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RESPONSE OF SAKHA 2 FLAX VARIETY TO FARMYARD MANURE AND PLANT DENSITY UNDER DIFFERENT HARVESTING DATES

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ABSTRACT

Two field experiments were conducted at Kafr El-Hamam Agric. Res. Station, El- Sharkia Governorate in the two successive seasons of 2003/04 and 2004/05 to study the effect of three harvesting dates at the main plot (140, 155 and 170 days after sowing), three plant densities (1750, 2000 and 2250 seeds / m^2) for sub-plot and three farmyard manure treatments (0, 10 and 20 m^3 FYM / fed.) for sub-sub plot, on yield quality and mineral content in seeds for flax variety(Sakha2).

Results obtained can be summarized as follow:

1- Delaying harvesting date up to the oldest age (170 days from sowing) caused on increase in all straw and seed yield characters in addition to all mineral contents of flax seeds, except with fiber fineness trait which remarkable reduction had happened as resulted of delaying harvesting date.

2- There was gradual increase in plant height, technical stem length, straw yield per fed., fiber yield per fed., fiber fineness, seed yield per fed., oil percentage and seed protein percentage. Meanwhile, all characters per plant in addition to 1000 seed weight decreased with increasing plant density towards 2250 seeds/m^2. But mineral content or percentage did not affected significantly in this case.

3- Straw and seed yields per fed and their related characters in addition to mineral content for seeds were increased but fiber fineness decreased with increasing farmyard application amount. D x H x FYM interaction was non-significant effect in all characters studied.

INTRODUCTION

Flax (*Linum usitatissimum* L.) is considered as a very important bast fiber crop. It is grown in Egypt since long time for oil and fiber production. It plays an important role in national Egyptian economy. It is contributes now far many products manufactured from fibers, seeds and even shives which extracted from the stem. Also, flax oil is one of the oldest commercial oil used as edible for human as well as oils used in the paint and varnish industry. The cultivated flax area in Egypt is very limited. Therefore, increasing flax yield per unit area is very important to do great efforts for increasing the yield of flax plants per fed in order to minimize the great gap between production and consumption. This could be achieved through improving the agronomic practices such as harvesting date to determine the optimum of maturity stage. Many investigator studied the effect of harvesting dates on yield and its quality in flax such as El-Farouk *et al.* (1980), Shafshak *et al.*, (1992), Ismail and Morsy (1994), El-Hariri *et al.,* (1996), El-Sweify and Mostafa (1996). Hussein (2002) and El-Azzouni (2003) who reported that there was increase in plant height, technical stem length, straw and fiber yield per fed., seed yield per plant as well as per fed., number of capsules per plant, oil yield per fed. with advancement flax plants towards maturity.

Concerning the effect of plant density, Momtaz *et al.,* (1981), El-Sweify and Mostafa (1996) and Abd El-Haleem (2006) reported that number of capsules per plant, oil yield per fad., seed, straw and fiber yields per plant as well as per fed. were significantly increased as plant density increased. Organic manures increase soil organic matter and hence improved the physiological, chemical and biological properties of many soil and can correct the deficiency of organic matter content and essential macro and microelements. Consequently, the availability of nutrient for plant will be increased as well as the other soil characteristics, Badyala *et al*.,1998, Abdel-Rasoul and El-Azzouni 2002, El-Azzouni and El-Banna, 2002 and Hussein, 2002, Showed significant effect of farmyard manure on soil and on yield and yield quality of flax and other crop.

Hence, the main objective of the present investigation was to study the effect of harvesting date, plant density and farmyard manure on yield, fiber quality and mineral contents of seeds flax variety, Sakha2.

MATERIALS AND METHODS

Two field experiments were carried out at Kafr El-Hamam Agric. Res. Station, El-Sharkia Governorate, Agric. Res. Center during the two successive seasons 2003/04 and 2004/05 to study the effect of harvesting dates, plant density and manuring with farmyard on yield, quality and seeds mineral content for flax variety, Sakha2. A split-split plot design with four replications was used where harvesting dates were 140, 155 and 170 days after sowing (DAS) in the main plots, however the three plant density (1750, 2000 and 2250 seeds / m^2) assigned in sub-plots. Moreover, organic manuring with FYM treatments (0, 10 and 20 m^3 FYM / fed.) were allocated in sub-sub plots, which was 2x3 (6 m^2) in size. Dates of cultivation were on November 15th and 18th during in both seasons, respectively. The preceding crops were maize in the two seasons. Organic fertilization was done before planting.

