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EFFECT OF NITROGEN SOURCES AND THEIR MIXTURES ON YIELD, SOME CHARACTERS AND MINERAL COMPOSITION OF SOME FLAX GENOTYPES (*Linum usitatissimum L.*)

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ABSTRACT

Two field experiments were conducted at the farm of Tag EL-EZZ Res. station, Dakahlia Governorate, during winter seasons of 2002/2003 and 2003/2004. The work aimed to study the effect of three nitrogen sources and their mixtures on yield, some seed characters and mineral concentrations in some flax genotypes (Sakha 1 & Sakha 2 varieties and strains of 2419/1 & 413/1/3/2). The nitrogen sources were used are: urea (46% N), ammonium nitrate (33% N) and ammonium sulphate (20.5% N) with the recommended dose (45 kg N fed^{-1}).

The obtained results can be summarized in the following:

1- The data showed that, there were highly significant differences between flax genotypes for the studied parameters in both seasons.

2- Sakha 1 variety surpassed Sakha 2 and the strains of 2419/1 and 413/1/3/2 for plant height, technical length, straw yield/plant, straw yield/fed. and fiber yield/fed. in both seasons.

3- Sakha 2 surpassed Sakha 1, 2419/1 and 413/1/3/2 for seed index and seed yield/fed. in both seasons, as well as macro and micronutrients concentration, while strain 2419/1 surpassed other strains and species for No. capsule and seed yield/plant in both seasons.

4- Using ammonium nitrate + ammonium sulphate significantly increased all studied parameters as yield and seed characters, as well as macro and micronutrients concentration in both studied seasons.

5- It is noticed that, the interactions effect between all treatments on all studied parameters were heighly significant in both seasons, of present work.

INTRODUCTION

Flax (linum usitatissimum, L.) is one of the ancient grown crops in several regions of the world for both fiber, seed and oil production. In Egypt, it is the most important fiber crops after cotton. Flax plays an important role in the national economy due to its importance in exportation and many local industrial purposes i.e., industrials of paint, varnish and nutritional, (Moawed, 2001a and Sharief *et al.,* 2005).

As a result of the decrease in flax area nowadays in Egypt, a gap between the production and consumption has been increased. This gap could be minimized by increasing flax yield/unit area through planting high yielding varieties and optimizing agricultural practices. Proper fertilization is among numerous factors involved in this concern. Doubtless, application of

NPK fertilizers play an important role for obtaining high flax yield (Leilah, *et al.* (2003).

Flax cultivars significantly differed in yield and its attributes (EL-Shimy *et al.* 1993; Leilah, 1993; EL-Kady *et al.*, 1995; El-Sweify and Mostafa, 1996; Mostafa *et al.*, 1997; Moawed and Abd EL-Hamid, 1999; Moawed, (2001a) and EL-Azzouni *et al.*, (2003).

EL-Sewfy, (1993) reported that Giza 7 surpassed other flax varieties in technical length, straw yield/fed. and fiber percentage, as well as strain 2419/1 was superior in number of capsules/plant, seed yield/fed. seed index, seed oil percentage and oil yield/fed. EL-Azzouni *et al.*, (2003) stated that Sakha 1 flax variety has the superiority on strain 2465/3 in straw yield/fed. and all related characters (plant height, technical length, straw yield/plant, straw yield/fed., fiber yield/plant and fiber yield/fed.) following by strain 2465/3 as well as ranked first in seed yield/fed. followed by strain 2465/3 and 402/12. Regarding the effect of nitrogen fertilizer, Yadav *et al.*, (1990) illustrated that increasing rates of N increased 1000-seed weight. Dubey, (1994) in India found that the highest seed yield and net return of flax CV. JLS-23 came from the application of 60 kg N and 30 kg P_2O_5/ha.

Sharief *et al.*, (2005) found that, increasing nitrogen fertilizer levels from 70 to 120 and 170 kg N/ha. significantly increased plant height, technical length, stem diameter, number of fruit branches/plant, number of capsules/plant, number of seeds capsule^{-1}, 1000-seed weight, seed and straw yield/plant and hectars, as well as nitrogen level of 170 kg N/ha was the recommended level to increase seed and straw yields/ha.

