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Impact of Soil Salinity and Different Levels of Nitrogen and Phosphorus Fertilization on the Productivity of some Flax Cultivars

Leilah, A. A.[1]; M. H. Ghonema[1]; M. E. Kineber[2] and I. H. M. Talha[2]
[1]Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt.
[2]Fiber Crops Research Department, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt.

ABSTRACT

The experiment was carried out under lyzometer condition (salinity controlled conditions) at Sakha Agricultural Research Station, Department of Soil Chemistry, Agricultural Research Center (ARC), Egypt during 2015/2016 and 2016/2017 seasons, to investigate the response of yields and its components to nitrogen and phosphorus fertilizers levels as well as technological characters of three flax cultivars under different saliniti levels. A split-split plot design with three replications was used. The main-plots were assigned to three flax cultivars *i.e.* Sakha3 (fiber type flax cultivar), Giza11 (dual purpose type flax cultivar) and Sakha5 (oil type flax cultivar). The sub-plots were allocated to some combination treatments of phosphorus and nitrogen fertilizers *i.e.* 45 kg N/fed. + 15.5 kg P_2O_5/fed., 45 kg N/fed. + 22.5 kg P_2O_5/fed., 55 kg N/fed. + 15.5 kg P_2O_5/fed. and 55 kg N/fed. + 22.5 kg P_2O_5/fed. and The sub- sub plots were concluded to four soil salinity levels (2, 4, 6 and 8 dsm^{-1}). Results showed that Sakha3 cultivar significantly surpassed the other two evaluated flax cultivars producing the maximum fiber yield / plant and per fed., fiber length, total fiber percentage , fiber fineness, straw yield per plant and straw yield per fed.. in both seasons. Meanwhile, Giza11 cultivar significantly surpassed in the technical length, length of top capsule zone, number of capsules/plant, seed index , number of seeds/plant, seed yield per plant and per fed. in both seasons. However, Sakha5 cultivar significantly surpassed the other studied flax cultivars and produced the maximum values of seed oil content. All characters under study, except fiber fineness, gradually increased as nitrogen and phosphorus fertilizer levels increased from 45 kg N/fed.+15.5 kg P2O5/fed. to 55 kg N/fed.+ 22.5 kg P2O5/fed.. Maximum seed, straw and fiber yields were found with fertilizing flax plants with 55 kg N/fed. + 22.5 kg P2O5/fed.. On the contrast, increasing soil saliniti levels from 2 to 4,6 and 8 dsm^{-1} resulted in marked reduction in the estimated characters, in the frst and second seasons. Generally, The following can be viewed that the highest values of straw and fiber yields/plant and per fed. and fiber fineness (in the first and second seasons) were produced from Sakha3 cultivar, while the highest number of seed yield per plant (in both seasons) and seed yields per fed. (in the second season) were resulted from Sakha5 cultivar when fertilized with 55 kg N/fed.+22.5 kg P_2O_5/fed. under the lowest salinity level of 2 dsm^{-1} soil saliniti level condition.

Keywords: Flax, cultivars, nitrogen and phosphorus levels, Salinity, yields, fiber quality.

INTRODUCTION

Flax (LinumusitatissimumL.) is a member of natural fiber sand one of the oldest stem fibers known to man. The plant has a single stem, reachingto a height of approximately 80-120 cm with few branches for fiber flax varieties and40-60 cm with more branching in oilseed varieties. It is an important source of industrial oil and has the potential of meeting edible oil and protein deficiencies (Green and Marshall, 1984)

Among the a biotic stresses, salinity is the most destructive factor which limits the crop productivity considerably. A large area of land in the world is affected by salinity which is increasing day by day. Salinity is more prominent irrigated agriculture contributes more than 30% of the total agricultural production problem in irrigated crop lands. Worldwide, around 17% of the cultivated land is under irrigation and (Hillel 2000) Higher level of salt stress inhibits the germination of seeds while lower level of salinity induces a state of dormancy (Khan and Weber 2008).Mineral fertilizers which are important factors for vigorous growth and consequently higher yield of different plant species.

This investigation is designed to revise the response of yields and its components to different nitrogen and phosphorus fertilizer levels and soil salinity as well as fiber quality of three flax cultivars in the condition of Kafrelshiekh Governorate.

MATERIALS AND METHODS

These work was approved in lyzometer experiment of sakha Agricultural Research Station, Department of soil chemistry Agricultural Research Center (ARC) Egypt during 2015/2016 and 2016/2017 seasons a split-split plot design with three replications. Three flax cultivars /*i.e.* Sakha3 cultivar (fiber type), Sakha5 cultivar (oil type) and iza11 cultivar (dual purpose type) carried out in main plots. These cultivars were taken from Fiber Crops Research Department, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt, and its history is president in Table (1).

