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ECONOMIC EVALUATION OF POTASSIUM FERTILIZATION USE ON FLAX PRODUCTIVITY UNDER NEWLY RECLAIMED LANDS IN EGYPT

[1]Mahmoud M. Abd El- Fattah, [2]Osama A. Nofal, [3]Bakry A. Bakry and [1]Faiza A. Mohamed

[1]Agriculture Economics Research Institute- ARC, Dokki, Egypt

[2]Plant Nutrition Department, NRC, Dokki, Egypt

[3]Field Crops Department, NRC, Dokki, Egyp*t*

Abstract

Flax is considered one of the most important fiber crops in Egypt in general and in new lands in particular. It was found from the research that its area decreased despite its economic, industrial and export importance. Therefore, it can benefit from biotechnology and modern agricultural treatments such as:

Fertilization rates, sources of chemical fertilizers and its use in flax cultivation in new lands to expand its cultivation in order to provide needs of local/ industries and exportation.

Flax area and seeds decreased by about 6.28%, 6.69% and there was stability in productivity of flax fibers and seeds in old lands. Moreover, flax area in new lands represents 2.70% from total area of flax and its area decreased by change rate 11.06% and fibers production decreased by 9.24% and flaxseed by 9.98% too. There was relative stability in fibers productivity in new lands. On the apposite side, seed productivity per feddan increased with change rate 1.77% and the annual average was about 0.566 ton.

Dakhliais the first governorate in flax cultivation in Egypt then come Gharbia, kafr El- sheikh, Sharkia, Demietta and Beheira. Results refers also to the straw productivity of Vaiking, Giza8, Eriana in the research sample which amounted to 2.689, 2.430, 2.590 tons/ feddan and seeds productivity amounted to 449.33, 577.94, 401.8 KG/Fed. it was found that Vaiking is the best variety for straw and Giza 8 for seeds. Share percentage of new lands in flax area, fibers production and seeds production reached about 2.70%, 2.57%, 2.36% respectively and the fibers productivity reached 4.11 tons and seed about 0.566 tons so it could be recommended to expand Giza8 which exceeds by about 2012%in seeds.

As a conclusion it is proved that KNO_3 is considered the best potassium fertilizer for all flax varieties in new lands in Nubaria region (Vaiking, Giza 8, Eriana) where it affected all studied characteristics and oil productivity by about 71%, 75%, 63% and fibers productivity by about 83%, 81%, 75% for studied variables respectively. Above of all it increased return and net return for (Giza8, Vaiking, Eriana) where the total revenue reached 7909, 7787, 6887 pounds/feddan and the net return reached 1239, 1117, 217 pounds/ feddan for the three varieties respectively.

Keywords **:** Flax productivity, economic evaluation, fertilization.

Introduction

Flax crop is one of the most important fibers crops after cotton in Egypt. It is cultivated for fibers and seeds moreover; its fibers are used in many industries such as, fire hoses textile for boats, papers printing banknotes, oil which is extracted from seeds and the product resulting from the squeezing process is used as food for milk animals. Flax is used also in manufacturing granular wood. In fact it is strategic crop through which it contributed by about 47334 thousand pounds from the average value of the agricultural income which amounted to about 381497 million pounds and that represents about 0.01% during (2015-2017) and it represents about 1.65% from the average value of fibers crops which amounted to 2873 million pounds. Its area amounted to about 11.41thousand feddans represents 0.07%, 5.49% from cropping area and total area respectively. As for its area in new lands it is amounted to 0.134 thousand feddans represents (Source : Ministry of Agricultural and land Reclamation, Economic Affairs sector, Central, Field crops research Institute, fiber crops research department, Bulletin 1357/2015.) about 1.17% from the total area of flax during the studied period.

Therefore, it contributes in supplying the local factories with fibers and seeds. Its best cultivation is in light clay lands or heavy yellow homogeneous fertility, but it is not found in high salty weedy lands. It is better to cultivate it in the same land after 2-3 years and it can be cultivated after cotton, maize or summer crops such as, soybeans and sunflower and also after rice with good attention to soil softening.

Research Problem

The use of chemical fertilizers is considered one of the most important technological methods to increase flax production especially in new lands. It is clear that its area has been economic affairs sector decreased in old lands, despite its economic industrial and export importance. So it can benefit from biotechnology and modern agricultural treatments such as fertilization rates, kinds of chemical fertilizers which can be used in cultivating flax in new suitable lands this will be reflected on the economic return of flax crop above of all the expansion of its cultivation to meet the needs of local industries and export.