As for interaction between flax varieties and fertilizer treatments, Leilah, (1993) found that, there is significant effects between them on technical length of stem as well as seed and straw yields fed^{-1}. On the other hand, Moawed and Abd EL-Hamid, (1999) found that, the effect of the interaction between cultivars (Iryana and vihing) and N fertilizer levels was not significant except seed yield/fed.

Nitrogen (N) plays a vital role in nutritional and physiological status on plant and is also the unique among the minerals nutrients that absorb as NO_3^- and NH_4^+ ions. Also nitrogen fertilization may promote changes in the mineral composition of a plant. The most common N fertilizers NO_3^- and NH_4^+ are the N carriers. This also the case for mixed and compound fertilizers. NH_4 is partially adsorbed on soil colloids and its uptake rate is usually therefore lower than that of NO_3^- under field conditions. For this reason most crops do not respond as quickly to NH_4^+ fertilizers as to NO_3 application. Nitrate fertilizers are known to produce a rapid response in the plant. In most cases, however, the difference between both types of N fertilizers play only a minor role (Mengel and Kirkby, 1982). Huppert and Buchner (1953) found that there were no major differences in yield response weather crops had been dressed with NO_3^- or NH_4^+-N.

The form and level of N-nutrition can considerably influence the cation-anion balance in plant (Jungk, 1967). Coic *et al.*, (1962) found that tomato plants fed with NO_3-N contain high levels of cations and organic anoins. In contrast plants supplied with NH_4^+-N often contain lower concentration of inorganic cations (Ca, Mg, K).

Therefore, the objectives of this work is to investigate the effect of using three sources from nitrogen fertilizers and their combination on some yield, seed characters and mineral compositions of some flax genotypes.

MATERIALS AND METHODS

Two field experiments were performed at the experimental farm of Tag EL-EZZ Res. Station, Dakahlia Governorate during winter seasons of 2002/2003 and 2003/2004, to study the effect of nitrogen sources and their combinations on growth, yield components and some characters as well as macro & micronutrient cocentratios of some flax varieties *(Linum usitatissimum L.)*. Chemical analysis and physical properties of the experimental soil are presented in Table (1).Chemical analyses of the soil were determined according to Richard, (1954). Available N, P and K in soil were determined according to Black, (1982). Available forms of Zn, Mn and Fe in soil were determined by DTPA method (diethylene triamine penta acetic acid) according to Lindsay and Norvell, (1978). Particle size distribution was determined by international method (Piper, 1950).

Table (1): Some chemical and physical properties of the studied soils for surface layer (0-30 cm depth) in both (2002-2003 and 2003-2004) seasons.

Season	EC_e soil paste dSm^{-1}	pH at 1: 2.5 suspension	ESP%	Available nutrients mg kg^{-1}					
				N	P	K	Fe	Zn	Mn
1st season	3.5	7.9	6.25	51	11	180	4.8	1.3	14
2nd season	4.1	7.9	6.63	46	13	183	4.6	1.6	18

Seasons	Coarse sand %	Fine sand %	Silt %	Clay %	O.M.	$CaCO_3$ %	Texture
1st season	3.83	19.18	20.87	51.05	2.03	3.04	Clay
2nd season	4.02	19.19	20.69	51.37	1.60	3.13	Clay

Three flax genotypes were used, which include Sakha 1 and Sakha 2 in addition to two strains of 2419/1 and 413/1/3/2, putted as main plots. The sub-plots were occupied by nitrogen sources and their mixtures with recommended dose 45 kg N/fed. and their combinations, i,e. urea (46% N), ammonium nitrate (33%), ammonium sulphate (20.5%), urea (22.5 kg N) + ammonium nitrate (22.5 kg N), urea (22.5 kg N) + ammonium sulphate (22.5 kg N) and ammonium nitrate (22.5 kg N) + ammonium sulphate (22.5 kg N). A split plot design with three replicates was used in each experiment and each plot area was (3 × 3.5) 10.5 m^2. Seeds were sown on November 15th in the first season and on 18th in the second one, seeds were obtained from the fiber Res. Section, Agric. Res. Center (A.R.C.), Giza, Egypt.

