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STUDIES ON ORGANIC MATTER AND CLAY AS AMENDMENT FERTILIZER FOR FLAX, (*Linum usitatissimum L*.) IN SANDY SOIL

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ABSTRACT

Two field experiments were conducted at Qalapshoo Agricultural Experimental Research Station, which belong to Bilqas District-Dakahlia Governorate, Egypt during the two growing seasons of 2004 /2005 and 2005 /2006 in sandy soil. The objectives of this study was conducted to study the effect of three organic matter (farmyard manure, compost and town refuse) in addition to clay at three rates (7, 14 and 21 t/ha.).

The most important results revealed that addition of organic matter forms had a significant effect on most characteristics in both seasons. Addition the clay significantly increased fruiting zone length in the first season, technical stem length, fiber yields per plant and per hectare, fiber percentage, fiber length, number of seeds/plant and seed index in both seasons. Adding farmyard manure significantly increased fibers strength and fineness, number of capsules/plant, seed yields per plant as well as per hectare and percentage in both seasons. Town refuse application significantly increased straw yields per plant and per hectare, straw with capsules yield/ha. and number of seeds/capsule in both seasons. Increasing organic fertilizers rate from 7 up to 21 t/ha. significantly increased straw and straw with capsules yields/ha. in first season, technical stem length, straw yield/plant, fiber yields per plant and per hectare, fiber percentage, fiber length, fibers strength and fineness, number of seeds/plant and oil percentage in both seasons, number of capsules/plant and number of seeds/capsule in the second seasons, seed index , seed yields per plant as well as per hectare in the first season. The interactions between the two factors under study on yield and quality of flax variety Sakha 2 were significant in most characteristics in both seasons.

Keywords: Flax, *Linum usitatissimum* L., Linseed, Clay, Farmyard manure, Compost, Town refuse, rates, yield and quality

INTRODUCTION

Egypt is suffering from main problems i.e., excess population pressure on limited arable and polluted rural areas. Therefore, agricultural security depends largely on two main schemes. The first is raising the productivity of cultivable soils and the second in urbanization of polluted rural areas.

Such planting could be attained through land application management of biosolids. Egyptian soils are located in arid or/and semiarid regions which contain low contents of organic matter in the same time environmental pollution. Biosolids land application regulate soil microbial biomass, which plays a great role in the destruction and detoxification of polluted rural areas (bioremediation). However, agrochemicals and mineral fertilizers, in addition, biosolids land applications to sustain soil quality and productivity are considered. El-Saady (1991) reported that application of sewage sludge at different rates up to 100 gm Kg $^{-1}$ soil, progressively and significantly

increased the yield of grain and straw of pea plants. Omar and Abou Baker (1991) studied the effect of three organic residues, e.g. fresh garbage, fresh compost and matured compost with or without NPK fertilizer on sunflower. The tested parameters were significantly increased due to application of different mineral fertilizers and / or organic materials added. Banik *et al*., (1997) studied the residual effects of 10 t farmyard manure (FYM) on winter crops. They found that yields of winter crops were highest on plots previously given 10 t FYM + 20 Kg N. El-Fakharani (1997) reported that the dry weight of both shoots and total wheat / plant were significantly increased by increasing the application rate of gypsum up to 2 Mg $ha.^{-1}$ and that of poultry manure from 10 to 20 Mg $ha.^{-1}$, El-Gazzar (1997) studied the effect of inorganic and organic N sources on flax seed crop production. He reported that 60 Kg N $fed.^{-1}$ as urea – N gave the highest dry matter weight followed by pigeon and poultry manure. However, application of either 45 Kg N or humus, farmyard manure manures, sugar beet compost and clover straw gave the lowest yields, respectively. Badiyala *et al*., (1998) on flax found that seed, stalk and fiber yields were highest with the highest fertilizer rates of 10 t farmyard manure, 0 Kg N and 13.1 Kg P/ha. Abdel-Sabour *et al*. (1991) on sunflower showed that a remarkable increases in the dry matter and seed yields due to the previous single composts addition after four successive cultivation season. A mixture of water hyacinth (5%) and biosolids (at 4 , 6 and 8 %) compost showed a superior effect if compared by other treatments. Puste *et al*. (1999) on rice- oilseed cropping sequence, reported that highest yields were with 75% of NPK (100% = 60 : 30 : 30 Kg N : P_2O_5 : K_2O/ha.) plus 10 t FYM. Arisha and Abd El-Bary (2000) assessed the effect of sulphur and sewage sludge application on growth, productivity of spinach and pea.