Aim of the Research

The research aims to evaluate the use of potassium fertilizer rates according to the cultivated flax varieties under new lands and to achieve this goal it is necessary to study the following points:

1- To know the position of flax crop in the Egyptian agriculture and its contribution in the national income.

2- To evaluate the use of potassium fertilizer rates in the production of flax in Egypt according to its varieties in the new lands.

3- To know the role and importance of new lands in the production of flax and the possibility to increase it.

4- To study the effect of some agricultural properties on the productivity of oil and fibers of flax in the new lands.

5- To estimate the regression functions among the use of potassium fertilizer and the factors affecting the production of oil and fibers.

6- To estimate the items of production cost and profitability of flax in the new lands and compare it with those in the old lands so that it can be recommended to expand it.

Materials and Methods

The research adopted both quantities and descriptive methods to analyze the primary data which obtained from the three experiments which have been done on three flax varieties: crop (Vaiking as fiber type), oil crop (Eriana as oil type) and (Giza 8 as double purpose type). Plant samples have been taken from the experimental farm of the agriculture research center in Nubaria which contain 30 observations of two seasons the first includes 15 and the second 15 observations also. This experiment contain 30 observations to study the response of the three flax varieties to four sources of potassium fertilization (potassium chloride (KCL), potassium sulfate (K_2SO_4(Potassium Nitrate (KNO_3) and potassium hydroxide (KOH) where cross section data has been used in the two seasons and the two experiments have been done on sandy soil.

Statistical analysis

The experimental design was split plot design with three replicates, which flax varieties occupy the main plots and potassium sources were allocated at random in subplots. Data were statistically analyzed separately for each season. The combined analysis was conducted for the data of the two seasons according to (Gomez and Gomez, 1984), some statistical measures have been used such as trend and multi regression for the economic variables, besides the least significant differences (LSD) was used to compare between means at 5 %.

Results and Discussion

Development of flax production, productivity and area of flax in old lands

The annual average of the total cultivated area of flax reached about 12.03 thousand feddans which comes between lower average 3.41thousand feddans in 2013 and upper average 20.82 thousand feddans in 2007. Trend equation in Table (2) refers to decreasing the total area of flax by 755.34 feddans and significant change rate about 6.28%

Development of flax fiber production

The annual average of fibers production reached about 52.47 thousand tons it comes between lower limit 13.69 thousand tons in 2013 and upper limit 92.07 thousand tons in 2007.

Table 1 : Area and production of flax in new Lands in Egypt during (2005-2017)

Area: Feddan / Production: ton

Year	Total area	Area of new lands	Are of new lands from total area %	Fibers			Seeds		
				Production of new lands from total %	Production of new lands	Total production	Production of new lands from total %	Production of new lands	Total production
2005	16345	515	3.15	69094	1794	2.60	11330	266	2.35
2006	15613	642	4.11	62065	2588	4.17	9761	328	3.36
2007	20820	442	2.12	92072	1972	2.14	12226	242	1.98
2008	20102	96	0.48	86833	403	0.46	11879	61	0.51
2009	12784	453	3.54	55359	1662	3.00	7888	222	2.81
2010	7951	474	5.96	33562	1721	5.13	4552	243	5.34
2011	8068	499	6.18	35704	2112	5.92	4536	276	6.08
2012	10181	527	5.18	51742	2634	5.09	5725	260	4.54
2013	3405	144	4.23	13690	607	4.43	1941	79	4.07
2014	6887	30	0.44	28351	105	0.37	4485	18	0.40
2015	7445	25	0.34	31547	113	0.36	4985	18	0.36
2016	12379	69	0.56	51028	236	0.46	7733	40	0.52
2017	14407	307	2.13	11101	1566	2.20	8423	198	2.35
Average	12030	325	2.70	52473	1347	2.57	7343	173	2.36

Source: Collected and calculated from Ministry of Agriculture and land reclamation Affairs sector, Agricultural statistical Bulletin, different numbers

Table 2 : Trend for development of flax area and production during (2005-2017)