All experimental plots received a recommended dose from phosphorus fertilizer with rate 15.5 kg P_2O_5/fed. in form of calcium superphosphate (15.5% P_2O_5) before sowing. Other agricultural practices

were applied as recommended. At maturity, ten guarded plants were pulled out randomly from each plot to measure the following characters:

A) Straw yield and its related characters:

1- Plant height (cm).
2- Technical length (cm).
3- Stem diameter (cm)
4- Straw yield/plant (gm).
5- Straw yield/fed. (ton).
6- Fiber yield/fed. (kg).

B) Seed yield and its related characters:

1- No. capsule.
2- Seed yield/plant (gm).
3- Seed index (%).
4- Seed yield/fed. (kg).

C) Economic characters:

1- Harvest index (%).
2- Biological yield (ton).

Harvest index (HI): the economic yield as percentage from the biological according to the following formula suggested by Wallaco *et al.*, (1972) and Kallo, (1988).

H.I. = Ey/W × 100 ..... where Ey = Economic yield.
W = Biological yield.

$$\text{Economic yield} = \frac{\text{Fiber yield + seed yield}}{\text{Biological yield}}$$

Biological yield = straw yield + seed yield

Plant samples were taken at flowering stage (as a physiological stage) from each plot. The taken part was the intertop of plant. Which this physiological stage represent the sufficient level for each nutrient. All collected samples were dried at 70 °C in forced-air circulation oven and ground in a porcelain mortar. Macro and micronutrients were determined as wet digested using H_2SO_4-HCl_4 mixture according to (Black, 1982). Fe, Zn, Mn were determined by the atomic absorption spectrophotometer (Pirken EL-mer 2380).

All obtained data were subjected to the analysis of variance according to the procedures outlined by Gomez and Gomez, (1984).

RESULTS AND DISCUSSIONS

A) Yield and yield components:

1- Straw yield and its related characters:

Means values of straw yield and its related characters i.e. plant height, technical length, stem diameter, straw yield/plant, straw yield/fed. and fiber yield/fed., as affected by flax genotypes, nitrogen sources and their interactions in the two successive seasons are presented in Table (2).

The statistical analysis of variance showed that, there were highly significant differences in all studied parameters as affected by flax genotypes, nitrogen sources and their interactions in both seasons.

1-1 Genotypes effect:

Data illustrated in Table (2) clearly show that, Sakha 1 flax variety in the first rank between the two strains (2419/1 and 413/1/3/2) and variety of Sakha 2 in plant height, technical length, straw yield/plant, straw yield/fed. and fiber yield/fed. at both seasons.

Table (2): Effect of some flax genotypes, nitrogen sources and their interactions on plant height, technical length, stem diameter, straw yield/plant, straw yield/fed. and fiber yield/fed. of flax at harvest stage during season of 2002-2003 and 2003-2004.