The results indicated that sewage sludge application significantly increased growth and yield of both crops. Medhi and Sarma (2000) studied the effect of various combination of organic and inorganic fertilizers applied to rice intercropping with linseed. The treatments used in the experiment were no fertilizer NPK, 100% NPK, 75% NPK + 5 t/ha. farmyard manure (FYM), 75 % NPK + 5 t/ha. green manure, 50% NPK + 10 t/ha. FYM, 50% NPK + 10 t/ha. pressmud, 50% NPK + 10 t/ha. biogas slurry and 50% NPK + 10 t /ha. green manure. The application of organic and inorganic source increased rice grain yield. However, the residual effect of 100% NPK applied to rice recorded the highest grain yield of linseed.

Mahmoud *et al*. (2001) showed that the effect of gypsum and sulphur alone or in combination with farmyard manure highly significantly increased the grains yield of sunflower, plant height, weight of 100 grains and the uptake of NPK by plants. Talha (2003) studied the effect of sewage sludge application, poultry manure and processed town refuse with or without sulphur (400 kg $fed.^{-1}$) and gypsum (5 t $fed.^{-1}$) as conditioners on soil productivity. He found that, the addition of biosolids with or without agrochemicals significantly increased the straw and seed yields and its components of flax crop.

This investigation was conducted to estimate the effect of some organic matter sources and their rates on the yield , yield components and quality of Sakha 2 flax variety in sandy soils.

MATERIALS AND METHODS

Two field experiments were conducted at Qalapshoo Agricultural Experimental Research Station, which belongs to Bilqas district-Dakahlia governorate, Egypt. Two successive winter seasons of 2004/2005 and 2005/2006. The objectives of this study was conducted to investigate the effect of three organic matter forms (farmyard manure, compost and town refuse) in addition to clay at three rates (7, 14 and 21 t/ha.). The organic matter sources and their rates were applied at the time of seed bed preparation. The soil of experiments was sandy in texture. Mechanical and some chemical analysis of the soil are tabulated in Table (1) :

Table (1): The mechanical and some chemical characteristics of the experimental soil

The season	Sand %	Silt %	Clay %	Soil type	pH	Ec	Available nutrients (ppm)			Total N %
							N	P	K	
Season 1st	95.91	2.41	1.68	Sandy	7.7	1.4	4.90	4.80	78.0	0.028
Season 2 nd	90.76	3.86	5.38	Sandy	7.5	1.5	5.60	5.60	62.0	0.031

Mechanical analysis of the soil samples were performed according to the method of Black (1982). Soil chemical analysis were conducted according to Cottenie *et al.* (1982). The preceding crop was barley (*Hordeum vulgase* L.) in both seasons. A split plot design was used in both seasons with four replication were randomly assigned to the main plots. The three organic matter farms and the clay treatments while the three rates were layedout in the sub – plots. Each sub-plot was (2 x 3 m) with an area $6m^2$. Sakha 2 flax variety was planted on November 5 and November 8 in the first and second seasons, respectively by manual broadcast at the rate of 143 kg seeds/ha. Nitrogen was added to plots in the form of ammonium nitrate 33.5% at the rate of 143 kg N/ha. on three equal doses. The first dose was added with the second irrigation, while the second dose was added with the third irrigation and the later dose with the fourth irrigation. Calcium super phosphate (15.5 % P_2O_5) at the rate of 36 Kg P_2O_5/ha. and potassium sulphate (48 % K_2O) at the rate of 57 Kg K_2O ha^{-1}. were added to the soils before planting. The other agricultural practices were applied as usually dome in the ordinary flax fields. At maturity, ten guarded plants were hand pulled at random from each sub plot to be used in determining the yield components of flax. Flax yields for straw, seeds per hectare and quality were determined on the whole plot area basis .

