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Influence of Water Deficit on Seed Yield and Seed Quality of Faba bean under Saline Soil Conditions at North Sinai, Egypt

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IMPACTS of climate change on crop yield losses and increasing in water demand show that Egypt is vulnerable to climate change because of it's depending on the Nile River basically. Great challenge of enhancing the agriculture is increasing the water use efficiency. A field trial was designed in Complete Randomize Block Design and carried out in Saline Soil at Sahl El-Tina (North Sinia) during the two winter seasons 2011/2012 and 2012/ 2013, to study the response of faba bean yield and seed quality to differential water regimes. The experiment included three water irrigation schedules 3600, 6000 and 7200 m^3/ha from El-Salam Canal and two varieties of faba bean (Nobaria-1 and Sakha-3). The results indicate decline in soil salinity values with increasing the water supply regimes. Applying the water regime 7200 m^3/ha results in decreasing the soil salinity with 30% compared to the water regime 3600 m^3/ha in both seasons. Nevertheless, the results show that weight of seeds/plant (g) and plant height (cm) decreased with reducing of the water supply. Seed quality, high protein, carbohydrate percent, radical length and seedling dry weight were accompanying with low water application (3600 m^3/ha). Water use efficiency was convenient with lower water supplies. Using the water regime of 6000 m^3/ha with Sakha-3 under saline soil conditions was more efficient according to the concept of water saving, water use efficiency, seed quality and yield.

Keywords: Soil salinity, Seed quality, Water regime, Water use efficiency, Faba bean .

Salinity is the most important threat to irrigated agriculture in semi arid environments, where one fifth of the world irrigated land is salt affected. Yearly, 1–2% of the arable land becomes unsuitable for cultivation because of salinity and water logging (FAO, 2002). Through changes of ionic status and water in plant cells, salinity affects plant physiology (Haesegawe *et al.,* 2000). Salinity had severe effects on the relative growth rate, biomass, and other morphological parameters of common bean seedlings, such as transpiration rate, photosynthesis, and stomata conductance adversely affected (Gama *et al.,* 2007). In addition, salinity of the soil water could inhibit plant growth for two reasons. Firstly, the effect of salts in the soil solution on the ability of the plant to take up water, this could lead to reduce plant growth rate. This process is referred to the osmotic or water deficit effect of salinity. Secondly, when excessive amounts of salts enter the plant in the transpiration stream process, there will be injury to plant cells of the transpiration leaves, and this could lead to further deterioration in photosynthesis processes causing reduction in plant growth rate (Munns and Tester, 2008).

Water stress is one of the most significant parameters affecting plant growth, seed yield and quality and photosynthesis productivity for most crops. Ouda *et al.* (2010) described that 20% of full irrigation supply could be saved with approximately yield reduction of 7%. Thus, Alderfasi and Alghamdi (2010) reported that irrigation water with 75 % of soil water holding capacity resulted in higher plant height, large number of plant branches, number of pods/plant, 100 seed weight and seed yield/pant and seed yield/ha. Hirich *et al.* (2012) stated that adding half of the required water supply enhanced crop productivity. In addition, irrigation during vegetative growth using half of the required water supply showed higher yield productivity than applying the full irrigation.