Characters / Treatments	Plant height cm		Technical length cm		Stem diameter cm		Straw yield/plant gm		Straw yield/fed. ton		Fiber yield/fed. kg.	
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
Genotypes												
2419/1	87.98	88.29	82.78	82.84	2.17	2.16	2.04	2.05	3.88	3.88	611.70	621.74
413/1/3/2	90.56	90.91	85.84	85.72	2.23	2.24	2.09	2.10	3.81	3.80	647.51	654.31
Sakha 1	98.60	99.77	94.97	95.31	2.05	2.05	2.22	2.23	4.42	4.41	744.36	747.53
Sakha 2	95.00	96.36	85.61	91.73	2.14	2.14	2.13	2.14	4.26	4.28	665.95	671.57
F. test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%	1.97	1.35	1.40	2.11	0.04	0.02	0.04	0.02	0.08	0.14	13.53	7.11
Fertilizers												
Urea	88.87	88.75	83.34	84.42	2.14	2.13	2.08	2.09	3.90	3.90	639.33	646.21
Am. Nitrate	91.76	93.05	85.53	87.25	2.15	2.15	2.10	2.11	4.02	4.01	660.76	665.81
Am. Sul.	87.10	87.22	80.88	82.26	2.13	2.13	2.08	2.08	3.75	3.77	629.68	632.17
Urea + Am N.	97.03	98.53	91.18	94.10	2.15	2.15	2.16	2.17	4.31	4.34	689.45	702.15
Urea + Am. Sul.	93.66	94.61	88.53	88.93	2.14	2.14	21.3	2.13	4.16	4.11	676.68	679.75
Am. N. + Am. Sul.	99.79	100.83	94.33	96.45	2.17	2.17	2.18	2.19	4.41	4.43	708.40	716.64
F. test	**	**	**		**	**	**	**	**	**	**	**
L.S.D. 5%	1.52	1.78	1.30	1.86	0.03	0.02	0.03	0.02	0.16	0.16	10.50	8.52
Interactions Genotypes × fertilizers F. test	**	**	**	**	**	**	**	**	**	**	**	**

Am = ammonium. Sul = sulphate. N = nitrate

Regarding straw yield ton/fed., data showed that Sakha 1 has heighest values with the means of 4.42 and 4.41, while the lowest mean values were obtained from strain 413/1/3/2 (3.81 and 3.80) in the first and second seasons, respectively. These findings are in harmony with those of Momtaz *et al.*, (1989); Leilah (1993); Moawed and Abdel Hamid (1999) and EL-Azzouni *et al.*, (2003).

From the same table, data illustrated that, Sakha 1 gave the heighest yield for fiber/fed. in both seasons (744.36 and 747.53 kg). These results agree with that found by EL-Swiefy and Mostafa , (1996) and EL-Azzouni *et al.*, (2003).

1-2 Nitrogen sources effect:

The effect of nitrogen sources on yield and yield components are illustrated in Table (2). Which indicate, there is a highly significant effect between nitrogen sources and all studied parameters in both seasons.

In this respect data showed that, using mixed from ammonium nitrate with ammonium sulphate gave the heighest values for all studied parameters, where their values for straw yield/fed. were: 4.41, 4.43 ton and 708.40, 716.64 kg for fiber yield/fed. in both seasons, respectively.

This finding attributed with that found by Yukio Fukunaga and John King, (1978), who, found that flax cells grew better in nitrogen medium supplemented with 2 mM NH_4^+ than in medium containing only nitrate and protoplast yield was also increased.Whereas the lowest values were obtained from using ammonium sulphate separately which its mean values were: 3.75,

3.77 ton/fed. for straw yield and 629.68, 632.17 kg/fed. for fiber yield in both seasons, respectively.

From the same table, it is clear that, using mixed nitrogen sources gave increase in yield and yield components better than using the same nitrogen sources as separately in their effect on studied parameters.

2- Seed yield and its related characters:

Mean values of seed yield and its related characters i.e. No. capsule, seed yield/plant, seed index, seed yield/fed., as well as harvest index and biological yield as affected by genotype of flax, nitrogen sources and their interactions are illustrated in Table (3).Where the analysis of variance revealed significant differences in all studied parameters as affected by flax genotype, nitrogen sources and their interactions, in both studied seasons.

2-1 Genotypes effect:

In this respect data showed that Sakha 2 flax variety ranked first for seed index, and seed yield/fed. compared with others variety and the two strains in both seasons. Where the mean values for seed yield/fed were: 685.47 and 687.55 kg in 2002/2003 and 2003/2004 seasons respectively, while 2419/1 strain surpassed others strain and species in No. capsule and seed yield/plant in both seasons.

While the lowest values were obtained from 413/1/3/2 strain which their values were: 578.46 and 584.7 kg/fed. in both seasons, respectively. But Sakha 1 was the first rank for harvest index and biological yield in both seasons among others varieties and strains, which their values were: 1.38, 1.39% for harvest index and 5.05, 5.05 ton for biological yield in both seasons, respectively.