Table 1. Type and history of the evaluated three flax cultivars.

Cultivar	Type	Seed colour	history
Sakha3	Fiber	Brown	Belinka2E × I.2096
Sakha5	Oil	yellow	I.370 × I.2561
Giza11	Dual purpose	Brown	Giza5×I.C235 (USA)

The sub-plots were assigned to some combination treatments of phosphorus and nitrogen fertilizers as follows: 45 kg N+15.5 kg P_2O_5/fed., 45 kg N+22.5 kg P_2O_5/fed., 55 kg N+15.5 kg P_2O_5/fed. and 55 kg N+ 22.5 kg P_2O_5/fed.. Phosphorus fertilizer in the type of superphosphate- Calcium (15.5% P_2O_5) at the aforesaid rates was additional after soil training to the experimental units. Fertilizer by nitrogen with the type of Nitrate Ammonium (33.5 % N) at the aforementioned rates was added before the first irrigation and before the second irrigation. The sub- sub plots were allocated to four salinity levels *i.e.* 2 dsm^{-1}, 4 dsm^{-1} , 6 dsm^{-1} and 8 dsm^{-1}. Each experimental unit area was 1×0.70 m, occupying an area of 0.70 m^2. The maize (*Zea mays* L.) was the past summer crop in the first and the second seasons.

The experiments were approved in Lyzimeters, each having the capacity dimensions of 100X70X90 cm, which was filled with clay soil (58% clay, 16% silt and 26% sand). Flax seeds were sown using spreading process at the suggested rate of each cultivar on 10th and 15th of November in the first and the second seasons, respectively. The Soil was taken from the EL-Hamol land , which concluded unlike salinity levels (2 , 4 , 6 and 8 dsm^{-1}) area at a depth of 0-30 cm from soil surface, where the chemical and Physical properties of soil as described in Table 2, according to Page (1982)

Table 2. Some chemical analysis (soil paste extract) during 2015/2016 and 2016/2017 seasons.

Salinity level	1st season (2015/2016)								
	Anions meq./L				Cations meq./L				pH
	CO_3^-	HCO_3^-	CL^-	SO_4^{--}	Ca^{++}	Mg^{++}	Na^+	K^+	
2 dsm^{-1}	-	4.01	11.03	5.66	7.50	1.70	11.30	0.20	8.01
4 dsm^{-1}	-	2.73	15.78	24.15	17.72	7.82	16.84	0.28	8.03
6 dsm^{-1}	-	3.50	23.23	36.64	22.22	14.72	25.99	0.44	8.07
8 dsm^{-1}	-	2.92	31.28	48.55	26.14	16.21	39.67	0.73	8.13
	2nd season (2016/2017)								
2 dsm^{-1}	-	3.98	10.93	5.28	6.82	2.34	10.80	0.23	8.00
4 dsm^{-1}	-	2.66	14.96	23.95	16.94	8.44	15.94	0.25	8.02
6 dsm^{-1}	-	3.47	22.20	34.99	21.38	13.98	24.91	0.42	8.05
8 dsm^{-1}	-	2.77	30.24	47.35	25.80	16.04	37.57	0.77	8.10

Ten plants were taken when the perfusion was complete from each sub-sub plot to be used in register flax yield component. Straw yield and its components were: technical length (cm), diameter of stem (mm), straw yield (g/plant) and(t/fed.), fiber yield (g/plant) and (kg/fed.). Seed yield and its components were: length of fruiting zone (cm), number of capsules/plant, 1000-seed weight (g), number of seeds/plant, seed yield (g/plant) and (t/fed.). Technological characters were: fiber length (cm/plant), total fiber percentage (%), fiber fineness (N.m.) which was resolute using Radwon and Moomtaz (1966) method according to the next equation:

$$N.m = N \times L / G.$$

Where: **N= Number of fibers (20 Fibers each 10 cm long), L= Length of fibers in cm and G= Weight of fibers in mg. Seed oil content (%) was estimated as described by A.O.A.C. (2007) using Soxhelt apparatus and petroleum ether 40 – 60 ċ as an organic solvent.**

Results of the two experiments were subjected to the proper statistical analysis of variance (AOV), according to Snedecor and Cochran (1982). Duncan's multiple range test (Duncan, 1995) was used for comparison among treatment means.