Faba bean (*vicia faba* L.) is an important pulse crop in the term of popularity and seed protein content. The total world cultivated area occupied with faba bean was approximately 4-7 M/ha (FAO, 2002). The nutritional value of faba bean was attributed to its high protein content with a range of 27-34%. Hossain and Mortuza (2006) noticed that, depending on the genotypes, the protein comprised of globulins (79%), albumis (7%) and glutelins (6%). DUC *et al.* (1999) stated that under the water deficit condition, protein content of faba bean tended to increase, and these results compensated with the data obtained by Alghamdi (2009) and Ibrahim & Kandil (2007) . Al-Suhaibani (2009) pointed that, the decrease in yield and yield component associated with increasing soil water deficit and high crude protein and carbohydrate percent in seeds were affected by low water applied levels. However, the seed weight was relatively stable yield component under water stress treatments of faba bean in different development stages. Seed quality is influenced by internal and environmental factors during seed development (Araujo *et al.*, 1982 and Welbaum & Bradford, 1991). Seed quality is measured by germination percentage, rate and longevity (Bravo and Venges, 1984 and Doijode, 2000) and by the performance of offspring. Nevertheless, seed germination and early seedling considered as the most critical phases for assessment any species. Thus, the tolerance of seeds to various stresses during germination should be determined. Alireza and Farshad (2013) showed that relationships between total dry matter, water use efficiency, water lose rate and flag leaf primarily water content were significant and they belong to the variation among cultivars in. With this context, Ahmed *et al.* (2008) found that water stress was more effective for faba bean than variation between varieties or salt stress. Also, El-Dakroury (2008) showed that increasing of the irrigation treatments from 60 to 100% of ET (Evapotranspiration), significantly increased the growth criteria, *i.e.*, plant height, number of branches, leaves and pods/plant, leaves area and dry weight of both stem and total plant.

The objective of this study is to investigate the influence of water regimes on water use efficiency, seed yield and the quality of faba bean (*Vicia faba* L.) under saline soil conditions in Sahl El-Tina, North Sinia.

Material and Methods

A field trial was conducted during the two winter successive growing seasons 2011/2012 and 2012/2013 on sandy loam soil at Gellbana village in Sahl El-Tina at North Sinai Governorate. The soil is irrigated from El-Salam canal with an average EC from 1.38 to 1.47 dSm^{-1}. This region has a continental climate with hot dry summer and rather wet winter. The lowest temperature is January and February (22^{o}C and 20^{o}C) and the maximum amount of rainfall is 12.7 mm/month in February. The highest humidity percent is 70 % in January (Agrama and Amer, 2012). El-Salam canal one of the five-mega irrigation projects which located at the northern Sinai. For reclamation of 620,000 feddans of desert located along the Mediterranean coast of Sinai, the Egyptian Government was diverting considerable amounts of agriculture drainage water to newly reclaimed areas after mixing the Nile water with agriculture drainage water in a ratio of 1:1 (Agrama and Amer, 2012). The chemical analyses of irrigation water (Table1) were carried out during the growing season of faba bean according to Cottenie *et al.* (1982).

TABLE 1. EC as well as macro-micronutrients content in irrigation water during faba bean planting in both seasons (2011/2012 and 2012/2013) .

Treatments	Seasons	Periods taken water sample				Mean
		November	January	March	April	
EC (dSm^{-1})	1st	1.25	1.12	1.55	1.61	1.38
	2nd	1.37	1.17	1.60	1.72	1.47
NO_3- N	1st	12.23	14.49	17.31	22.20	16.56
	2nd	14.66	19.96	19.23	22.58	19.11
NH_4 -N	1st	6.74	9.65	12.69	14.27	10.84
	2nd	9.36	14.30	16.20	17.84	14.43
P	1st	1.98	2.08	2.82	2.12	2.25
	2nd	1.33	2.19	2.04	2.28	1.96
K	1st	11.68	14.20	17.33	12.90	14.03
	2nd	8.77	14.73	16.98	14.67	13.79
Fe	1st	1.44	1.67	1.73	1.41	1.56
	2nd	1.49	1.85	1.89	1.77	1.75
Mn	1st	2.62	2.81	2.74	2.58	2.69
	2nd	2.51	2.60	2.79	2.12	2.51
Zn	1st	1.06	1.04	1.18	1.03	1.08
	2nd	1.34	1.66	1.54	1.14	1.42

The experimental design was a Randomize Complete Block with three replications. Two varieties of faba bean (Nobaria-1 and Sakha-3). Three water regimes were conducted as follow: N1"Normal irrigation" (7200 m^3/ha), L1" irrigation with 6000 m^3/ha " and L2 "irrigation with 3600 m^3/ha ". The irrigation design was surface flow irrigation through line pipes performed with meter gages for controlling the amount of water supplied. In order to overcome the soil salinity problems which could affect the sowing processes, the soil was irrigated for 4 hr in the first day of sowing, while in the second day of the plant sowing, plants were irrigated for 7 hr and then every 10 days. The physico-chemical properties of the investigated soil are characterized by a sandy loam texture according to the standard methods of Page *et al.* (1982) and presented in Table 2.