2-2 Nitrogen sources effect:

The effect of nitrogen sources on seed yield and its related characters as well as harvest index (%) and biological yield (ton) are illustrate in Table (3), which showed significant differences for all studied parameters in both seasons. Where, using ammonium nitrate mixed with ammonium sulphate have the heighest mean values among other fertilizers treatments and had clear effect on all studied parameters in both seasons. The mean values were: 664.73 and 673.22 kg. in both seasons for seed yield/fed., respectively. The lowest values were obtained as ammonium sulphate fertilizer was used only where the mean values were: 614.61 and 615.57 for seed yield/fed. in both seasons, respectively.

B) Macro and micronutrients concentrations:

1- Varieties effect:

Data illustrated in Table (4) show the effect of strains (2419/1 and 413/1/3/2) and species (Sakha 1 and Sakha 2) on macro and micrnutrients concentrations in both seasons. Which the statistical analysis refer to there is heighly significant effect were found between all varieties and factors under study in both seasons except K% in second season. From the Table (4) Sakha 2 gave the highest values between all varieties for most studied factors, where, their mean values were: 1.98, 2.16, 0.29, 0.35, 1.62 and

1.40 % for N, P, K in both seasons, respectively and 180.00, 188.56, 40.61, 43.56, 65.72 and 70.67 mg kg^{-1} for Fe, Zn and Mn, in both seasons, respectively. From the same data, it's found that the concentration mean values for macro and micronutrients lies in sufficient range for all nutrients except K%, in second season. This attributed to the available K in experimental soil was lower than sufficient range for plant. These data agree with that found in Manitoba soil fertility guide (2004), which refer to that the sufficient ranges for K% lies between 1.5-3.0%.

Table (3): Effect of some flax genotypes, nitrogen sources and their interactions on No. capsule, seed yield/plant, seed index, seed yield/fed., harvest index and biological yield of flax at harvest stage during seasons of 2002-2003 and 2003-2004.

Characters	No. capsule/plant		Seed yield/plant gm		Seed index %		Seed yield/fed. kg.		Harvest index %		Biological yield ton.	
Treatments	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
Genotypes												
2419/1	10.54	10.81	0.41	0.42	9.99	10.00	653.02	655.80	1.27	1.28	4.54	4.53
413/1/3/2	9.79	9.95	0.24	0.25	8.09	8.09	578.46	584.71	1.23	1.26	4.38	4.40
Sakha 1	7.94	8.13	0.36	0.37	9.69	9.71	637.71	642.32	1.38	1.39	5.05	5.05
Sakha 2	8.42	8.53	0.39	0.40	10.07	10.07	685.47	687.55	1.35	1.36	4.95	4.92
F. test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%	0.31	0.23	0.02	0.02	0.04	0.04	6.06	39.52	0.02	0.02	0.07	0.06
Fertilizers												
Urea	8.39	8.48	0.33	0.34	9.44	9.44	620.61	648.59	1.27	1.20	4.52	4.54
Am. Nitrate	8.78	8.98	0.34	0.37	9.45	9.48	634.99	641.53	1.30	1.31	4.66	4. 65
Am. Sul.	7.02	7.18	0.32	0.33	9.44	9.43	614.61	615.57	1.24	1.25	4.36	4.31
Urea + Am N.	10.48	10.79	0.37	0.38	9.48	9.48	652.52	661.43	1.34	1.36	4.96	5.00
Urea + Am. Sul.	9.38	9.49	0.35	0.35	9.47	9.46	644.51	615.23	1.32	1.32	4.80	4.75
Am. N. + Am. Sul.	11.01	11.22	0.39	0.40	9.49	9.49	664.73	673.22	1.37	1.39	5.08	5.11
F. test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%	0.25	0.29	0.03	0.02	0.03	0.03	8.61	40.77	0.02	0.01	0.16	0.10
Interactions Genotype × fertilizers F. test	**	**	**	**	**	**	**	**	**	**	**	**