Flax seeds Sakha2 were treated with fungicide (Rhizo lext) at rate of 3g / 1kg seeds to protect seeds from infection during germination and flax seeds were sown by drilling machine in rows 15 cm apart. All agricultural practices were carried out as recommended in this district. Some properties of experimental site are listed in Table (1).

At harvest time, ten guarded plants were taken randomly from each sub-sub plot to be used in recording the yield and yield component to measuring the following characters:

A-Straw yield and its related characters: Total length (cm), technical stem length(cm), straw yield (g) / plant, straw yield (ton) / fed., fiber yield (g) / plant calculated, fiber yield (ton) / fed., fiber fineness (Nm) according Radwan and Momtaz, 1966).

B- Seed yield and its related characters: no. of capsules / plant, 1000-seed weight (g), seed yield (g) / plant, seed yield (kg) / fed., oil yield (kg) / fed., and both seed oil percentage and seed protein percentage (according to the extraction method described by the American Oil Chemist's Society, 1980).

Mechanical, chemical analysis, PH values and farmyard manure components for the experimental soil in the two successive seasons of 2003/04 and 2004/05 are presented in Table (1). Straw fiber and seed yields per fed were calculated from the whole sub-sub plot area basis.

Table (1): Some soil properties of investigated soil and the added farmyard manure in 2003/04 and 2004/05 seasons.

Soil characteristics	Season 2003/04	Season 2004/05	Soil characteristics	Season 2003/04	Season 2004/05	Farmyard manure	Season 2003/04	Season 2004/05
Particle size distribution			**Available nutrient**			**C%**	4.91	3.90
Organic matter%	1.75	1.51	**N%**	29.14	28.33	**Total N%**	0.32	0.31
Sand%	12.99	12.87	**P%**	15.21	14.36	**C/N**	15.34	12.58
Silt%	22.91	21.80	**K%**	241.17	23.31	**Total P%**	0.13	0.09
Clay%	64.10	63.82	**Fe%**	3.88	3.69	**Total K%**	0.52	0.48
Textural class	clay	Clay	**Mn%**	3.24	2.94	**PH**	7.40	8.20
EC	2.15	1.94	**Zn%**	1.07	1.02	**EC dsm-1**	3.70	3.44
PH	7.85	7.72	**Cu%**	0.15	0.11	**O.M%**	35.50	31.78

*** EC were determined in water extraction (1:5).**

C- Mineral content in seeds: Samples of seeds were over dried at 70° C for 24 hours, crushed and kept for chemical analysis. ½ g of seed powder were wet digested with H_2SO_4- $HclO_4$ mixture according to Peterburgski (1968). NPK, Fe, Mn, Zn and C_4. Nitrogen was determined by using Semimicro-Kyeldahl technique and Potassium was determined photo metrically using flame photometer. Iron, Manganese Zinc and Copper were determined using a Perkin Elmer atomic absorption spectroscope (Chapman and Pratl, 1961). Phosphorus was determined calorimetrically at a wave length 880 nm, using the ascorbic acid method described by Watanabe and Oslen (1965).

Statistical Analysis

All data were statistically analyzed according to Snedecor and Cochran (1982), differences between means were tested by L.S.D. at the level of 0.05 only.

RESULTS AND DISCUSSION

Mean values of straw yield and related characters for the flax variety Sakha2 as affected by harvesting dates, plant density and farmyard manure amounts in 2003/04 and 2004/05 seasons are presented in Table (2).

Analysis of variance showed significant differences among harvesting dates for total length, straw yield / plant as well as per fed., technical length, fiber yield / plant as per fed. and fiber fineness traits in the two successive seasons. All seven characters previously mentioned significantly differed as affected by either plant density or farmyard quantity application in both seasons.

There are gradual increase for all straw yield characters as delaying harvesting date till 170 days from sowing with exception to fiber fineness trait which was in the opposite direction, that means the first harvesting date after 140 days recorded maximum values for fiber fineness and gradual decrement

occurred towards the latter harvesting date (170 days old). The total length ranged from 114.09 to 120.87 cm, technical length ranged from 98.12 to 106.37 cm, straw yield / plant ranged from 2.50 to 2.89 g, straw yield / fed. ranged from 4.24 to 4.75 ton, fiber yield / plant ranged from 0.73 to 0.90 g and fiber yield / fed ranged from 0.42 to 0.56 ton, but fiber fineness ranged from 209.88 to 184.67 for the harvesting dates at 140 and 170 days. Generally, delaying harvesting date caused more growth in flax plants and more coarse fiber as resulted from accumulation of more cellulose layers in the secondary wall of fibers. Increasing in the previously traits noted with dealing the date of harvesting is attributed to the progressive development of the tissues and the increase in dry matter content of flax plants to the progressive building of tissues and accumulation in the organs of flax plants.