TABLE 2. Physical and chemical properties in soil study before planting .

Soil Properties	Value
Particle size distribution [%]:	
Coarse Sand	7.88
Fine Sand	70.23
Silt	7.43
Clay	14.46
Texture class	Sandy Loam
Organic matter [g kg^{-1}]	0.44
$CaCO_3$ [g kg^{-1}]	6.90
EC, pH and Soluble ions:	
EC (dSm^{-1}) [Soil paste extract]	10.23
pH [Soil suspension 1:2.5]	8.18
Soluble ions (mmolc L^{-1})	
Na^+	79.64
K^+	0.93
Ca^{++}	8.83
Mg^{++}	12.90
Cl^-	70.00
HCO_3^-	5.33
$SO_4^=$	26.97
Macronutrients and Micronutrients [mg/kg]	
N	45.00
P	4.25
K	178.00
Fe	1.39
Mn	3.43
Zn	0.81
Cu	0.13

*Texture according to the USDA triangle.

The sowing dates were on November 25 and 28 in the first and second seasons, respectively. Each experimental plot composed of 6 ridges, 60 cm apart, 5 m width and 10 m length. Seeds of faba bean cultivars- Nobaria1 and Sakha 3- were sown in hills on one side of the ridge at a rate of 3 seeds per hill with 20 cm between hills. One plant per hill was maintained by thinning the seedlings at 35 days after sowing. Recommended dose of Phosphorus was added as calcium superphosphate (15.5 % P_2O_5) at rate of 360 kg/ha before sowing during soil preparation. Potassium as potassium sulphate (48 % K_2O) was applied at the rate of 120 kg K_2O/ha in two equal doses after 21 and 45 days from sowing. In addition, as a recommended rate after 21 and 45 days from sowing, basic application of nitrogen at the rate of 48 kg N/ha was added directly in form of Urea (46 % N).

At maturing, faba bean plants were harvested in middle of May for both seasons. Random samples of ten guarded plants from each plot were taken to stimulate Plant height (cm), weight of seeds/ plant(g), 100 seed weight (g), seed yield (Mg/ha), biological yield (Mg/ha), and Harvest index (%). Harvest index was calculated by dividing seed yield by above ground biomass. Water use efficiency (WUE) was determined according to Bos (1985) based on above ground biomass using the following equation:

WUE = seasonal biomass as dry matter/kg divided by seasonal water in ET.

ET = is an equivalent dry land or rain-fed plot.

Laboratory experiments were carried out to assess the seed quality parameters of the field experiments at Seed Technology Research Department, Agricultural Research Center during 2011/2012 and 2012/2013. Germination percentage was expressed by the percentage of normal seedlings at the end of testing period according to the International Seed Testing Association (I.S.T.A, 1985). Three replications of 25 seeds were planted in boxes of 40 X 20 X 20 cm dimension containing sterilized sandy soil and the boxes were watered and incubated at 20°C in germination chamber for 10 days. Normal seedlings were counted and expressed as the germination percentage at the final count. Ten normal seedlings from each replicate were taken to measure shoot and radical length (cm) and the seedling dry weight according to Kirshasamy and Seshu (1990).

For the seed quality, Twenty five seeds per replicate for the electrical conductivity (dSm^{-1}/mg) determination were weighed and soaking in 250 ml of deionized water at 20°c for 24 hr. The electrical conductivity of seed leachate was estimated according to (I.S.T.A., 1985). Total carbohydrate percentages and crude protein (%) in seeds were determined according to A.O.A.C. (1990). The statistical analyses of the results were computed according to Sendecor and Cochran (1982).