Am = ammonium. Sul = sulphate. N = nitrate

2- Fertilizers effect:

The effect of fertilizers sources on N, P, K, Fe, Zn and Mn concentrations in flax tissues are found in Table (4), which refer to there is heighly significant effect were found between fertilizers and all studied factors in both seasons. Mixed ammonium nitrate + ammonium sulphate gave the highest effect between all fertilizers treatment in both studied seasons as well as has the highest mean values which are 1.97, 2.14, 0.29, 0.34, 1.62 and 1.43 % for N, P and K% in both seasons, respectively as well as 191.50, 199.33, 42.42, 46.08, 70.92 and 76.17 mg kg^{-1} for Fe, Zn and Mn in both seasons, respectively. This could explained by finding with Coic *et al.*, (1962) who mentioned that the plants fed with NO_3^--N contain high levels of cations and plants supplied with NH_4^+-N have higher concentration for anions.

The interaction effect for species with fertilizers over studied parameters are found in Table (4) which showed, heighly significant relationship in both seasons for all studied parameters.

From this study, it can be recommended by, using mixtures from ammonium nitrate (22.5 kg N/fed.) + ammonium sulphate (22.5 kg N/fed.) to fertilize the two genotypes of Sskha1 and Sakha2 to obtain the highest fiber yield and some seed characters respectively as well as improving mineral compositions for flax genotypes.

Table (4): Effect of some flax genotypes, nitrogen sources and their interactions on macro and micronutrient concentrations in plant tissues of flax at flowering stage during seasons of 2002-2003 and 2003-2004.

Characters	N %		P %		K %		Fe mg kg^{-1}		Zn mg kg^{-1}		Mn mg kg^{-1}	
Treatments	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
Genotypes												
2419/1	1.88	2.04	0.26	0.31	1.55	1.37	167.11	182.72	35.72	40.33	59.78	67.56
413/1/3/2	1.90	2.08	0.27	0.32	1.56	1.42	171.50	184.50	35.72	40.50	62.83	68.44
Sakha 1	1.88	2.06	0.27	0.31	1.55	1.38	179.167	186.83	38.27	43.44	63.78	71.11
Sakha 2	1.98	2.16	0.29	0.35	1.62	1.40	180.00	188.56	40.61	43.56	65.72	70.67
F. test	**	**	**	**	**		**	**	**	**	**	**
L.S.D. 5%	0.04	0.04	0.02	0.02	0.04	N.S	11.08	5.30	1.40	1.35	2.71	2.70
Fertilizers												
Urea	1.88	2.06	0.27	0.32	1.56	1.39	165.67	177.08	35.17	39.67	57.58	64.08
Am. Nitrate	1.92	2.10	0.27	0.32	1.55	1.39	170.67	179.92	35.08	40.50	60.00	66.33
Am. Sul.	1.86	2.03	0.26	0.31	1.54	1.38	165.08	177.42	34.42	39.42	55.92	68.67
Urea + Am N.	1.95	2.11	0.28	0.32	1.60	1.39	174.75	188.08	38.50	42.00	66.08	71.42
Urea + Am. Sul.	1.89	2.07	0.27	0.33	1.56	1.37	179.00	192.08	39.92	44.08	67.67	70.00
Am. N. + Am. Sul.	1.97	2.14	0.29	0.34	1.62	1.43	191.50	199.33	42.42	46.08	70.92	76.17
F. test	**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%	0.03	0.03	0.02	0.02	0.03	0.03	5.54	4.79	2.63	2.41	5.47	1.75
Interactions Genotypes × fertilizers F. test	**	**	**	**	**	**	**	**	**	**	**	**

Am = ammonium. Sul = sulphate. N = nitrate

REFERENCES

Black, C.A. (1982). "Methods of Soil Analysis". Part 2. American society of Agronomy, Inc. Publisher, Madison, Wisconsin, USA.