Item	A	B	Average	R^2	T	F	Annual change rate %
Total area	17317.12	-755.34	12030	0.31	*(-2.21)	4.88	6.28
Area of new lands	576.54	-35.96	325	0.40	**(-2.71)	7.34	11.06
Total production (fibers)	72697.81	-2889.27	52473	0.23	*(-1.81)	3.28	5.67
production of new lands (fibers)	2218.50	-124.48	1347	0.27	*(-2.03)	4.12	9.24
Total production (Seed)	10783.73	-491.48	7343	0.34	*(-2.39)	5.71	6.69
production of new lands (Seed)	294	-17.26	173	0.36	*(-2.49)	6.20	9.98

(*) significant at level 0.05 (**) significant at level 0.01

Source: collected and calculated from Table (1)

Trend equation in Table (2) appears decreasing of fibers production by 2.89 thousand tons with 5.67% change rate. Moreover, the annual production of seeds amounted to 7.34 thousand tons which it lies between lower limit 1.94 thousand tons in 2013 and upper limit 12.23 thousand tons in 2007. Of seeds decreased by 491.48 tons with change rate significantly about 6.69%.

Development of production (fibers and seeds)

The annual productivity of flax fibers reached 4.348 ton/feddans it comes between lower limit 3.973 ton/feddans in 2006 and upper limit 5.087 ton/feddans in 2012. Trends in Table (4) reflect the economic changes during the studies period proved that there was relative stability in productivity. It was also shown that the annual productivity of seeds reached 0.610 ton/feddans which was relative stability in seed productivity.

Development of area production and productivity of flax in new lands

(1) Cultivated area

Table (1) refers to the annual average of flax in new lands which amounted to 325 feddans represent about 2.70% from the average of total area and it lies between lower limit 25feddans in 2015 and upper limit 642 feddans in2006, but Table (2) refers to the decreasing the cultivated flax area under new lands by 35.96 feddans with significant change rate about 11.06%.

(2) Fibers production

Table (1) shows that the annual average of fibers production in new lands amounted to 1.35 thousand tons represents 2.57% from the average of total production of fiber which comes between lower limit 105 tons in 2014 and upper limit 2.63 tons in 2012.On the other hand, Table (2) refers to the decreasing in fibers production in new lands by about 124.48 tons with significant change rate 9.24%.

(3) Seeds production

Table (1) refers to the annual average of seeds production in new lands which amounted to 173 tons represent 2.36% from the total average of Seeds which lies between lower limit 18 tons in 2014 and upper limit 328 tons in 2006.

Table (2) refers to the decreasing in Seeds production in new lands by amount 17.26 tons with significant change 9.98%.

Table 3 : Area and production of flax in new Lands in Egypt during (2005-2017)

Area: Feddan / Production: ton

Year	Fibers		Seeds	
	Productivity of old lands	Productivity of new lands	Productivity of old lands	Productivity of new lands
2005	4.251	3.483	0.699	0.517
2006	3.973	4.031	0.630	0.511
2007	4.421	4.462	0.588	0.548
2008	4.320	4.798	0.591	0.635
2009	4.355	3.669	0.622	0.490
2010	4.209	3.631	0.576	0.513
2011	4.438	4.232	0.563	0.553
2012	5.078	4.998	0.566	0.493
2013	4.12	4.215	0.571	0.549
2014	4.119	3.500	0.651	0.600
2015	4.236	4.520	0.669	0.720
2016	4,126	3.420	0.635	0.580
2017	4.932	5.101	0.583	0.645
Average	4.348	4.112	0.610	0.566

Source: Ministry of Agriculture and land reclamation, Economic Affairs sector, Agricultural statistical Bulletin, different numbers.

Table 4 : Trend for development of productivity of flax in old and new land in Egypt during (2005-2017)

Item	A	B	Average	R^2	T	F	Annual change rate %
Productivity of old lands (fibers)	4.21	0.02	4.348	0.06	(0.81)	0.66	-
Productivity of new lands (fibers)	3.83	0.04	4.112	0.08	(0.96)	0.92	-
Productivity of old lands (Seed)	0.62	-0.002	0.610	0.610	(-0.55)	0.30	-
Productivity of new lands (Seed)	0.50	0.o1	0.566	0.566	*(2.25)	5.06	1.77

(*) significant at level 0.05

Source: collected and calculated from Table (3)

(4) Productivity of fibers

Table (3) refers to the annual/average of fibers productivity is new lands which amounted to 4.112 ton/ feddans which lies between lower limit 3.42 ton/ feddan in 2016 and upper limit 4.998 ton/ feddan in 2012 and Table (4) refers to the relative stability in fibers productivity along the research period.