Data collected included :

A- Straw yield and its components:

1- Technical stem length (cm.) *2- Fruiting zone length (cm).*
3- Stem diameter (m.m). *4- Straw yield / plant (g).*
5- Straw yield / hectare (t). *6- Straw with capsules yield/ hectare (t).*

B- Fiber yield and its components :

1- Fiber yield / plant (g). *2- Fiber yield / hectare (t).*
3- Fiber length (cm). *4- Fiber percentage.*

5- Fiber strength (R. K. M.). 6- Fiber fineness (N.m.).

Fiber fineness in metrical number (N. m.) was determined by using Radwan and Momtaz methods (1966)

C- Seed yield and its components :

1- Number of capsules /plant . 2- Number of seeds / capsule.
3- Number of seeds / plant. 4- Seed index (g/1000-seed).
5- Seed yield / plant (g). 6- Seed yield / hectare (t) .
7- Oil percentage.

All data were subjected to the analysis of variance according to the procedures outlined by Snedocor and Cochran (1980). The mean value of treatments were compared according to Duncan's Multiple Range Test (Duncan, 1955). All statistical analysis was performed using analysis of variance technique by means of MSTATC computer software package.

RESULTS AND DISCUSSION

A- Straw yield and its components:

Analysis of variance showed significant differences among the organic fertilizer forma and clay compared to check treatment in all the six characteristics studied except with fruiting zone length in the second season and stem diameter in both seasons which did not reach the level of significance.

Results presented in Table (2) indicate that clay trait ranked first and recorded maximum estimates of technical stem length in both seasons and fruiting zone length in the first season, which increased by 41.9 , 35.1 and 36.5% over the control, respectively. On the other hand, town refuse treatment ranked first and recorded maximum estimates of straw yield / plant, straw yield/ha. and straw with capsules yield/ha. in both seasons. which increased by 66.7, 66.7, 57.1, 43.0, 54.0 and 57.7% over the check treatment, respectively. Presence of the clay or the organic fertilizer improved the soil characteristics i.e., soil bulk density, soil cation exchange capacity, water holding capacity. These led to improve flax growth and quality. These results are in agreement with those obtained by Badiyala *et al.* (1998). Relatively at the effect of organic fertilizer rates Table (2) indicated clearly a significant affect in technical stem length and straw yield/plant in both seasons, straw yield/ha. and straw with capsules yield/ha. in the first season only, while the another characteristics did not reach the level of significance in both seasons. It could be concluded that, 21 t/ha. was superior over 7 t/ha. in most of straw characteristics. The superiority ration were 19.7 and 20.3 % for technical stem length, 27.3 and 30.4% for straw yield/ha. in the first and second seasons, respectively and 18.1% for straw yield/ha. and 15.1% for straw with capsule yield/ha. these may be due to that available nutrient i.e., nitrogen, phosphorus and potassium presented from organic mater degradation was higher with 21 ton ha-1. and it's effect on soil characteristics improvement.

T2

Such results were reported by El-Fakharani (1997) on wheat. A summary of the significant interaction effects of the two experimental factors is given in Table (3). In this Table the highest values of the studied characteristics are given fruiting zone length in the first season only, technical stem length, straw yield/plant, straw yield/ha. and straw with capsules yield/ha. in both seasons. It was illustrated also the different interaction effects on straw yield and its components.

The interaction between organic fertilizer forms and organic fertilizer rates had significant effect on all studied characteristics except fruiting zone length in the second seasons and stem diameter in both seasons. The highest values of technical stem length and fruiting zone length were achieved with clay trait at 21 t/ha. The highest values of straw yield/plant, straw yield /ha. and straw with capsules yield/ha. were achieved with town refuse trait at 21 t/ha.

Table (3): Highest values of flax straw yields as affected by the significant interaction between experimental factors in 2004/2005 and 2005/2006 seasons

Variable	Seasons	Highest value	F. test	Treatment
Technical stem length (cm)	2004/05	92.4	*	Clay x 21 t/ha.
	2005/06	99.9	*	Clay x 21 t/ha.
Fruiting zone length (cm)	2004/05	14.4	*	Clay x 21 t/ha.
	2005/06	-	N.S	----------
Straw yield per plant (g)	2004/05	1.80	*	Town refuse x 21 t/ha.
	2005/06	1.11	*	Town refuse x 21 t/ha.
Straw yield /ha. (t)	2004/05	6.823	*	Town refuse x 21 t/ha.
	2005/06	7.123	*	Town refuse x 21 t/ha.
Straw with capsules yield/ha. (t)	2004/05	10.851	*	Town refuse x 21 t/ha.
	2005/06	12.784	*	Town refuse x 21 t/ha.