Results and Discussion

The results of irrigation supply regimes during faba bean planting in the two seasons on the soil salinity were collected from the surface layer (0- 30 cm) after 4 days from irrigation, are presented in Table 3. The results reflected that the lower mean values of the soil salinity were noticed during the period from January to March compared to the values in December and April for the two seasons. This could be attributed to the effect of rainfall at North Sinai from January to March. Furthermore, as a result of increasing the evaporation activity, stopping the water supply and increasing the water table level, the soil salinity values increased during May when faba bean was harvested.

TABLE 3. Mean values of EC (dSm^{-1}) after 4 days from irrigation water through faba bean planting (2011/2012) and (2012 /2013) .

Irrigation	December		January		March		April		Mean		Harvest	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
EC (dSm^{-1}) in soil												
3600	6.81	5.71	4.19	3.17	5.22	4.63	8.25	7.69	6.12	5.30	8.76	8.25
6000	4.52	4.20	2.91	2.43	4.19	4.10	7.39	6.44	4.75	4.29	6.92	6.37
7200	3.27	3.18	1.33	1.22	3.04	2.99	5.55	5.82	3.30	3.30	6.12	5.77

These results are in agreement with Ahmed (2013) who stated that the values of soil salinity increased due to high temperature and high evaporation in North Sinai. The impact of different irrigation supply regimes on the soil salinity during the two seasons are presented in Table 3. The results showed that irrigation supply with 7200 m^3/ha resulted in lower soil salinity in the both seasons with 3.30 and 3.30 dSm^{-1} in the two seasons, compared to the other two water supply regimes where the soil salinity with irrigation of 6000 m^3/ha was 4.75 and 4.29 dSm^{-1} and with irrigation of 3600 m^3/ha was 4.75 and 4.29 dSm^{-1} in the first and second season respectively. In addition, the results of the soil salinity during the harvest period revealed that increasing the water supply regimes resulted in decreasing the soil salinity in both seasons. The irrigation with water supply with 3600 m^3/ha reflected higher soil salinity during the harvest time with 8.76 and 8.25 dSm^{-1} in the first and second season, respectively, compared to the other two water supply regimes where the soil salinity with irrigation of 6000 m^3/ha was 6.92 and 6.37 dSm^{-1} and with irrigation of 7200 m^3/ha was 6.12 and 5.77 dSm^{-1} in the first and second season, respectively.

The results of the potentially of faba bean yield parameters, estimated as plant height (cm),weight of seeds/plant (g), 100–seed weight (g) and seed yield Mg/ha for the two varieties under different water supply regimes are presented in Table 4. The results reveal that plants grown under normal irrigation (N1) gave higher values of yield parameters than the (L1) irrigation and (L2) irrigation. The trend of decreasing that parameter was parallel with increasing irrigation intervals.

The results in Table 4, showed that the mean values of plant height (cm), weight of seeds/plant (g), 100-seed weight(g) and seed yield (Mg/ha) were reduced with decreasing the water irrigation amount (79.6 cm, 76.3 cm, 48.0 cm for plant height), (149 g, 136.0 g, 87.1 g for seed weight), (104.0g, 89.0g, 76.0g for 100 seed weight) and (3.75 Mg/ha, 3.30 Mg/ha, 2.09 Mg/ha for grain yield), respectively.

TABLE 4. Yield and yield components of Faba bean as affected by irrigation intervals for combined analysis as mean values for (2011/2012-2012/2013) seasons.