(5) Productivity of seeds

Table (3) refers to the annual/average of seeds in the new lands which amounted to 0.566 ton/ feddans and it lies between lower limit 0.49 ton/ feddan in 2009 and upper limit 0.72 ton/ feddan in 2015 which Table (4) it was shown in trend equation that there was increasing in productivity of

seeds in new lands by about 0.01 ton/ feddan with change rate 1.77% during the studies period.

Geographical distribution of flax crop in Egypt

(a) Cultivated area

Table (5) refers to Dakhlia as the most important governorate in flax cultivation the area amounted to about 3894 feddans represents 34.12% from the total area during (2015-2017) then come Gharbia, kafr-el sheikh, sharkia and Damietta where the area amounted to 2841, 1441, 1125 and 1209 feddans represent about 24.90%, 12.36%, 10.60% and 9.86% respectively at last Beheira 730 feddans represents 6.40%.

(b) Total fiber yield production

From table (5) it is obvious that Dakhlia is the first governorate in flax fibers production which amounted to 18235 tons represents 35.60% from total production of fibers during the same period then come Gharbia, Kafr-El sheikh, sharkia and Damietta with average production 9593, 8575, 6401 and 4613 tons respectively represent 18.73%, 16.74%, 12.5% and 9.2% then comes Beheira 730 tons represents 5.75%.

Table 5 : Geographical distribution of flax area and production according to the most important governorates during (2005-2017)

Governorate	Are average feddan	%	Fibers		Seeds	
			Production average(ton)	%	Production average(ton)	%
Beheira	730	6.40	2945	5.75	377	5.35
Gharbia	2841	24.90	9593	18.73	1315	18.66
Kafr el sheikh	1441	12.63	8575	16.74	1284	18.22
Dakhlia	3894	34.12	18235	35.60	2639	37.45
Damietta	1195	9.86	4713	9.20	491	6.97
Sharkia	1209	10.60	6401	12.50	832	11.81
Menofia	99	0.86	427	0.83	51	0.72
Kaloubia	70	0.62	328	0.64	56	0.80
Total	11408	99.98	51217	99.98	7046	99.99
Inside valley	11408	99.98	51217	99.98	1046	99.99
Noubaria	2	0.02	8	0.02	1	0.01
Outside vally	2	0.02	8	0.02	1	0.01
Total	**11410**	**100**	**51225**	**100**	**7047**	**100**

Source: Ministry of Agriculture and land reclamation, Economic Affairs sector, Agricultural statistical Bulletin, different numbers

(c) Total seed yield production

Table (5) shows that Dakhlia is the first governorate in seeds production where the average production reached 2639 tons represented 37.45% from the total then come Gharbia, kafr-el sheikh, Sharkia and Damietta with 1315, 1284, 832 and 491 tons represented 18.66%, 18.22%, 11.81% and 6.97% respectively then comes Beheira with seeds production 377 tons represented 5.35%.

Current situation of flax fertilization in new lands

The cultivation of flax crop in new lands needs phosphate fertilizer rates more than then valley lands which needs 150 kg per feddan mono super phosphate during the land preparation, 50 kg potassium sulphate 48% before the last plaguing, 75 units of nitrogen fertilizer from ammonium nitrates 33.5%. It is not favorable to use urea fertilizer as a source of nitrogen for flax where nitrogen fertilizer is added under sprinkler irrigation system in 5 equal doses the first dose before agricultural irrigation to activate seedlings growth, but the last one is after 60 days from cultivation. On the other side in case of furrow irrigation, nitrogen fertilizer is added in 4 equal doses and fertilization must be every 15 days directly before irrigation. Soil analysis must be done to estimate the fertilizer needs from macro and micro elements, moreover drip irrigation has been used in this land. Fertilization rates use were as following:

- Phosphate fertilizer was used in the form of super calcium phosphate 100 kg per feddan.
- Nitrogen fertilizer in the form of ammonium nitrate 33.5% 120 kg per feddan after complete germination ,then after two weeks it have been used 4 sources of potassium fertilizer as (potassium oxide (potassium chloride, potassium sulfate, potassium nitrate and potassium hydroxide) where potassium fertilizer was used as foliar application on leaves with rate 800 ppm (parts per million) in the form of potassium oxide before flowering stage and during capsules filling.