B- Fiber yield and its components:

Statistical analysis revealed significant differences among the organic fertilizer forms, in both seasons (Table 4). Data indicate also that clay trait ranked first and recorded maximum estimates of fiber yields per plant as well as per hectare, fiber percentage and fiber length, which increased by 66.7 and 57.1 % for fiber yield / plant, 86.0 and 55.5% for fiber yield/ha. , 21.2 and 17.2% for fiber percentage and 43.6 and 36.5% for fiber length compared with the untreated plot in the first and second seasons, respectively. Meanwhile, farmyard manure trait was over than the another treatments and ranked first of fiber strength and fiber fineness with the superiority percentages of 11.9 , 9.4, 17.5 and 15.6 for compared with the untreated plot in the first and second seasons, respectively.

T4

This may be due to amino acids and other compounds released from organic matter decomposition which enhanced growth and quality of fibers in flax. This finding is in agreement with those obtained by Talha (2003).

Data presented in Table (4) indicate that increasing organic matter from 7t/ha. up to 21 t/ha were increased all studied characteristics, which was superior over 7 t/ha. in all studied characteristics. The superiority rations were 28.6 and 25.0% for fiber yield/plant, 38.7 and 11.8% for fiber yield/ha. 14.3 and 14.1 % for fiber percentage, 2205 and 22.4 for fiber length, 6.7 and 5.4 for fiber strength and 6.9 % for fiber fineness in the first and second seasons, respectively.

Increasing of organic fertilizer rate increased microbial activity macro and micro nutrients in soil and consequently, improving soil characteristics. These results are in harmony with those obtained by El-Fakharani (1997).

Table (5): Highest values of flax fiber yields as affected by the significant interaction between experimental factors in 2004/2005 and 2005/2006 seasons

Variable	Seasons	Highest value	F. test	Treatment
Fiber yield / plant (g)	2004/05	0.15	*	Clay x 21 t/ha.
	2005/06	0.16	*	Clay x 21 t/ha.
Fiber yield / ha. (t)	2004/05	1.141	*	Clay x 21 t/ha.
	2005/06	1.300	*	Clay x 21 t/ha.
Fiber percentage	2004/05	19.0	*	Clay x 21 t/ha.
	2005/06	20.0	*	Clay x 21 t/ha.
Fiber length (cm)	2004/05	85.0	*	Clay x 21 t/ha.
	2005/06	84.0	*	Clay x 21 t/ha.
Fiber strength (R. K. M.)	2004/05	82.8	*	Farmyard manure x 21 t/ha.
	2005/06	84.7	*	Farmyard manure x 21 t/ha.
Fiber fineness (N.m.)	2004/05	352.2	*	Farmyard manure x 21 t/ha.
	2005/06	384.1	*	Farmyard manure x 21 t/ha..

Table (5) illustrates the different interactions effects on fiber yield its components. The interaction between organic fertilizer forms and organic fertilizer rates had significant effect on all studied characteristics in both seasons. The highest values of fiber yield/ plant, fiber yield/ha., fiber percentage and fiber length were achieved with clay trait at 21 t/ha. Fiber strength and fiber fineness were achieved with farmyard manure trait at 21 t/ha.

C- Seed yield and its components :

Mean values of seed yield and its related characteristics for organic fertilizer forms, clay treatment and three organic fertilizer rates are presented in Table (6).

T6

Data indicated that organic fertilizer forms significantly affected all studied characteristics in both seasons. Results indicated that clay trait ranked first and recorded maximum value of number of seeds/plant and seed index which increased by 51.8, 34.5, 34.0 and 16.8% over the check treatment in first and second seasons, respectively. Meanwhile, farmyard manure treatment ranked first and gave the highest value of seed yield/plant, seed yield/ha. and oil percentage which increased by 25.0, 44.4, 27.0, 76.0, 5.3 and 6.8 % over the cheek treatment in the first and second seasons, respectively. While, town refuse trait ranked first and recorded maximum value of number of seeds/plant which increased by 55.3 and 38.4% over the check treatment in the first and second seasons, respectively. Relatively compost trait was surpassed the control and ranked last among the other treatments in both seasons. This may be due to increasing of available nutrients, water retention and improving soil characteristics which related to clay and organic matter application. Similar results were reported by Omar and Abou Baker (1991) on sunflower and Banik *et al*., (1997) on winter crops.