RESULTS AND DISCUSSION

1. Cultivars performance:

Obtained results in Tables 3,4 and 5, revealed that there were differences significant among the three flax cultivars studied in straw yield and its components (technical length, diameter of stem, straw yield per plant, straw yield per fed.), seed yield and its components (length of top capsule zone, number of capsules per plant, seed index , number of seeds per plant, seed oil content, seed yield per plant and seed yield per fed.) and fiber yield and its quality (fiber length/plant, total fiber percentage, fiber fineness , fiber yield/plant and fiber yield/fed.) in both seasons. Sakha3 significantly surpassed the other two flax cultivars and produced the maximum number of fiber yield per plant and per fed.., fiber length, total fiber percentage , fiber fineness, straw yield per plant and fed. While, Sakha3 cultivar resulted in the minimum number of stem diameter, length of top capsule zone, number of capsules/plant, seed index, number of seeds/plant, seed yield per plant and per fed. and seed oil content in both seasons. Meanwhile, Giza11 cultivar produced the highest number of diameter of stem, technical length, length of top capsule zone, number of capsules/plant, seed index, number of seeds/plant, seed yield per plant and per fed.. While Giza11 cultivar recorded the minimum number of fiber fineness. in both seasons. However, Sakha5 cultivar significantly surpassed other two flax cultivars under studied and produced the maximum number of % oil, while gave the lowest number of technical length, straw yield per plant and per fed., fiber yield per plant and per fed., fiber length and total fiber percentage during the two growing seasons. Differences in varieties of three types of flax can be attributed mainly to their response to environmental conditions and the genetic constitution . These study are similar to those recorded by EL–kady *et al*. (2010), Abo-Kaied *et al*. (2015), Kineber *et al*. (2015), Sorour *et al*. (2015) and Kumar *et al*. (2018).

2. Effect of NP fertilizer levels :

it can be showed that effects were noticed with varying NP levels and this was clear obvios in all qualities studied *i.e.* straw yield and its components (technical length, stem diameter, straw yield /plant and straw yield/fed.), seed yield and its quality (length of top capsules zone, number of capsules/plant, seed index, number of seeds/plant, seed oil content, seed yield/plant and seed yield/fed.) and fiber yield and its components (fiber yield/plant (g) , fiber yield/fed., fiber length/plant, total fiber percentage, fiber fineness in the frst and scond seasons showed in Tables 3 , 4 and 5. All studied characters of flax gradually increased as nitrogen and phosphorus levels increased from 45 kg N/fed.+15.5 kg P_2O_5/fed. to 55 kg N/fed.+22.5 kg P_2O_5/fed., except fiber fineness. Generally, maximum means of all qualities studied were showed from fertilizing flax plants with 55 kg N/fed.+22.5 kg P_2O_5/fed., except fiber fineness in frst and scond seasons. This data is due to the role of nitrogen, which takes into account the main elements of plant nutrition and leads to increased vegetal increase of plants and forming strong plants with the highest straw, fiber and seed yields components of flax. Moreover, the role of nitrogen in stimulating the plant to obtain other active elements, and thus the growth of plants. Phosphorus also greatly assists root development in small flax plants, Increase the ability to benefit from other nutrients from the soil. Energy obtained from photosynthesis and carbohydrate metabolism is also stored in phosphate compounds such as ATP and ADP for growth and production, thus enhancing growth measurements and all straw, fiber and seed yield components. These results of study are similar with those showed by Leilah *et al.* (2003), Khajani *et al.* (2012), Abd El-Daiem *and* EL-Borhamy (2015), Abdel-Galil *et al.* (2015), Xie *et al.* (2016) and Patil *et al.* (2018).

Table 3. Means of straw yield and its components of three flax cultivars as affected by N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons.

Variable	Sig	Cultivars (C)			Sig	N and P fertilizers levels(F)				Sig	Salinity levels (S)				Interactions			
		Sakha 3	Sakha 5	Giza 11		1	2	3	4		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	CXF	CXS	FXS	CXF XS
2015 / 2016 season																		
Technical length(cm)	**	68.95b	59.23c	69.76a	**	61.95d	63.36c	67.19b	71.42a	**	65.91a	62.93b	59.26c	57.82d	Ns	**	**	Ns
Stem diameter (mm)	**	1.63c	1.65b	2.01a	**	1.72d	1.84c	1.93b	1.98a	**	2.03a	1.92b	1.78c	1.76d	*	**	**	Ns
Straw yield /plant (g)	**	0.977a	0.919b	0.971a	**	0.881d	0.932c	0.997b	1.083a	**	1.109a	1.018b	0.939c	0.828d	**	**	**	**
Straw yield /fed.. (ton)	**	3.020a	2.450c	2.920b	**	2.678d	3.008c	3.021b	3.105a	**	3.145a	3.030b	2.456c	2.246d	**	**	**	**
2016 / 2017 season																		
Technical length(cm)	**	72.96b	63.92c	73.36a	**	65.72d	67.55c	71.35b	75.69a	**	79.07a	73.17b	63.08c	62.99d	Ns	Ns	Ns	Ns
Stem diameter (mm)	**	1.67c	1.68b	2.04a	**	1.75d	1.87c	1.96b	2.01a	**	2.06a	1.95b	1.82c	1.76d	*	**	**	Ns
Straw yield /plant (g)	*	1.097a	1.060c	1.071b	**	0.981d	1.032c	1.096b	1.183a	**	1.206a	1.118b	1.040c	0.928d	**	**	**	**
Straw yield /fed.. (ton)	**	3.090a	2.405c	2.835b	**	2.301d	2.475c	3.038b	3.098a	**	3.098a	3.071b	2.227c	2.137d	**	**	**	**