Table 2. Main values of straw yield and its related characters for flax variety Sakha2 as affected by harvesting dates (H), plant density (D) and farmyard manure (FYM) manure treatments (combined of analysis over two season)

Treatments		Plant height (cm)	Technical Length (cm)	Straw yield/plant(g)	Straw yield/fed.(ton)	Fiber yield/fed.(ton)	Fiber yield/plant(g)	Fiber fineness
H	H1	114.09	98.12	2.50	4.24	0.43	0.73	209.88
	H2	118.46	102.50	2.76	4.74	0.51	0.84	208.33
	H3	120.87	106.37	2.89	4.75	0.52	0.90	184.67
F.test		*	*	*	*	*	*	*
L.S.D.0.05		**0.90**	**0.77**	**0.21**	**0.17**	**0.04**	**0.07**	**11.00**
D	D1	113.84	99.76	2.97	4.09	0.56	0.77	185.72
	D2	118.66	102.41	2.63	4.82	0.46	0.85	208.66
	D3	120.90	104.82	2.55	4.87	0.44	0.85	214.50
F.test		*	*	**Ns**	*	*	*	*
L.S.D.0.05		**1.01**	**0.54**	**-**	**0.35**	**0.06**	**0.05**	**10.60**
FYM	FYM1	113.32	95.61	2.25	4.00	0.42	0.75	217.75
	FYM2	119.56	104.35	2.87	4.82	0.51	0.86	194.96
	FYM3	120.54	107.03	3.04	4.91	0.52	0.89	190.17
F.test		*	*	**Ns**	*	*	*	*
L.S.D.0.05		**1.04**	**1.36**	**-**	**0.28**	**0.03**	**0.08**	**9.76**
interaction	H.D	Ns	Ns	Ns	Ns	Ns	Ns	Ns
	H.FYM	Ns	Ns	Ns	Ns	Ns	Ns	Ns
	D.FYM	Ns	Ns	Ns	Ns	Ns	Ns	Ns
	H.D.FYM	Ns	Ns	Ns	Ns	Ns	Ns	Ns

This might be due to an increase in metabolites synthesized by flax plants aiming to prolonged growth period and that was more pronounced especially during the 3rd harvesting date which in turn increased dry matter accumulation in plant organs till it reached full maturity stage (170 days from planting).

Similar results were obtained by El-Farouk *et al.* (1980), Shafshak *et al.*, (1992 and El-Azzouni (2003).

Concerning plant density effect, data illustrated that all the seven straw yield traits increased gradually with increasing plant density from 1750 to 2250 seeds / m^2, while the lowest plant density achieved highest straw yield / plant and fiber yield /plant when compared with the intermediate and highest plant density. The averages of total length as affected by plant density ranged from 113.84 to 120.90 cm, technical length ranged from 99.76 to 104.82 cm, straw yield / fed. ranged from 4.09 to 4.87 ton, fiber yield / fed. ranged from 0.44 to 0.56 ton and fiber fineness ranged from 185.72 to 214.50 for the two plant density 1750 and 2250 seeds/m^2. The differences between the mean values of straw yield / plant and fiber yield / plant as affected by the two plant density at 2000 and 2250 seeds / m^2 did not reached the level of significance in both seasons. Increase plant density per unit area caused an increment in plant height due to the more competition between plants and consequently flax plants trended to elongate searching for light. Moreover, increase plant density reduce straw, fiber and seed yields/ plant, but decrease their yields / fed as resulted from the great plants number in the higher plant density which compensate the lower plant production. Many investigations conferred that increase plant density per unit area caused an increment in straw and fiber yields /fed, but decreased straw characters per plant such as Momtaz *et al.,* (1981), El-Sweify and Mostafa (1996) and Abd El-Haleem (2006).