Coic, Y.; Lesaint and L.E. Roux F. (1962). Effects of ammonium and nitrate nutrition and a change of ammonium and nitrate supply on the metabolism of anions and cations in tomatoes. Ann. Physiol. Veg. (4): 117-125.

Dubey, O.P. (1994). Response of linseed to nitrogen and phosphorus. Sciences 23(34): 37-38.

EL-Azzouni, A.M.; E.A. Moawed and S.M. Salama (2003). Effect of seeding rate, potassium fertilizer on some genotypes of flax *(Linum usitatissimum, L.)* J. Agric. Sci. Mansoura Univ., 28(8): 5887-5902.

EL-Kady, E.F.A.; S.E. Shafshak; E.L. Gab-Allah and M.E.A. Kineber (1995). Effect of seeding rates on yield and its components for six promising flax genotypes under saline conditions. J. Agric. Sci. Mansoura Univ., 20(2): 593-602.

EL-Shimy, G.H.; E.A. EL-Kady and N.K.M. Mourad (1993). Effect of seeding rates and nitrogen fertilizer levels on yield and anatomical manifestation on some flax genotypes. J. Agric. Res. Tanta Univ.,, 19(1): 92-104.

EL-Sweify, A.H.H. (1993). Evaluation of some promising flax strains in relation of growth, yield and quality. PH.D. Thesis. Fac Agric. Moshtoher Zagazig University. Egypt.

EL-Sweify, A.H.H. and S.H.A. Mostafa (1996). Growth, yield and quality of flax as affected by genotypes, potassium fertilizer and plant density. Egypt J. Appl. Sci., 11(7): 116-133.

Gomez, K.A. and A.A. Gomez (1984). "Statistical Procedures for Agricultural Research". John Wiley and sons. Inc. New York.

Huppert, V. and A. Buchner (1953). Recent experimental results on the effect of several N forms with particular regard to environmental conditions. Pflanzenernahr. Dang Bodenk, 60, 62-92.

Jung, K.A. (1967). Effect of ammonium and nitrate nitrogen on the cation-anion balance in plants and its relationship to the yield. Landw. Forsch., Sonderh. 21, 50-63.

Kallo (1988). Vegetable breeding. Vol. 111. CRC, Pr., Inc. Baco Ration, Florida, p. 174.

Leilah, A.A. (1993). Evaluation of yield and its components of flax cultivars under different nitrogen fertilizer levels). J. Agric. Sci., Mansoura Univ., 18(2): 313-321.

Leilah, A.A.; A.T. EL-Kassaby; M.H. EL-Hindi and T.A. Abu-Zaid (2003). Requirements of some flax cultivars from NPK fertilizers. Sci. J. of King Faisal Univ. (Basic and Applied Sciences) 4 (1424): 125-139

Lindsay, W.L. and W.A. Norvell (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Soc. Amer. J. 42: 421-428.

Manitoba Soil Fertility Guide (2004). Soil testing and proper soil analysis.. Manitoba Agriculture, Food and Rural Initiatives (May) www.gov.mb.ca/splash.html.

Mengel, K and E.A. Kirkby (1982). "Principles of Plant Nutrition". Publisher, International Potash Institute, p. 363-364.

Moawed, E.A. (2001a). Effect of irrigation intervals and time of nitrogen application on yield and technological characters in flax *(Linum usitatissumum, L.)*. J. Agric. Sic. Mansoura Univ., 26(2), 615-628.

Moawed, E.A. (2001b). Effect of microelements and row distances on the yield of some flax *(Linum usitatissimum, L.)* varieties. Egypt. J. Appl. Sci., 16(6): 157-172.

Moawed, E.A. and S.Z. Abd EL-Hamid (1999). Response of some local and introduced flax *(Linum usitatissimum, L.)* cultivars to various nitrogen fertilization levels. Egypt J. Appl. Sci., 14(12), 518-540.

Momtaz A.; M.EL-Farouk; N.K.M. Mourad; T. Nasar EL-Din; E.A.F. EL-Kady and A.M.A. Hella (1989). New flax varieties Giza 7 and Giza 8. Agric. Res. Rev., 68(7): 1461-1475.