***,**and NS indicate P < 0.50, P < 0.01 and not significant, respectively. Means of each factor followed by a common letter are not significantly different at 5 % level according to Duncan's multiple range test.**

(1) fertilizer by 45 kg N/fed. and 15.5 kg P_2O_5/fed., (2) fertilizer by 45 kg N/fed. and 22.5 kg P_2O_5/fed. ,

(3) fertilizer by 55 kg N/fed. and 15.5 kg P_2O_5/fed. and (4) fertilizer by 55 kg N/fed. and 22.5 kg P_2O_5/fed..

Table 4. Means of seed yield and its components of three flax cultivars as affected by N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons.

Variable	Sig	Cultivars (C)			Sig	N and P fertilizer levels (F)				Sig	Salinity levels (S)				Interactions			
		Sakha 3	Sakha 5	Giza 11		1	2	3	4		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	CXF	CXS	FXS	CXF XS
2015 / 2016 season																		
Lenghofopcapsulezone(cm)	**	6.75c	9.98b	10.83a	**	8.14d	8.78c	9.82b	10.01a	**	10.82a	9.89b	8.02c	8.02c	**	**	**	**
Number of Capsules/plant	**	6.50c	10.55b	11.25a	**	10.09d	10.45c	11.13b	11.47a	**	11.97a	11.34b	9.56c	8.87d	*	Ns	Ns	Ns
Number of seeds /plant	**	41.43c	77.48b	89.41a	**	80.70d	88.39c	90.75b	95.26a	**	98.93a	93.03b	63.31c	60.82c	Ns	**	Ns	Ns
Seed index	**	5.95c	6.65b	8.44a	Ns	6.95	7.14	7.33	7.44	**	8.04a	7.74b	6.52c	6.56c	Ns	ns	Ns	Ns
Seed yield /plant (g)	**	0.484c	0.633b	0.813a	**	0.634d	0.652c	0.739b	0.852a	**	0.819a	0.745b	0.444c	0.418d	**	**	**	**
Seed yield /fed.. (kg)	**	253.22c	352.77b	369.78a	**	211.68c	256.39b	357.57a	365.37a	**	338.83a	319.17b	282.21c	210.82d	*	*	Ns	Ns
Oil %	*	34.87c	45.59a	38.08b	Ns	36.59	37.71	38.24	38.83	*	38.85a	38.35b	37.62c	36.55d	Ns	Ns	Ns	Ns
2016 / 2017 season																		
Lenghofopcapsulezone(cm)	**	8.73c	12.00b	12.81a	**	10.12d	10.75c	11.82b	12.05a	**	12.82a	11.86b	10.05c	10.00c	**	**	**	**
Number of Capsules/plant	**	6.77c	10.65b	11.88a	**	9.92d	10.76c	11.42b	11.74a	**	12.44a	11.03b	10.85c	9.55d	**	**	**	Ns
Number of seeds /plant	**	40.33b	75.06a	88.69a	**	80.04d	81.24c	88.54b	91.01a	**	101.19a	89.67b	81.13c	80.76c	Ns	Ns	Ns	Ns
Seed index	**	6.02c	7.10b	8.95a	*	6.98d	7.27c	7.84b	8.93a	Ns	7.71	7.39	7.31	6.98	Ns	Ns	Ns	Ns
Seed yield /plant (g)	**	0.509b	0.669a	0.848a	**	0.596d	0.654c	0.700b	0.748a	**	0.686a	0.671b	0.647c	0.589d	**	**	**	**
Seed yield /fed.. (kg)	**	261.40c	360.55b	417.74a	**	246.6d	305.51c	357.13b	396.99a	**	304.72a	272.57b	260.32c	248.65d	**	**	**	**
Oil %	*	35.91c	46.65a	39.06b	*	37.56d	38.65c	39.22b	44.07a	*	45.19a	39.35b	39.02c	38.94c	Ns	Ns	Ns	Ns

***,**and NS indicate P < 0.50, P < 0.01 and not significant, respectively. Means of each factor followed by a common letter are not significantly different at 5 % level according to Duncan's multiple range test.**

(1) fertilizer by 45 kg N/fed. and 15.5 kg P_2O_5/fed., (2) fertilizer by 45 kg N/fed. and 22.5 kg P_2O_5/fed. ,

(3) fertilizer by 55 kg N/fed. and 15.5 kg P_2O_5/fed. and (4) fertilizer by 55 kg N/fed. and 22.5 kg P_2O_5/fed..