Results of crop analysis in sample

Ten plants samples have been taken from central area for m^2 from every sector in full maturation stage (mid may) and the harvested plants have been tied and left to dry then the capsules have been removed carefully to estimate straw and seed yield (ton/ feddan).

The seeds were cleaned from straw and other sediments and weighed in grams and converted to (kg/feddan). Percentage of oil was determined by soxhlet set according to (A, O, A, C., 1980) method. As for the remaining straw was transported to Tanta Company for flax and oil by using warm water under degree (30- 35) and the following characters were estimated:

1- Oil productivity (kg/feddan). seed productivity (kg/feddan). Oil percentage in seed (%).

2- Fiber percentage = total weight of Fibers in gm/ straw weight in gm. *100

3- Fibers crop (kg/feddan) = straw crop (kg/feddan) * Fibers percentage.

First: Effect of Flax varieties

The data in Table (6) show that there were significant difference between flax varieties (Eriena, Giza-8andvaiking) in all the studied characters under this trail(seed yield (kg/fed.), straw yield (ton / fed.), oil percentage in seeds, oil yield (kg/fed.), fibers percentage % and fibers yield (kg/fed.).Giza-8 variety significantly exceeded the other varieties in seed yield (577.94 kg/fed.), oil yield (225.54 kg/fed.), oil percentage (38.91 %) and fiber percentage (13.90 %).

On the other hand, vaiking variety exceeded significantly the other flax varieties in straw and fibers yields per feddan which reached to 2.689 ton/fed. and 374.53 kg/fed. respectively.

Table 6 : Effect of flax varieties on some studied characteristics

Characters	Flax cultivars			L.S.D 5 %
	Vaiking	Giza8	Eriana	
Seed yield Kg/fed.	449.33	577.94	401.08	8.45
straw yield ton/fed.	2.689	2.430	2.590	0.10
oil %	38.42	38.91	38.28	0.12
Oil yield Kg/fed.	173.45	225.54	154.16	2.33
Fibers %	13.89	13.90	13.65	0.05
Fiber yield Kg/fed.	374.53	337.93	354.19	3.17

Source: Data from research sample

Second :Effect of potassium fertilizers sources

Table (7) shows that there were significant differences among potassium fertilizers sources in all studied characters.

Potassium nitrate (KNO_3) surpassed the other potassium sources in seed straw, oil and fibers yields/fed. which reached the highest value 572.09 kg/fed., 2.921 ton/fed., 231.09 kg/fed. and 414.72 kg/fed. respectively.

There are significant differences among four potassium fertilizers (KNO_3) and the other potassium sources in oil and fibers percentage which reached to 40.40% and14.19% respectively.

Table 7 : Effect of potassium fertilizers types on agricultural properties of flax

Characteristics	Potassium fertilizers types					L.S.D
	Control	KOH	KNO_3	K_2SO_4	KCL	
Seed yield Kg/fed.	387.05	470.94	572.09	502.21	448.29	16.14
Straw yield ton/fed.	2.184	2.634	2.921	2.631	2.490	0.06
oil %	36.80	37.88	40.40	39.09	38.52	0.43
Oil yield Kg/fed.	142.89	178.47	231.09	196.43	173.03	4.21
Fibers %	13.35	13.85	14.19	13.88	13.79	0.03
Fiber yield Kg/fed.	291.27	363.42	414.72	364.95	343.36	7.18

Source: Data from research sample

Third : Effect of interaction between potassium fertilizers sources andflax varieties

The results reported in Table (8) that the interactions between potassium fertilizers sources and the flax varieties had significant effects on all studied traits in the combined analysis of. Data recorded that there was a significant increase in straw yield per feddan, fiber percentage and fiber yield per feddan due to the interaction between growing Vaiking variety and foliar application of potassium nitrate (KNO_3) which reached to (3.211 ton/fed.), (14.34%) and (460.49 ton/fed.), respectively. While, the interactions between the same potassium source with Giza-8 variety gave the highest values of (562.55 and 221.70 kg/fed.), seed and oil yields per feddan, respectively. On the other hand, growing Eriana variety and fertilized with the same potassium source gave the highest values of oil percentage (41.03 %).

