرى المتقارب كل ٧ أيام وقد أدى إلى زيادة معنوية فى صفات المحصول ومكوناته فى كلا الموسمين.

٢- أوضحت النتائج أن لطرق الزراعة تأثيرا معنويا فى كل الصفات تحت الدراسة فى كلا الموسمين وقد تفوقت طريقة الزراعة على خطوط فى تحمل نباتات القمح للملوحة عن باقي المعاملات.

٣- أشارت النتائج إلى تفوق الصنف سخا ٩٣ عن الصنف سخا ٩٦ فى كل الصفات تحت الدراسة فى كلا موسمي الزراعة وأظهر تأثيرا معنويا.

٤- سجل التفاعل بين فترات الرى وطرق الزراعة تأثيرا معنويا فى عدد الفروع/ النبات، طول السنبلة، عدد السنيبلات/ السنبلة وعدد الحبوب/ السنبلة، وزن السنبلة، وزن الألف حبه، عدد السنابل/ م٢، محصول الحبوب/ فدان فى الموسم الأول ، بينما كان عدد الحبوب / السنبلة، عدد السنابل /م٢، المحصول البيولوجي/ فدان ونسبة البروتين % لها تأثيرا معنويا في الموسم الثاني .

٥- كان التفاعل بين فترات الرى وصنفي القمح سخا ٩٣، سخا ٩٦ تأثيرا معنويا فى عدد الفروع/ النبات، عدد السنيبلات/ السنبلة، وزن السنبلة، وزن حبوب النبات، وزن الألف حبه، محصول الحبوب/ فدان، محصول القش/ فدان، محصول البيولوجي/ فدان، نسبة البروتين % فى الموسم الأول. بينما كان فى طول النبات، وزن حبوب النبات، محصول الحبوب/فدان، محصول القش/ فدان، المحصول البيولوجي/ فدان، نسبة البروتين% لهما تأثيرا معنويا فى الموسم الثاني.

٦- أظهر التفاعل بين طرق الزراعة وصنفي القمح سخا ٩٣، سخا ٩٦ تأثيرا معنويا فى عدد السنيبلات/ السنبلة، عدد الحبوب/ السنبلة، وزن الألف حبة، نسبة البروتين % فى الموسم الأول، بينما كان لهما تأثيرا معنويا فى طول النبات، وزن حبوب/ النبات، محصول القش/ فدان ونسبة البروتين % فى الموسم الثاني.

٧- أظهر التفاعل بين فترات الرى وطرق الزراعة وصنفي القمح سخا ٩٣ ، سخا ٩٦ تأثيرا معنويا فى عدد السنيبلات/ السنبلة وزن السنبلة، وزن حبوب/ النبات، وزن الألف حبة، محصول القش / فدان والمحصول البيولوجي/ فدان ونسبة البروتين % فى الموسم الأول. بينما كان له تأثيرا معنويا فى طول النبات، محصول القش/ فدان، المحصول البيولوجى/ فدان، نسبة البروتين % فى الموسم الثاني.

من خلال الدراسة يمكن التوصية بزراعة أصناف قمح مقاومة للملوحة خاصة الصنف سخا ٩٣ فى منطقة راس سدر والمناطق المشابهة بجنوب سيناء والتي يتم الرى فيها من خلال الآبار على أن تكون الزراعة فى خطوط مع مراعاة أن يكون الرى كل ٧ أيام مع الزراعة مع الاهتمام بالمعاملات الزراعية الأخرى للحصول على أعلى إنتاجية ممكنة.