Table 5. Means of fiber yield and its quality of three flax cultivars as affected by nitrogen and phosphors fertilizer levels under salinity levels during 2015/2016 and 2016/2017 seasons.

Variable	Sig	Cultivars (C)			Sig	N and P fertilizer levels (F)				Sig	Salinity levels (S)				Interactions			
		Sakha 3	Sakha 5	Giza 11		1	2	3	4		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	CXF	CXS	FXS	CXF XS
2015 / 2016 season																		
Fiber length (cm)	**	65.59a	48.98c	59.76b	**	54.20d	57.92c	62.69b	65.63a	**	69.08a	67.73b	50.01c	49.62d	**	Ns	Ns	Ns
Fiber yield /plant (g)	**	0.390a	0.266c	0.385b	**	0.322d	0.327c	0.384b	0.397a	**	0.453a	0.438b	0.258c	0.244d	Ns	*	Ns	Ns
Fiber yield /fed.. (kg)	**	309.30a	210.78c	303.07b	**	255.92d	263.46c	270.55b	297.2a	**	444.37a	382.86b	135.71c	134.60c	**	**	**	**
Fiber %	*	16.13a	12.58c	14.06b	Ns	14.25	14.01	16.66	16.55	Ns	16.70	15.73	12.89	11.69	Ns	Ns	Ns	Ns
Fiber fineness	**	271.18a	245.83b	245.06b	Ns	269.66	258.82	256.65	253.95	*	274.49a	256.55b	248.92c	236.13d	Ns	Ns	**	Ns
2016 / 2017 season																		
Fiber length (cm)	**	68.31a	52.35c	65.45b	**	60.14d	60.69c	62.55b	67.26a	**	69.32a	66.55b	58.99c	51.28d	*	Ns	Ns	Ns
Fiber yield /plant (g)	Ns	0.490	0.403	0.441	*	0.398d	0.403c	0.418b	0.490a	**	0.419a	0.404b	0.358c	0.298d	Ns	*	Ns	Ns
Fiber yield /fed.. (kg)	**	328.97a	230.84c	323.07b	**	279.81d	284.62c	299.5b	320.5a	**	363.93a	302.38b	255.71c	245.16c	**	**	**	**
Fiber %	**	16.17a	12.72c	13.70b	Ns	14.63	14.45	16.47	16.63	**	16.24a	16.02b	14.85c	14.60d	**	**	Ns	Ns
Fiber fineness	**	291.14a	260.83b	255.30c	Ns	266.33	265.49	270.26	274.33	**	289.40a	271.55b	264.09c	251.38d	**	**	**	**

***,**and NS indicate P < 0.50, P < 0.01 and not significant, respectively. Means of each factor followed by a common letter are not significantly different at 5 % level according to Duncan's multiple range test.**

(1) fertilizer by 45 kg N/fed. and 15.5 kg P_2O_5/fed., (2) fertilizer by 45 kg N/fed. and 22.5 kg P_2O_5/fed. ,

(3) fertilizer by 55 kg N/fed. and 15.5 kg P_2O_5/fed. and (4) fertilizer by 55 kg N/fed. and 22.5 kg P_2O_5/fed..

3. Effect of salinity:

Raising soil salinity levels from (2 dsm^{-1} to 4 dsm^{-1}, 6 dsm^{-1} and 8 dsm^{-1}) had reverse effects on all qualities studied *i.e.* straw yield and its components (technical length, stem diameter, straw yield per plant and straw yield per fed.), seed yield and its components (length of top capsules zone, number of capsules per plant, seed index, number of seeds per plant, seed oil content, seed yield per plant and seed yield per fed.) and fiber yield and its quality (fiber yield/plant, fiber yield/fed., fiber length per plant, total fiber percentage and fiber fineness). In other words, it can be said that aforementioned characters of flax regularly decreased as a effect of increasing salinity levels from(2 dsm^{-1} to 8 dsm^{-1})in both seasons. Hashem *et al.* (2011) and El-Hamid and Sadak (2012) found that Salt stress induced reduction in plant height, compared with the control. It was evident that, under the environmental conditions of this study, maximum means of all studied characters were produced under 2 dsm^{-1} salinity level in both seasons obtained in Tables 3 , 4 and 5.