Regarding farmyard manure quantity effect, results indicated an increment in all straw characters studied as the farmyard amount increase except with fiber fineness which decreased in this case, by means every excess from farmyard caused coarser fiber in both seasons. averages of total length ranged from 113.32 to 120.54, technical length ranged from 95.61 to 107.03 cm, straw yield / plant ranged from 2.25 to 3.04 g, straw yield / fed. ranged from 4.00 to 4.91 ton, fiber yield/ plant ranged from 0.75 to 0.89 g, fiber yield / fed. ranged from 0.42 to 0.52 ton, in addition to fiber fineness character ranged from 217.75 to 190.17 for the two farmyard quantity 0 and 20 m^3/ fed. This increase in all flax characters as a result of the significant mineralization of the macro and microelements particularly Nitrogen, which led to increase the minerals availability to the plant. In addition FYM might improve the chemical and physical properties of soil. The previously results were in harmony with those obtained by El-Azzouni and El-Banna, 2002 and Hussein, 2002.

The interaction between harvesting dates (H) and plant density (D) had significant effect on total length, fiber yield / fed., fiber fineness, seed yield / plant (g) and seed yield / fed (kg) in both seasons. Meanwhile, the interaction between harvesting dates and farmyard had significant effect of fiber yield / plant (g), fiber fineness and seed yield / plant (g) in both seasons, this means that each two factors H and D or H and FYM done their effect dependently. On the other hand, D x FYM interaction was significant effect on fiber yield / fed (ton), capsules number/ plant and seed yield / plant, in both seasons. on the other hand, the second order interaction (H x D x FYM) was non-significant effect.

Table (3), explain the mean values of seed yield and related characters as affected by harvesting dates, plant density and farmyard amounts application.

Table 3. Main values of seed yield and its related characters for flax variety Sakha2 as affected by harvesting dates (H), plant density (D) and farmyard manure (FYM) manure treatments (combined of analysis over two season)

Treatments		No.of capsules/plant	1000-seed weight (g)	Seed yield/plant(g)	Seed yield/fed.(Kg)	Oil yield/fed.(kg)	Seed oil %	Seed portein%
	H1	7.05	7.91	0.50	541.79	205.37	37.82	25.75
H	**H2**	7.63	8.88	0.58	585.03	235.15	39.84	27.95
	H3	8.14	8.90	0.58	589.53	247.41	40.03	28.11
F.test		*	*	*	*	*	*	*
L.S.D.0.05		0.52	0.06	0.07	14.84	10.47	0.83	0.74
	D1	8.05	8.59	0.59	545.78	211.92	38.59	25.86
D	**D2**	7.58	8.40	0.54	586.25	232.53	39.49	27.89
	D3	7.18	8.20	0.53	584.31	243.48	39.61	28.07
F.test		**Ns**	**Ns**	*	*	*	**Ns**	*
L.S.D.0.05		-	-	0.04	14.14	8.00	-	0.96
	FYM1	6.81	7.92	0.50	535.00	202.14	37.81	25.21
FYM	**FYM2**	7.94	8.58	0.57	587.73	235.04	39.87	27.98
	FYM3	8.07	8.69	0.58	593.62	250.75	40.00	28.62
F.test		*	*	*	*	*	*	*
L.S.D.0.05		0.79	0.36	19.76	29.40	16.47	0.57	1.17
interaction	**H.D**	NS	NS	NS	NS	NS	NS	NS
	H.FYM	NS	NS	NS	NS	NS	NS	NS
	D.FYM	NS	NS	NS	NS	NS	NS	NS
	H.D.FYM	NS	NS	NS	NS	NS	NS	NS

Statistical analysis showed significant differences among the harvesting dates and farmyard quantity in all seed characters under study in both seasons, but the three plant density affected significantly No. of capsules / plant only in the first season, seed yield / plant in the second one, while seed yield / fed, oil yield / fed. and seed protein percentage. Regarding harvesting dates effect, the mean values of No. of capsules / plant ranged from 7.91 to 8.90, while 1000-seed weight ranged from 0.50 to 0.58 g and seed yield / plant ranged from 541.79 to 0.589.53 kg, oil yield / fed. ranged from 205.37 to 247.41 kg and oil percentage ranged from 37.82 to 40.03% and seed protein ranged from 25.75 to 28.11%. Many researchers reported that delaying harvest date increased seed yield and its components such as Yousef *et al.,* (1980), El-Sweify and Mostafa (1996) and Hussein (2002).