Concerning the effect of organic matter rates, it indicated clearly a significant efficiton number of capsules / plant and number of seeds/ capsule in second seasons only, seed index, seed yields per plant and per hectare in first seasons. Opposite to that, the another characteristics did not reach the level of significance. Data presented in Table (6) conclude that, 21 t/ha. was superior over 7 t/ha. The superiority ration were 62.9 % for number of capsules/plant, 69.4% for number of seeds/ capsule, 16.2% for seed index, 75.0% for seed yield /plant, 40.0 % for seed yield/ha. , 39.3 and 68.4% for number of seeds/plant and 4.4 and 7.6 % for oil percentage in first and second seasons, respectively. These results are in harmony with those of El-Fakharani (1997).

Table (7): Highest values of flax seed yield as affected by the significant interaction between experimental factors in 2004/2005 and 2005/2006 seasons

Variable	Seasons	Highest value	F. test	Treatment
Number of capsules / plant	2004/05	-	N.S	----------
	2005/06	12.2	*	Farmyard manure x 21 t/ha..
Number of seeds/plant	2004/05	59.0	*	Clay x 21 t/ha.
	2005/06	64.9	*	Clay x 21 t/ha.
Seed index (g/1000-seed)	2004/05	8.32	*	Clay x 21 t/ha.
	2005/06	-	N.S	----------
Seed yield / plant (g)	2004/05	0.48	*	Clay x 21 t/ha.
	2005/06	-	N.S	----------
Seed yield/ha. (t)	2004/05	1.825	*	Farmyard manure x 21 t/ha.
	2005/06	2.276	*	Farmyard manure x 21 t/ha..
Oil Percentage	2004/05	42.0	*	Farmyard manure x 21 t/ha.
	2005/06	43.0	*	Farmyard manure x 21 t/ha..

Summary of the significant interaction effects of the two experimental factors is given in Table (7). The highest values of the studied characteristics are number of capsules / plant in second seasons, seed index and seed yield / plant in the first season, number of seeds/ plant, seed yield/ha. and oil percentage in both seasons. It is clear that the highest values of number of seeds/plant and seed index were recorded by clay trait at 21 t/ha., while number of capsules/ plant, seed yields per plant and per hectare were achieved by farmyard manure trait at 21 t/ha.

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دراسات على المادة العضوية والطين كمصلح وسماد للكتان فى الأراضى الرملية

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أجريت تجربتان حقليتان بمحطة البحوث الزراعية بقلابشو مركز بلقاس محافظة الدقهلية – خلال موسمى ٢٠٠٤ / ٢٠٠٥ و ٢٠٠٥ / ٢٠٠٦ لدراسة إستجابة محصول الكتان صنف سخا ٢ للتسميد بصور مختلفة من الأسمدة العضوية وهى (بدون معاملة ، الطين ، السماد البلدى ، الكمبوست ، مخلفات المدينة) تحت معدلات مختلفة وهى (٧، ١٤ ، ٢١ طن / هكتار) ويمكن تلخيص النتائج المتحصل عليها فى الآتــى : -

أدى إضافة الطين إلى زيادة معنوية فى طول المنطقة الثمرية فى الموسم الأول وطول الساق الفعال ومحصول الألياف للنبات والهكتار والنسبة المئوية للألياف وطول الألياف وعدد بذور النبات ووزن الألف بذرة فى كلا الموسمين. أدى إضافة السماد البلدى إلى زيادة معنوية فى متانة ونعومة الألياف وعدد كبسولات النبات ومحصول البذرة للنبات والهكتار والنسبة المئوية للزيت فى كلا الموسمين. أدى إضافة مخلفات المدينة إلى زيادة معنوية فى محصول القش للنبات والهكتار وكذلك محصول القش بالكبسول للهكتار وعدد بذور الكبسولة فى كلا الموسمين.