4. Interaction effects:

Obtained results in Tables 6, 7, 8, 9 and 10 indicate that there was a significant showed by the response to interaction between flax cultivars × nitrogen and phosphorus fertilizer levels × soil salinity levels on seed index and total fiber percentage, technical length, straw yield per plant and per fed., seed yield per plant and length of top capsules zone, in the first and the second seasons and fiber fineness and seed yield per fed. in second season. The highest mean numbers of straw and fiber yields per plant and per fed. and fiber fineness were resulted from mineral fertilizing Sakha3 cultivar with 55 kg N/fed.+22.5 kg P_2O_5/fed. under 2 dsm^{-1} salinity level in both seasons. Under aforementioned NP fertilizer and salinity levels, Giza11 cultivar produced the highest value of length of top capsules zone in both seasons. Kineber and El-Kady (2002), El-Beltagi *et al.* (2008) and EL-Yamanee (2018) came to similar results.

In general, it can be recommended that rising salinity levels from 2 to 8 dsm^{-1} decreased flax yields and its components, while increasing fertilizer levels from 45 kg N/fed. + 15.5 kg P_2O_5/fed. to 55 kg N/fed.+ 22.5 kg P_2O_5/fed. produced the highest values of yields and its components of flax cultivar. Fertilizing Sakha3 cultivar with 55 kg N/fed. + 22.5 kg P_2O_5/fed. gave the maximum straw and fiber yields, under Kafr El-sheikh governorate land, Egypt.

Table 6. Straw yield /plant as influenced by the interaction between cultivars, N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons.

Treatments		Straw yield /plant (g)							
		2015/2016				2016/2017			
Cultivars	fertilizer levels	Salinity levels				Salinity levels			
		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}
Sakha 3	1	0.992lm	0.915qr	0.836vw	0.606A	1.092jk	1.015n	0.936rs	0.706v
	2	1.086fg	0.990m	0.975mn	0.754y	1.186ef	1.090jk	1.075kl	0.854t
	3	1.207a	1.026jk	0.994lm	0.863tu	1.274bc	1.126hi	1.094jk	0.963pq
	4	1.225a	1.170bc	1.026jk	0.887s	1.295a	1.270bc	1.126 hi	0.987p
Sakha 5	1	1.065hi	0.975mn	0.880st	0.864tu	1.165fg	1.075kl	0.980pq	0.964pq
	2	1.043g	0.923pq	0.883st	0.855uv	1.143gh	1.023n	0.983p	0.955qr
	3	1.112de	0.938op	0.898rs	0.888s	1.212de	1.038mn	1.013no	0.988op
	4	1.154c	1.097ef	1.069gh	0.983m	1.254c	1.197e	1.169fg	1.083k
Giza 11	1	0.989m	0.932pq	0.812x	0.714z	1.089jk	1.032mn	0.912s	0.814u
	2	1.087fg	1.013kl	0.837v	0.734yz	1.187ef	1.113ij	0.937rs	0.834tu
	3	1.161c	1.108def	0.956no	0.815wx	1.261bc	1.209de	1.056lm	0.915s
	4	1.184 b	1.126d	1.101ef	0.973mn	1.284 b	1.226 d	1.201de	1.073kl

Means followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Table 7. Straw yield /fed. as influenced by the interaction between cultivars , N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons.

Treatments		Straw yield /fed.. (ton)							
		2015/2016				2016/2017			
Cultivars	fertilizer levels	Salinity levels				Salinity levels			
		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}
Sakha 3	1	2.195m	2.086qrs	1.958uv	1.917v	2.362kl	2.286mno	2.158rs	2.117st
	2	2.914ef	2.423kl	2.131n-q	2.011tu	3.014f	2.623i	2.331lm	2.211pqr
	3	3.0456bcd	3.016cd	2.162m-p	2.043st	3.117b	3.116bc	2.362kl	2.243n-q
	4	3.136a	3.077 b	2.472k	2.099qrs	3.120a	3.117b	2.681i	2.299lmn
Sakha 5	1	2.545j	2.398l	2.014tu	1.900v	2.544j	2.398k	2.081tuv	1.900x
	2	2.670i	2.558 j	2.118opq	2.092qrs	2.669i	2.555j	2.118st	2.089tuv
	3	2.733gh	2.713hi	2.124opq	2.105pqr	2.833h	2.813h	2.224o-r	2.205qr
	4	2.774 g	2.746gh	2.187mn	2.114opq	2.874h	2.846h	2.187qr	2.114stu
Giza 11	1	2.877f	2.731gh	2.050rst	2.015tu	2.877h	2.831h	2.050uvw	2.014w
	2	2.963 e	2.949e	2.05rst	2.023t	2.966g	2.949g	2.05uvw	2.023vw
	3	3.052bc	3.048cd	2.171mno	2.100qrs	3.055d	3.088e	2.271m-p	2.200qr
	4	3.062bc	3.071bc	2.218m	2.130n-q	3.062c	3.071d	2.218pqr	2.231opq

Means followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Table 8. Seed yield /Plant as influenced by the interaction between cultivars, N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons .

Treatments		Seed yield /Plant (g)							
		2015/2016				2016/2017			
Cultivars	fertilizer levels	Salinity levels				Salinity levels			
		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}
Sakha 3	1	0.508i	0.433l	0.170x	0.097x	0.508lm	0.433no	0.100yz	0.095z
	2	0.792c	0.469jk	0.218vw	0.104w	0.514lm	0.469mn	0.101xy	0.104xyz
	3	0.599h	0.511i	0.234v	0.121vw	0.533jkl	0.511lm	0.104x	0.101xy
	4	0.579h	0.513i	0.260u	0.129v	0.579ij	0.513lm	0.110x	0.109x
Sakha 5	1	0.625ef	0.678g	0.206s	0.186t	0.625ghi	0.578ijk	0.139w	0.206tu
	2	0.514i	0.735ef	0.233q	0.171r	0.692cde	0.635fghi	0.265rs	0.171uv
	3	0.849a	0.744de	0.252pq	0.232q	0.748c	0.644efgh	0.352pq	0.232st
	4	0.867a	0.757d	0.264p	0.243q	0.960a	0.760b	0.243rst	0.264rs
Giza 11	1	0.785c	0.687g	0.245o	0.225o	0.685def	0.485lmn	0.145v	0.125v
	2	0.799c	0.722f	0.398 m	0.365n	0.604hi	0.522klm	0.298qr	0.253rst
	3	0.800 c	0.736ef	0.462k	0.433 l	0.700cde	0.537jkl	0.362p	0.333pq
	4	0.821b	0.762d	0.484j	0.453k	0.721cd	0.662efg	0.384op	0.353pq

Means followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Table 9. Seed yield/fed. as influenced by the interaction between cultivars, N and P fertilizer levels and salinity levels during 2016/2017 season.

Treatments		Seed yield /fed.. (kg)			
		2016/2017			
Cultivars	fertilizer levels	Salinity levels			
		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}
Sakha 3	1	126.36lmn	121.62nop	162.26y	125.81y
	2	137.26ij	103.14jk	138.21wx	126.01x
	3	183.15ghi	158.61hi	149.53qrst	129.23stu
	4	195.48gh	165.16hi	186.42 pq	154.14qrs
Sakha 5	1	266.53 f	197.38gh	155.33 uv	145.43vw
	2	388.58cde	294.55f	130.39rstu	107.36 tuv
	3	431.62bc	393.29cde	172.68qrs	152.55 qrst
	4	478.77a	462.34ab	181.08kl	160.98k-n
Giza 11	1	401.97cde	374.80 de	95.84opq	136.04pqr
	2	397.54cde	361.81e	157.34k-n	134.01mno
	3	408.53cd	369.23de	185.44kl	151.72lmn
	4	310.83 f	368.91de	219.30g	170.48klm

Means followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Table 10. Fiber yield / fed. influenced by the interaction between cultivars, N and P fertilizer levels and salinity levels during 2015/2016 and 2016/2017 seasons.

Treatments		Fiber yield /fed.. (kg)							
		2015/2016				2016/2017			
Cultivars	fertilizer levels	Salinity levels				Salinity levels			
		2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}	2 dsm^{-1}	4 dsm^{-1}	6 dsm^{-1}	8 dsm^{-1}
Sakha 3	1	285.28h	266.26i	138.2q-u	137.47q-u	299.95h	286.26 i	158.28q-u	157.4q-u
	2	461.47b	334.16f	143.94o-s	142.98 o-t	381.47 b	254.16f	163.94o-s	162.98o-t
	3	474.01a	351.16e	145.85opq	145.04opqr	394.01a	271.16e	165.85opq	165.0o-r
	4	481.18a	339.30f	152.37o	150.14op	401.27a	259.27f	172.37o	170.14op
Sakha 5	1	191.69l	141.46 n	124.4w	122.66w	111.69 l	159.13n	144.43w	149.33uvw
	2	221.15k	165.56m	124.60w	123.55w	141.15k	185.56m	144.60w	143.55 w
	3	233.86j	187.31l	125.60vw	125.11vw	153.86 j	107.31l	145.60vw	145.11vw
	4	237.10j	188.15l	130.5uvw	129.69uvw	157.10j	104.82l	150.53uvw	149.69uvw
Giza 11	1	316.15g	263.64i	132.4s-w	131.69 t-w	236.15g	183.64i	152.4s-w	151.6t-w
	2	334.19f	328.23f	133.89r-w	132.86s-w	254.19f	248.24f	153.89r-w	152.8s-w
	3	444.96c	414.04d	138.02q-u	136.6 q-v	364.96c	334.04d	158.02q-u	156.6 q-v
	4	451.42bc	415.04d	138.66p-u	137.45q-u	371.42bc	335.04d	158.66p-u	157.4q-u