Table 8 : Effect of interaction between flax varieties and potassium fertilizers sources on some studied characteristics

Varieties	Potassium fertilizers sources	Seed yield Kg/fed.	Straw yield ton/fed.	Oil percentage in seed %	Oil yield Kg/fed.	Fibers percentage %	Fibers yield Kg/fed.
Vaiking	Control	325.32	2.386	36.25	117.93	13.03	310.85
	KOH	432.08	2.701	38.17	164.92	13.97	377.26
	KNO_3	562.55	3.211	39.41	221.70	14.34	460.49
	K_2So_4	483.28	2.658	39.19	189.40	14.21	377.71
	KCL	443.43	2.492	39.08	173.29	13.40	346.34
GIZA-8	Control	480.33	2.015	37.77	181.42	13.69	275.85
	KOH	540.12	2.559	38.15	206.06	13.79	352.89
	KNO_3	655.58	2.643	40.76	271.29	14.19	375.01
	K_2So_4	643.17	2.535	39.17	251.93	13.79	354.14
	KCL	560.50	2.397	38.72	217.03	13.84	331.69

Eriana	Control	355.50	2.152	36.38	129.33	13.34	278.11
	KOH	440.62	2.611	37.32	164.44	13.79	360.13
	KNO_3	488.13	2.909	41.03	200.28	14.05	408.66
	K_2So_4	380.18	2.619	38.92	147.97	13.45	362.99
	KCL	340.95	2.581	37.77	128.78	13.64	352.06
L.S.D		3.43	0.121	0.32	2.15	0.01	1.87

Source: Data from research sample

Statistical estimation for the effect of some agricultural characteristics of flax production in the simple

In this part, it has been studied the effect of some agricultural characteristics on the productivity of oil and seeds of flax in the new lands according to the use of four types of potassium fertilizers they are (KNO_3, KOH, KCL, K_2SO_4) in the new lands for three varieties of flax they are Vaiking, Eriana, Giza & moreover, regression relationships among fertilizer use and properties affecting oil and fibers production results obtained are followed:

First : Oil productivity

(1) Vaiking

Table (9) shows regression equation in fact, oil yield has been affected by both seed and fibers yields when KOH fertilizer has been used while for KNO_3 fertilizer the oil yield has been affected by seed, straw and fiber yields and oil percentage in seed. Also seed productivity has been affected by straw productivity, oil percentage in seed and fibers productivity that is for KCL fertilizer.

(2) Giza-8

From Table (9) it is proved that oil yield was affected by both seed and fibers yield when KOH fertilizer is used, but when $KNO_3$is used. It has been found that oil yield was affected by both seed and straw yield, oil percentage in seed, fibers percentage and fibers yield and when $K_2SO_4$is used it was obvious that oil yield was affected by seed yield, oil percentage in seed and fibers percentage. At last for KCL using, it as been found that seed yield was affected by oil percentage in seed and fibers percentage.

(3) Eriana

Having a look at Table (9) it was found that oil yield has been affected by both seed yield and oil percentage in seed when KOH fertilizer is used, but when $KNO_3$is used it was found that oil yield has been affected by seed yield, straw yield, oil percentage in seed, fibers percentage and fibers yield. As for K_2SO_4 oil yield has been affected by seed yield, oil percentage in seed and fibers yield. At last when KCL fertilizer is used it is proved that seed yield has been affected by oil percentage in seed and fibers percentage.

From previous results it was found that KNO_3 fertilizer is preferable than the other potassium fertilizers for all flax cultivated varieties in new lands in Nubaria region (Vaiking, Giza8, Eriano) where this fertilizer affected in all studied characteristics which affected oil yield with about 72%, 75%, 63% for mentioned varieties respectively.