With respect to plant density effect, data revealed progressive reduction in No. of capsules / plant, 1000-seed weight and seed yield / plant with increasing plant density from 1750 up to 2250 seeds / m^2, but seed yield / fed., oil yield / fed., seed oil percentage and seed protein percentage recorded gradual increase with increasing plant density toward the highest

rate, this increment which happened in the two above mentioned characters *i.e.,* seed yield / fed as well as oil yield / fed. due to more number of flax plants per square meter. These results were agreement with those obtained by Momtaz *et al.,* (1981), Gyanendra *et al.,* (2001) and Abou-Zaid and El-Azzouni (2003).

The mean values of all the seven seed characters studied showed gradual increase with increasing farmyard quantity from the control up to 10 or 20 m^3 , the averages of No. of capsules / plant ranged from 6.81 to 8.07, the respective ranges from 1000-seed weight were 7.92 to 8.69 g, seed yield / plant ranged from 0.50 to 0.53 g, seed yield / fed. ranged from 535.00 to 593.62 kg, oil yield /fed. ranged from 202.14 to 250.75 kg, kg, oil percentage ranged from 37.81 to 40.00% and seed protein percentage ranged from 25.21 to 28.62% and farmyard at the untreated control and added 20 m^3 / fed. Simelar results were obtained by Abdel-Rasoul and El-Azzouni (2002) and Hussein (2002).

H x D interaction had significant effect on seed yield / plant as well as per fed., H x FYM interaction was significantly affected only seed yield / plant. While, D x FYM interaction had significant affect on number of capsules and seed yield / plant in both seasons. On the other hand D x H x FYM interaction was non-significant effect.

Table (4), illustrated the estimates of some mineral content in flax seed for the variety Sakha 2 as affected by harvesting dates, plant density and farmyard quantity application in 2003/04 and 2004/05 seasons.

The estimates of the seven mineral contents in flax seeds increased with delaying harvesting date towards the third one at 170 days from sowing, by mean more minerals accumulation for seeds during the long growth period. There are significant differences among the averages of each of Phosphorus, Potassium, Ferric, Zinc, Manganese and Copper content as affected by the three harvesting dates, but Nitrogen content did not reached the level of significance. The Nitrogen percentages ranged from 4.08 to 4.51%, Phosphorus ratio ranged from 1.57 to 1.67%, Ferric content ranged from 9.17 to 114.06 ppm, and from 87.35 to 106.03 ppm, Mag. ranged from 39.07 to 58.76 ppm in addition to Copper content ranged from 11.19 to 22.13 ppm. Simelar results were obtained by Abd El-Haleem (2006).

The differences among the seven minerals content characters as affected by plant density did not reached the level of significance in the two successive seasons. generally, the estimates of mineral content slightly decreased with increasing plant density up to the highest one (2250 seeds /m^2), this behavior may be due to that flax plants at little number per unit area (at plant density of 1750 seeds / m2) had a great chance from soil distance around each plant and consequently more mineral content in comparison with the intermediate or highest plant density in this case. Simelar results were obtained by Abd El-Haleem (2006).

Concerning farmyard manure effect, data indicated significant differences among the all mineral content of the flax seeds as affected by farmyard quantity. Gradual increment in averages of all mineral content traits with increasing farmyard amount towards the highest one (20 m^3 / fed.) in

both seasons. The maximum estimates for minerals achieved by added 20 m^3/ fed for all characters under study with the mean values of 4.56 for Nitrogen, 0.69% for Phosphorus, 1.69% from potassium, 112.34 ppm for Ferric, 95.57 ppm for Zinc, 55.20 ppm for Manganese, in addition to 20.04 ppm for Copper. Many investigators reported that the increase of farmyard quantity resulted in an increment for Nitrogen, Phosphorus and Potassium such as Badran Nadia *et al.,* (2000) and Sakr *et al.,* (1992).

Table 4: Main values of some mineral content in flax seeds of variety Sakha2 as affected by harvesting dates (H), plant density (D) and Farmyard manure (FYM) manure treatments (combined of analysis over two season)