أدى زيادة معدل الأسمدة العضوية من ٧ طن / هكتار إلى ٢١ طن / هكتار إلى زيادة معنوية فى محصول الهكتار من القش ، والقش بالكبسول فى الموسم الأول والطول الفعال للساق ومحصول النبات من القش ومحصول النبات والهكتار من الألياف والنسبة المئوية للألياف وطول الألياف ومتانة ونعومة الألياف وعدد بذور النبات والنسبة المئوية للزيت فى كلا الموسمين ووزن الألف بذرة ومحصول النبات والهكتار من البذرة فى الموسم الأول وعدد كبسولات النبات وعدد بذور الكبسولة فى الموسم الثانى. كان التفاعل بين عاملى الدراسة معنويا فى معظم الصفات المدروسة.

Table (2): Straw yield and its related characteristics of flax as affected by organic fertilizer forms and organic fertilizer rates in 2004 / 2005 and 2005 /2006 seasons

Characteristics	Season	Organic fertilizer forms						Organic fertilizer rates (t/ha)				Interaction
		Sig.	Without	Clay	Farmyard manure	Compost	Town refuse	Sig.	7	14	21	
Technical stem length (cm)	2004/05	*	57.9 c	82.2 a	74.4 b	62.7 c	72.6 b	*	65.4 c	69.6 b	78.3 a	*
	2005/06	*	60.6 d	81.9 a	76.5 b	66.3 c	74.1 b	*	65.1 c	72.0 b	78.3 a	*
Fruiting zone length (cm)	2004/05	**	10.4 d	14.2 a	12.6 ab	11.2 cd	12.2 bc	N.S	11.3	12.1	13.0	*
	2005/06	N.S	12.2	16.2	15.2	14.0	14.4	N.S	13.8	14.4	15.0	N.S
Stem diameter (m.m)	2004/05	N.S	1.26	1.38	1.38	1.29	1.31	N.S	1.31	1.32	1.34	N.S
	2005/06	N.S	1.29	1.54	1.60	1.50	1.50	N.S	1.42	1.45	1.58	N.S
Straw yield / plant (g)	2004/05	*	0.54 d	0.78 ab	0.75 bc	0.60 cd	0.90 a	*	0.66 b	0.66 b	0.84 a	*
	2005/06	*	0.63 d	0.87 b	0.75 c	0.66 cd	1.05 a	*	0.69 c	0.78 b	0.90 a	*
Straw yield / hectare (t)	2004/05	**	4.378 e	5.207 c	6.278 b	4.764 d	6.878 a	*	4.928 b	5.757 a	5.821 a	*
	2005/06	**	5.143 b	5.800 b	5.457 b	5.350 b	7.357 a	N.S	5.707	5.728	6.031	*
Straw with capsules yield / hectare (t)	2004/05	**	7.157 d	10.007 b	10.322 b	7.800 c	11.022 a	*	8.450 b	9.600 a	9.729 a	*
	2005/06	**	8.286 d	11.972 b	12.193 b	10.857 c	13.071 a	N.S	10.793	11.086	11.950	*

*** , ** and N.S indicate P < 0.·5, P < 0.01 and not significant, respectively.**
Means designated by the same letter are not significantly different at the 5% level, according to Duncan's multiple range test.

Table (4): Fiber yield and its related characteristics of flax as affected by organic fertilizer forms and organic fertilizer rates in 2004 / 2005 and 2005 /2006 seasons