irrigation	Varieties	Plant height(cm)	Weight of seeds/plant (g)	100-seed weight (g)	Seed yield Mg/ha
N1 "Normal irrigation"	Nubaria-1	82.00	152.20	109.20	3.57
	Sakha -3	77.30	145.90	98.70	3.93
Mean		***79.60***	***149.00***	***104.00***	***3.75***
L1 "Late irrigation"	Nubaria-1	80.00	131.00	94.30	3.03
	Sakha -3	73.30	140.00	84.00	3.57
Mean		***76.60***	***136.00***	***89.00***	***3.30***
L2 "Very late irrigation"	Nubaria-1	50.60	73.50	86.00	1.61
	Sakha -3	45.00	100.70	67.50	2.57
Mean		***48.00***	***87.10***	***76.80***	***2.09***
LS.D 5%					
I*		2.27	10.10	1.56	3.70
V**		4.85	8.26	3.91	1.70
I x V***		3.21	12.30	5.70	2.20
c.v		12.60	14.80	11.60	15.90

N1"Normal irrigation" (7200 m^3/ha), L1"Late irrigation" (6000 m^3/ha), and L2 "Very late irrigation" (3600m^3/ha) * Irrigation ** Varieties *** Interaction between the irrigation and varieties .

These results are convenient with Hirich *et al.* (2012) who stated that deficit irrigation during vegetative growth using half of required water supply showed higher yield productivity than applying the full irrigation. Balasio *et al.* (2006) found that the irrigation intervals of 28 and 14 days during vegetative stage gave highest grain yield.

The results in Table 5 evidenced that level of water regime imposed in this experiment (N1, L1 and L2) induced a significant reduction in biological yield (t/ha) with increasing intensity of the drought stress. These results are parallel with De Costa *et al.* (1999). They indicated that yield component analysis of faba bean showed positive yield response for irrigation as increasing in total biomass.

TABLE 5. Water deficit impacts on some yield parameters of faba been in two sequence growing seasons, (combined computation of the two seasons) .

Irrigation	Varieties	Biological yield Mg/ha	Harvest index %	Water use efficiency (WUE_b) Kg/m^3
N1, total applied water 7200m^3/ha	Nubaria-1	9.67	36.92	1.34
N1, total applied water 7200m^3/ha	Sakha -3	9.59	40.98	1.33
L1, total applied water 6000 m^3/ha	Nubaria-1	8.09	37.45	1.35
L1, total applied water 6000 m^3/ha	Sakha -3	8.90	40.11	1.48
L2, total applied water 3600 m^3/ha	Nubaria-1	3.78	42.59	1.05
L2, total applied water 3600 m^3/ha	Sakha -3	4.98	51.61	1.38

N1"Normal irrigation" (7200 m^3/ha), L1"Late irrigation" (6000 m^3/ha) and L2 "Very late irrigation" (3600 m^3/ha).

Moreover, as shown in Table 5, the data reflected significant differences between water treatments in water use efficiency (WUE) and in the harvest index. The results show that WUE by using the water regime of 6000 m^3/ha on Sakha-3 was 1.48 kg/m^3 and it was higher than the other treatments by 1.34, 1.33, 1.35, 1.05 and 1.38 compared with the irrigation water supply of 7200 m^3/ha with Nubaria-1, 7200 m^3/ha with Sakha-3, 6000 m^3/ha with Nubaria-1, 3600 m^3/ha with Nubaria-1 and 3600 m^3/ha with Sakha-3, respectively. In addition, the results in Table 5 revealed that using the water regime of 3600 m^3/ha with Sakha-3 under saline soil conditions was more efficient according to the concept of water saving and the WUE. Harvest index was influenced water regime. The results refer that the harvest index was accompanying with less water supply by 36.92 %, 40.98 %, 37.45%, 40.11%, 42.59% and 51.61% with the irrigation water supply of 7200 m^3/ha with Nubaria-1, 7200 m^3/ha with Sakha-3, 6000 m^3/ha with Nubaria-1, 6000 m^3/ha with Sakha-3, 3600 m^3/ha with Nubaria-1, and 3600 m^3/ha with Sakha-3, respectively.These results are in agreement with the founding by Al-Suhaibani (2009), Link *et al.* (2010) and Alireza & Farshad (2013) .