Means followed by the same letter (s) is (are) not significantly different at 5% level according to Duncan's multiple range test.

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تأثير ملوحة التربة والتسميد النيتروجيني والفوسفاتي على انتاجية بعض أصناف الكتان

عبد الرحيم عبد الرحيم ليله[١]، محمد حسين غنيمة[١]، محمد السيد قنيبر[٢] و إبراهيم حسن محمد طلحة [٢]

[١]قسم المحاصيل - كلية الزراعة - جامعة المنصورة - مصر.

[٢]قسم بحوث محاصيل الألياف - معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية - الجيزة – مصر.

أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا (ليزوميتر قسم كيمياء الأراضي) - محافظة كفر الشيخ - مركز البحوث الزراعية - الجيزة – مصر، خلال موسمي ٢٠١٥/٢٠١٦ و ٢٠١٦/٢٠١٧ لدراسة تأثير مستويات الملوحة والسماد النيتروجيني والفوسفاتي على المحصول ومكوناته وكذلك الصفات التكنولوجية لثلاثة أصناف من الكتان. وقد نفذت التجربة في تصميم القطع المنشقة مرتين ذو ثلاث مكررات. خصصت القطع الرئيسية لأصناف الكتان: سخا٣ (طراز ليفي)، سخا٥ (طراز زيتى) وجيزة١١ (طراز ثنائى الغرض), بينما خصصت القطع الشقية الأولي لمستويات التسميد النيتروجيني والفوسفاتي: ٤٥ كجم نيتروجين /فدان+ ١٥.٥كجم فو٢ا٥ / فدان، ٤٥ كجم نيتروجين /فدان+ ٢٢.٥ كجم فو٢ا٥/ فدان، ٥٥ كجم نيتروجين/فدان + ١٥.٥ كجم فو٢ا٥/ فدان و٥٥ كجم نيتروجين + ٢٢.٥ كجم فو٢ا٥/ فدان. وخصصت القطع تحت الشقية لمستويات الملوحة (٢، ٤، ٦و ٨ ديسيمينز/متر). أظهرت نتائج الدراسة تفوق الصنف سخا٣ معنوياً على الصنفين الأخرين حيث أعطي أعلى القيم لمحصول الألياف للنبات والفدان، محصول القش للنبات والفدان، طول الألياف، النسبة المئوية للألياف ونعومة الألياف في كلا الموسمين. كما تفوق الصنف جيزة١١ مسجلا أعلى القيم لعدد الكبسولات / نبات، وزن ١٠٠٠ بذرة، عدد البذور/ نبات، محصول البذور للنبات والفدان في كلا الموسمين. بينما تفوق الصنف سخا٥ معنوياً في محتوى الزيت بالبذرة. اشارت النتائج إلى أن جميع الصفات تحت الدراسة قد زادت تدريجيا نتيجة لزيادة مستويات السماد النيتروجيني والفوسفاتي، باستثناء صفة نعومة الألياف في كلا الموسمين.وعلى العكس , فقد قلت قيم الصفات تحت الدراسة تدريجيا نتيجة لزيادة مستويات الملوحة في كلا الموسمين, وتم الحصول على أعلى القيم لجميع الصفات المدروسة تحت أقل مستوى ملوحة (٢ ديسيمنز/متر) في كلا الموسمين. توصي النتائج المتحصل عليها من هذه الدراسة بتسميد صنف الكتان جيزة١١ بمعدل ٥٥ كجم نيتروجين/فدان + ٢٢.٥ كجم فو٢ا٥ / فدان وذلك تحت مستوي من الملوحة (٢ ديسيمينز/متر) وذلك للحصول على أعلى محصول للبذور ومكوناته ومع نفس مستوى الملوحة والتسميد للصنف سخا٣ للحصول على أعلى محصول قش وألياف وذلك تحت الظروف البيئية لمحافظة كفر الشيخ، مصر.