Characteristics	Season	Organic fertilizer forms						Organic fertilizer rates (t/ha)				Interaction
		Sig.	Without	Clay	Farmyard manure	Compost	Town refuse	Sig.	7	14	21	
Fiber yield / plant (g)	2004/05	*	0.06 e	0.10 a	0.09 b	0.07 d	0.08 c	*	0.07 c	0.08 b	0.09 a	*
	2005/06	*	0.07 e	0.11 a	0.10 b	0.08 d	0.09 c	*	0.08 c	0.09 b	0.10 a	*
Fiber yield / hectare (t)	2004/05	**	0.535 e	0.995 a	0.912 b	0.647 d	0.764 c	**	0.622 c	0.815 b	0.863 a	*
	2005/06	**	0.746 e	1.160 a	0.915 c	0.852 b	0.988 b	**	0.897 c	0.900 b	1.003 a	*
Fiber percentage	2004/05	**	13.2 c	16.0 a	15.6 ab	14.8 b	15.4 ab	*	14.0 c	15.0 b	16.0 a	*
	2005/06	**	14.5 c	17.0 a	16.8 ab	15.9 b	15.8 b	*	14.9 c	16.1 b	17.0 a	*
Fiber length (cm)	2004/05	**	55.7 d	80.0 a	72.3 b	60.5 c	70.3 bc	**	63.1 c	66.3 b	77.3 a	*
	2005/06	**	58.4 d	79.7 a	74.3 ab	64.5 c	71.5 b	**	62.5 c	71.8 b	76.5 a	*
Fiber strength (R. K. M.)	2004/05	*	61.5 d	65.3 b	68.8 a	63.9 c	65.5 b	*	63.0 b	64.8 b	67.2 a	*
	2005/06	*	64.5 c	69.5 ab	70.6 a	66.7 b	68.7 ab	*	66.5 b	67.4 b	70.1 a	*
Fiber fineness (N.m.)	2004/05	**	274.3 e	311.3 b	322.3 a	292.1 d	300.5 c	**	290.2 c	299.8 b	310.0 a	*
	2005/06	**	306.2 e	333.2 b	354.1 a	324.1 d	332.4 c	**	318.3 c	328.3 b	343.4 c	*

*** , ** and N.S indicate P < 0.·5, P < 0.01 and not significant, respectively.**
Means designated by the same letter are not significantly different at the 5% level, according to Duncan's multiple range test.

Table (6): Seed yield and its related characteristics of flax as affected by organic fertilizer forms and organic fertilizer rates in 2004 / 2005 and 2005 /2006 seasons

Characteristics	Season	Organic fertilizer forms						Organic fertilizer rates (t/ha)				Interaction
		Sig.	Without	Clay	Farmyard manure	Compost	Town refuse	Sig.	٧	١٤	٢١	
Number of capsules / plant	2004/05	**	4.0 e	7.0 b	8.0 a	5.4 d	6.0 c	N.S	5.6	5.8	6.8	N.S
	2005/06	**	4.6 e	7.6 b	10.0 a	5.8 d	6.8 c	*	5.4 c	6.6 b	8.8 a	*
Number of seeds /capsule	2004/05	**	8.5 e	11.9 c	12.0 b	10.9 d	13.2 a	N.S	10.4	11.7	11.8	N.S
	2005/06	*	8.6 c	9.7 bc	10.6 ab	8.8 c	11.9 a	*	7.2 c	10.5 b	12.2 a	N.S
Number of seeds / plant	2004/05	**	21.6 e	54.4 a	45.2 b	26.4 d	32.4 c	**	30.0 c	36.2 b	41.8 a	*
	2005/06	**	22.6 e	53.0 a	38.8 b	24.4 d	33.2 c	**	26.6 c	31.8 b	44.8 a	*
Seed index (g/1000-seed)	2004/05	*	5.50 d	7.37 a	6.55 b	6.00 c	6.37 bc	*	5.87 c	6.38 b	6.82 a	*
	2005/06	*	7.00 d	8.18 a	7.74 b	7.40 c	7.70 bc	N.S	7.4	7.5	7.9	N.S
Seed yield / plant (g)	2004/05	**	0.16 d	0.34 ab	0.36 a	0.22 bc	0.30 b	*	0.20 c	0.28 b	0.35 a	*
	2005/06	**	0.18 c	0.36 ab	0.44 a	0.24 bc	0.30 b	N.S	0.24	0.33	0.34	N.S
Seed yield /hectare (t)	2004/05	**	0.600 e	1.262 c	1.362 a	0.790 d	1.238 b	*	0.890 c	1.033 b	1.228 a	*
	2005/06	**	1.009 e	1.505 b	1.776 a	1.129 d	1.333 c	N.S	1.305	1.343	1.400	*
Oil percentage	2004/05	**	38.0 c	39.4 ab	40.0 a	38.8 bc	39.3 b	**	38.3 c	39.2 b	40.0 a	*
	2005/06	**	38.2 c	39.6 ab	40.8 a	39.0 bc	39.4 b	**	38.1 c	39.2 b	41.0 a	*

*** , ** and N.S indicate P < 0.٠5, P < 0.01 and not significant, respectively.**

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