Data displayed in Table 6, clearly indicated water treatments significantly affected the protein content of seeds. Increasing trend in seed protein was in parallel with less water supply. The 6000 m^3/ha and 3600 m^3/ha water regimes increased seed protein contents than high levels of water supply. This may be attributed to the interpretation of the fact that plants under 7200 m^3/ha and/or 6000 m^3/ha had lower number of seeds/plants than 3600 m^3/ha. Seeds of these plants are also expected to have less protein but higher seed yield. These results are in agreement with those findings of Alghamdi (2009) and Musallam *et al.* (2004). For the Carbohydrate content in Faba bean, data indicated that higher water supply regime (N1) resulted in the lowest values of seeds protein and carbohydrate content, while plants under water L1 and L2 showed higher value of total seed carbohydrate and protein content.

TABLE 6. Chemical composition of Faba bean as affected by irrigation intervals for combined analysis (2011-2012/2012-2013) seasons .

Irrigation	Varieties	Crude protein %	Carbohydrate %	Electrical conductivity dSm^{-1}/mg
N1, total applied water 7200m^3/ha	Nubaria-1	20.4	71.0	0.106
N1, total applied water 7200m^3/ha	Sakha -3	20.3	73.0	0.066
Mean		**20.3**	**72.0**	**0.086**
L1, total applied water 6000 m^3/ha	Nubaria-1	21.5	72.2	0.095
L1, total applied water 6000 m^3/ha	Sakha -3	21.8	73.5	0.052
Mean		**21.6**	**72.8**	**0.073**
L2, total applied water 3600 m^3/ha	Nubaria-1	23.7	72.4	0.134
L2, total applied water 3600 m^3/ha	Sakha -3	24.2	73.8	0.055
Mean		**23.9**	**73.0**	**0.095**
LS.D 5%				
I*		0.32	0.43	4.80
V**		0.42	0.53	5.40
I x V***		0.12	n.s	7.60
c.v		1.72	0.32	5.30

N1"Normal irrigation" (7200 m^3/ha), L1"Late irrigation" (6000 m^3/ha), and L2 "Very late irrigation" (3600 m^3/ha) * Irrigation ** Varieties *** Interaction between the irrigation and varieties .

The mean values for the carbohydrate in seeds were 20.3 %, 21.6%, 23.9% and seed protein contents were 72%, 72.8% and 73% under N1, L1 and L2 water regime, respectively. These results are convenient with Liu and Andersen (2004) and Al-Suhaibani (2009) who found that high crude protein and carbohydrate percent in seeds were accompanying with low water supply. In addition, Ibrahim and Kandil (2007) , Ahmed *et al.* (2008) and Alghamdi (2009) found that water stress increased protein percentage and electrical conductivity. The mean values were 0.095 dSm^{-1}/mg under 3600 m^3/ha water supply and 0.086 and 0.073 dSm^{-1}/mg under 7200 m^3/ha and 6000 m^3/ha water supply, respectively (Table 6).

Data manifested in Table 7 display the effect of water supply regimes on germination percentage, shoot and radical length, fresh and dry seedling weight of the two varieties. The results reveal that using the normal water regime (L1) significantly increased the germination percentage to 90% compared to N1 and N2 water supply regimes of 84% and 80.0% and this was true where faba bean seeds cannot tolerate water stress resulted of increasing irrigation intervals up to 21days under saline condition.

TABLE 7. Vigor test of Faba bean as affected by water regimes for combined analysis (2011-2012/2012-2013) seasons.

Irrigation	Varieties	Germination %	Shoot Length (cm)	Radical Length (cm)	Fresh Weight (g)	Dry Weight (g)
N1 "Normal irrigation"	Nobaria-1	88.0	15.7	9.7	2.5	0.20
	Sakha -3	92.0	16.0	9.3	2.3	0.22
Mean		**90.0**	**15.8**	**9.5**	**2.4**	**0.21**
L1 "Late irrigation"	Nobaria-1	82.0	13.3	12.5	2.2	0.23
	Sakha -3	86.0	12.5	13.3	2.0	0.25
Mean		**84.0**	**12.9**	**12.9**	**2.1**	**0.24**
L2 "Very late irrigation"	Nobaria-1	79.0	11.5	13.5	2.0	0.30
	Sakha -3	82.0	11.4	12.8	1.9	0.32
Mean		**80.0**	**11.4**	**13.1**	**1.9**	**0.31**
LS.D 5%						
I*		n.s	n.s	n.s	0.6	0.30
V**		2.3	0.48	0.27	n.s	0.20
I x V***		n.s	n.s	0.34	1.12	0.58
c.v		1.27	1.63	0.93	2.28	5.6