Treatments		Nitrogen cont. %	phosphorus cont. %	Potasium cont.%	Ferric cont. P.P.M.	Zinc cont. P.P.M.	Manganes cont. P.P.M.	Copper cont P.P.M.
H	H1	4.08	0.55	1.57	93.17	75.89	39.07	11.19
	H2	4.48	0.68	1.64	112.03	95.78	56.47	21.95
	H3	4.51	0.70	1.67	114.06	98.80	58.76	22.13
F.test		**Ns**	*	*	*	*	*	*
L.S.D.0.05		-	0.05	0.06	7.16	10.73	6.27	3.07
D	D1	4.51	0.69	1.67	111.05	95.62	54.88	20.55
	D2	4.47	0.68	1.66	109.99	95.08	53.26	19.03
	D3	4.14	0.63	1.59	107.02	89.07	47.65	18.37
F.test		**Ns**	**Ns**	**Ns**	**Ns**	**Ns**	**Ns**	**Ns**
L.S.D.0.05		-	-	-	-	-	-	-
FYM	FYM1	4.05	0.56	1.55	98.61	80.07	44.29	15.17
	FYM2	4.50	0.68	1.63	110.82	94.81	54.80	20.05
	FYM3	4.56	0.69	1.69	112.34	95.57	55.20	20.04
F.test		**Ns**	*	**Ns**	*	*	*	*
L.S.D.0.05		-	0.08	-	11.18	9.37	4.81	2.17
interaction	H.D	NS	NS	NS	NS	NS	NS	NS
	H.FYM	NS	NS	NS	NS	NS	NS	NS
	D.FYM	NS	NS	NS	NS	NS	NS	NS
	H.D.FYM	NS	NS	NS	NS	NS	NS	NS

H x D interaction had significant effect on potassium, ferric, zinc, manganese and copper contents (ppm) in both seasons. H x FYM interaction significantly affected potassium, manganese and copper contents, the inter action between D and FYM had significant effect on phosphorus and potassium contents in the two successive seasons. while, H x D x FYM interaction was non-significant effect.

General conclusions:

In general, It can be recommended that cultivation the flax variety Sakha 2 which harvesting at 170 days old with the highest plant density 2250 seeds / m^2 and in addition to 20 m^3 FYM / fed in order to get the highest straw yield and seed yield as well as get the highest mineral content of flax seeds under the environmental conditions of the study.

REFERENCES

Abd El-Haleem, R.A. (2006). Response of some flax varieties to plant density and Bio-Fertilization in sandy soils. M.Sc. Thesis, Fac. Agric. Moshtohor, Benha Univ.

Abdel-Rasoual, S.H.M. and A.M. A. El-Azzouni (2002). Effect of magnesium farmyard manure and mineral fertilizers on yield, yield components and nutrient contents of some flax genotyoes on sandy soil. J. Agric. Sci. Mansoura Univ., 27: 7951-7962.

Abou-Zaid, T.A. and A.M.A. El-Azzouni (2003). Response of flax to soil leveling, planting methods and seeding rates.J. Agric. Sci., Mansoura Univ., 28: 6577-6589.

A.O.A.C. (1980) Association of Official Analytical Chemist's. Official Methods of Analysis. Washington, D.C., U.S.A.

Badran, Nadia, M.; M.E.A. Khalil and M.A.A. El-Emam (2000). Avaliability of N, P and K in sandy and clay soils as affected by the addition of organic materials. Egypt. J. Soil Sci. 40:265-283.

Badyala, D.; C.M. Singh and S. Kumar (1998). Fertilizer management in flax *(Linum usitatissimum* L.). Indian J. Agric.Sci.,68:302-303.

Chapman, H.D. and P.F. Pratt (1961). Methods of analysis for soil, plant and water. Univ. California, Division Agric. Sci.

El-Azzouni, A.M. and El-Banna, A.A.(2002). Response of flax crop to biofertilizer and nitrogen levels under new reclaimed soil condition. Egypt, J. Appl. Sci; 17: 139-145.

El-Azzouni, A.M. (2003). Effect of pulling date and foliar applications of microelements and gebberllic acid on yield and its components of flax. J. Agric. Sci. Mansura Univ,. 28: 5903-5913.

El-Farouk, M.; T.A. Shalaby; H.M. Moawed and A. Momtaz (1980). The effect of various planting and harvesting times on the quantity and quality of flax production. Tanta J. Agric. Res., 6: 77-87.

El-Hariri, D.M.; Amna H. H. El-Sweify and S.H. Mostafa (1996). Response of flax yield quality to cultivars, phytohormene level and pulling dates. Workshop of the FAO network of flax. Rouen Frnce, Spetember 25/28: 117-129.

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.

Gyanendra-Tiwari; Dwived, S.K., Shivastava, S.K.; Tiwari, J.P.; V.K. Agrowal and G. Tiwari (2001). Effect of plant population density and phosphorus, nitrogen on physiological determinates of yield in linseed *(Linum usitatissimum* L.). Crop Res. Hisar. 21: 57-59.