Mostafa, S.H.A.; S.Z. Zidan and M.E. Kineber (1997). Association studies between quantitative trails in some flax genotypes. Egypt. J. Appl. Sci., 13(7): 93-108.

Piper, C.S. (1950). "Soil and Plant Analysis" Interscience publisher Inc. New York.

Richard, L.A.E.D. (1954). "Diagnosis and Improvement of Saline and Alkali Soils". USA Handbook No. 60.

Sharief, A.E. (1999). Performance of some flax cultivars to seeding rates. J. Agric. Sci. Mansoura Univ., 18(10): 2827-2834.

Sharief, A.E.; M.H. EL-Hindi; S.A. EL-Moursy and A.K. Seadh (2005). Response of two flax cultivars to N, P and K fertilizer levels. Sci. J. King Faisal Univ. (Basic and Applied Sciences) 6 (1426): 127-144.

Yadav, L.N.; A.K. Jain; P.P. Singh and M.D. Vyas (1990). Response of linseed to nitrogen and phosphorus application. Indian Jour. Of Agron. 35(4): 427-428.

Yukio Fukunaga and John King (1978). Effects of different nitrogen sources in culture media on protoplast release from plant cell suspension cultures. Plant Science Letters, V (11): 241-250.

Wallaco, D.H.; J.I. Ozbun and H.M. Munger (1972). Physiological genetics of crop yield. Adv. Agron., 24: 97-146.

تأثير المصادر النتروجينية والخلط بينها على المحصول وبعض الخصائص المحصولية والتركيب المعدنى لبعض أصناف الكتان

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أجرى هذا البحث فى محطة البحوث الزراعية بتاج العز دقهلية خلال موسمى الشتاء ٢٠٠٢/٢٠٠٣ و٢٠٠٣/٢٠٠٤. ويهدف هذا البحث إلى دراسة تأثير استخدام ثلاث مصادر نتروجينية والخلط بينهم على المحصول وبعض الصفات المحصولية والبذرية وتركيز بعض العناصر الغذائية فى بعض أصناف الكتان. ولقد استخدم صنفان هما سخا ١ وسخا ٢ وسلالتين هما ١/٢٤١٩ و٢/٣/١/٤١٣ أما المصادر النتروجينية فهى اليوريا (٤٦% ن) ونترات الأمونيوم (٣٣% ن) وسلفات الأمونية (٢٠,٥% ن) بالمعدل الموصى به. وهو ٤٥ كجم نتروجين/فدان. وبعض مخاليط منهم مثل اليوريا + نترات الأمونيوم واليوريا + سلفات الأمونيوم ونترات الأمونيوم + سلفات الأمونيوم.

ويمكن تلخيص النتائج المتحصل عليها كالتالى:

١- أظهرت النتائج أن هناك اختلافات معنوية بين أصناف الكتان لكل الصفات المدروسة خلال موسمى الدراسة وهى الخصائص المحصولية والبذور وتركيز العناصر الغذائية الكبرى والصغرى.

٢- لقد تميز صنف سخا ١ على كل من سخا ٢ والسلالتين ١/٢٤١٩، ٢/٣/١/٤١٣ فى كل من طول النبات والطول الفعال ومحصول القش/النبات ومحصول القش/فدان ومحصول الألياف/فدان فى كل من موسمى الدراسة.

٣- بينما تميز صنف سخا ٢ فى صفات وزن المائة حبة ومحصول البذور/فدان فى كلا الموسمين. كما تفوق أيضاً فى تركيزات العناصر الكبرى والصغرى.

٤- وكان لاستخدام سماد نترات الأمونيوم + سلفات الأمونيوم تأثير معنوى على كل صفات الدراسة المحصولية والبذرية وتركيز العناصر الكبرى والصغرى فى كلا الموسمين.

٥- وكان تأثير التفاعل بين كل المعاملات الدراسية على الصفات المدروسة معنوياً جداً خلال موسمى الدراسة.