N1"Normal irrigation" (7200 m^3/ha), L1"Late irrigation" (6000 m^3/ha), and L2 "Very late irrigation" (3600m^3/ha) * Irrigation ** Varieties *** Interaction between the irrigation and varieties .

Generally, the germination percentage of Sakha-3 was higher than Nobaria-1 under irrigation treatments. The highest values of germination was 92%, it is obtained by Sakha-3 under water supply regime of N1 while the lowest value are 79% was obtained by Nobaria-1 under L2 water regime. The N1 water regime (N1) increased shoot to 15.8 cm compared L1 and L2 water regimes of 12.9 cm and 11.4 cm, respectively. However, applying water L2 regime increased the radical length to 13.1cm compared with N1 and L2 water regimes of 9.5 cm and 12.9 cm, respectively. Varieties were not significantly differed in fresh seedling weight. But the N1water regime was better and resulted in higher fresh weights (2.5 g and 2.3 g) for the two varieties compared L1 and L2 water regimes. In dry seedling weight L2 water regime increased seedling dry weight to 3.1 g compared to N1 and L1 water regimes of 0.21 g, and 0.24 g, respectively.

Conclusion

Overall treatments in the present study, the results indicate a decline in soil salinity values with increasing the water supply regimes, while yield and yield component characters decreased with reducing of water supply under saline soil conditions. Applying the water regime 7200 m^3/ha results in decreasing the soil salinity with 30% compared to the water regime 3600 m^3/ha in both seasons. In addition, seed germination percentages were decreased under low water supply compared to the normal irrigation, while radical length and seedling dry weight was increased with low water application (3600 m^3/ha). Nevertheless, high protein and carbohydrate percent in seeds were accompanying with low water supply. The water regime of 3600 m^3/ha with Sakha-3 under saline soil conditions was more efficient according to the concept of water saving and the WUE. This variety could be used to compensate the other treatments to reduce the amount of the water supply under saline soil in North Sinai.

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تاثير العجز المائى على محصول البذور وجودة البذور لصنفى الفول البلدي نوباريا 1 وسخا 3 تحت ظروف الاراضى الملحية بشمال سيناء ، مصر

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اظهرت التغيرات المناخية خسائر كبيرة فى المحاصيل نتيجة للاحتياجات المائية ونقص المياه وعلى ذلك أجريت تجربه زراعية لموسمين متتالين 2012/2011 و 2012/ 2013 لدراسة تاثير معدلات من مياه الرى على انتاجية وجودة بذور محصول الفول البلدى لصنفى نوبارية 1 وسخا3 فى ارض ملحية بمنطقة شمال سيناء . وكان تصميم التجربة فى قطاعات كاملة العشوائية . واشتملت التجربة على ثلاث كميات من مياه الرى وهى 3600 و 6000 و 7200 متر مكعب للهكتار على صنفين من الفول البلدى هما نوبارية 1 وسخا 3 ، واظهرت النتائج زيادة فى انتاجية المحصول للفدان وكذلك جودة البذور ونسبة البروتين والكربوهيدرات فى البذور بزيادة كميات المياه . ولوحظ أنخفاض فى ملوحة التربة أثناء الزراعة وبعد الرى ب4 أيام وأرتفعت الملوحة عند الحصاد. ووجد ان افضل كمية مياه 6000 متر مكعب للهكتار اعطى اعلى انتاجية وجودة للبذور للصنف سخا 3 تحت ظروف الاراضى الملحية .