Hussein, M.M.M. (2002). Effect of some fertilization treatments and harvesting dates on yield quality of flax under new reclaimed land conditions. Ph.D. Thesis Fac. Agric, Suez Canal Univ.

Ismail, M.S. and M.R. Morsy (1994). Flax plants performance as influenced by seeding rate and harvesting date and their response curves. Menofya J. Agric. Res. 19: 2243-2255.

Momtaz, A.M; M. El-Farouk and T.A. Shalaby (1981). Studies of plant density and nitrogen fertilizer levels effect on yield and quality of flax. Tanta. Agric. Res. Tanta Univ. 2: 211-222.

Peterburgski, A.V. (1968). Hand Book of Agronomic Chemistry. Kolos Publishing hous Moscow (In Russian PP. 29-86). (C.F. Shms El-Din, H.A. Ph.D. Thesis (1993), Mansoura Univ.).

Radwan, S.R. and A. Momtaz(1966): The technological properties of flax fibers and methods of estimating them. El- Felaha J. 46 (5): 466-476 (in Arabic) .

Sakr, A.A.; Risk, S. A. and A.S. El-Sebaay (1992). Effect of organic manure on plant growth and NPK uptak by wheat and maize plants. Egypt. J. Soil Sci. 32: 249-262.

Shafshak, S.E.; T. Nasr El- Din; A.M. Hella and S.H. Mostafa (1992): Effect of seeding rates and harvesting time on flax yield. Egypt. J. Agric. Res., 70 (4): 1205-1215.

Snedecor,G.W. and W.G. Cochran. (1982). Statistical Methods 7th edition, Iowa State Univ., Press. Ames., Iowa, U.S.A : 325 :330.

Watanabe, F. S. and S.R. Olsen (1965). Test of an ascorbic acid method for determining phosphorus in water and $NaHCo_3$ extracts from soil. Soil Sci. Soc. Amer., Proc., 29: 677-678.

Yousef, M.A.; T.A. Hussein; T.A. Shalaby and M.I. Zaitoon (1980). Effect of seeding rates and harvesting dates on yield of straw and fiber of some flax varieties. El-Minia. J. Agric. Res. 15: 1-18.

استجابة صنف الكتان سخا٢ للسماد العضوي والكثافة النباتية تحت مواعيد حصاد مختلفة

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أقيمت تجربتان حقليتان بمحطة البحوث بكفر الحمام-مركز البحوث الزراعية خلال الموسمين ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ وذلك لدراسة تأثير إضافة ثلاثة مستويات من السماد العضوي وكذلك ثلاثة كثافات نباتية (١٧٥٠ ،٢٠٠٠ ،٢٢٥٠ بذرة/م٢) تحت ثلاثة مواعيد حصاد (بعد ١٤٠ ، ١٥٥ ،١٧٠ يوم من الزراعة) على المحصول وجودته ومحتوى بعض العناصر المعدنية للبذور للصنف سخا٢.

يمكن تلخيص أهم النتائج المتحصل عليها كما يلي :-

1- تأخير ميعاد الحصاد حتى ١٧٠ يوم من الزراعة أدى إلى زيادة كل صفات محصول القش والبذور بالإضافة إلى العناصر المعدنية بالبذور فيما عدا صفة نعومة الألياف وقد انخفضت بتأخير معاد الزراعة.

2- حدثت زيادة الكثافة النباتية أدت إلى زيادة متدرجة في الطول الكلي ،الطول الفعال ،محصول القش/فدان ،محصول الألياف/فدان ،نعومة الألياف ،محصول البذور/فدان ،محصول الزيت/فدان ،النسبة المئوية للزيت النسبة المئوية للبروتين في البذور بينما حدث انخفاض في كل الصفات الخاصة بمكونات محصول النبات وكذلك وزن الألف بذرة وذلك بزيادة الكثافة النباتية. كما أن محتوى العناصر المعدنية في البذور لم تتأثر معنويا ولكن انخفضت قيم نعومة الألياف.

3- محصول القش والبذور ومكوناتهما بالإضافة إلى العناصر المعدنية في البذور زادت بزيادة الكمية المضافة من السماد العضوي. كما تشير النتائج إلى أن التفاعل الثلاثي كان غير معنوي لكل الصفات تحت الدراسة.

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