Table (9): Regression relationships among oil yield of flax varieties grown under new lands and some agricultural characteristics

Type of fertilizer	Equation	Determination coefficient	F
First: Vaiking			
KOH	$\hat{Y}$ =186.42 + 374.59x_1 +407.48 x_5 **(3,26) *(5.12)	0.56	22.37
KNO_3	$\hat{Y}$ =262.24 + 512.23x_1 +4.31x_2 +33.16x_3 +515.73 x_5 **(4,32) **(3.87) **(7.29) **(4.52)	0.72	41.22
K_2So_4	$\hat{Y}$ =202.71 + 492.83x_1 +3.12x_2 +39.33x_3 +475.51 x_5 *(2,69) **(6.24) **(4.46) **(2.63)	0.67	27.33
KCL	$\hat{Y}$ =159.72 + 2.93x_2 +40.32x_3 +371.58 x_5 **(5.72) **(2.31) **(2.79)	0.43	17.39
Second: GIZA-8			
KOH	$\hat{Y}$ =241.51+ 614.33x_1 +382.74 x_5 **(3,65) **(5.22)	0.48	18.92
KNO_3	$\hat{Y}$ =381.02 + 624.31x_1 +2.53x_2 +42.32x_3 +15.14 x_4 +487.22 x_5 **(4,07) **(7.82) **(2.83) **(6.42) **(4.25)	0.75	43.71
K_2So_4	$\hat{Y}$ =312.21 + 722.74x_1 +37.83x_2 +14.47x_4 *(2,74) **(6.28) **(5.13)	0.61	30.03
KCL	$\hat{Y}$ =196.85 + 584.92x_2 +38.71x_3 +13.77 x_5 **(5.98) **(3.66) **(2.36)	0.59	26.94
Third : Eriana			
KOH	$\hat{Y}$ =181.27 + 482.57x_1 +47.36 x_3 **(4,35) **(5.06)	0.51	23.72

KNO_3	Y_e =249.86 + 392.27x_1 +2.33x_2 +49.14x_3 +14.74x_4 +412.87 x_5 **(3,84) **(2.39) **(6.11) **(2.96) **(4.26)	0.63	26.94
K_2So_4	Y_e =199.23 + 533.19x_1 +36.94x_3 +393.65x_4 **(4,77) **(2.34) **(5.45)	0.49	19.18
KCL	Y_e =131.82 + 38.11x_3 +14.03 x_4 **(5.98) **(2.36)	0.60	26.11

Where: value between brackets calculated (T)

Y_e estimated value of flax oil yield (kg/fed.)

X_1= Seed yield (Kg/fed.) X_2 = straw yield (ton/fed.) X_3 = oil percentage in seed

X_4 = Fibers percentage X_5 =Fiber yield(Kg/fed.)

(**) significant at level 0.01

Source : collected from research sample

Second: Fibers productivity

(1) Vaiking

Table (10) shows the regression relationships among flax fiber yield and some agriculture characteristics in new lands. fibers yield has affected fiber percentage when KOH is used, but when $KNO_3$is used it is found that fiber yield has been affected by seed yield, straw yield, oil percentage by seed yield, straw yield, oil percentage in seed, fibers percentage and fibers yield

As for K_2SO_4fiber yield has been affected by both straw yield and fiber percentage. At last when KCL was used straw yield affected fiber yield.

(2) GIZA 8

In Table (10) when KOH fertilizer was used fiber yield has been affected by both straw yield and fiber percentage but for KNO_3 fiber yield has been affected by seed yield, straw yield, oil percentage in seed, fibers percentage and fibers yield. As for K_2SO_4 fertilizer fiber yield has been affected by straw yield, oil percentage in seed and fibers percentage. At last when KCL fertilizer was used fiber yield has been affected by fiber yield.

(3) Eriana

Table (10) refers to fiber yield which was affected by seed yield and straw yield when KOH is added, but for KNO_3fertilizer it was found that fiber yield was affected by seed yield, straw yield, oil percentage in seed, fibers percentage and fiber yield. As for $K_2SO_4$the productivity of fibers was affected by straw yield, oil yield and fibers percentage, moreover the productivity of fibers was affected by straw yield and fibers percentage when KCL was used.

From previous result it can be concluded that KNO_3 is considered the best potassium fertilizer for all varieties of cultivated flax in the new lands in Nubaria (Vaiking, Giza 8, Eriana) where it affected in all studied characteristics which affected sequence fibers yield by about 83%, 81%, 75% for mentioned varieties respectively.

Table 10 : Regression relationships among fiber yield of flax varieties grown under new lands and some agricultural characteristics

Type of fertilizer	Equation	Determination coefficient	F
First: Vaiking			
KOH	Y_e =394.12 + 3.62x_2 +13.57 x_5 **(7,34)^2**(6.82)	0.65	46.51
KNO_3	Y_e =513.91 + 645.21x_1 +5.01x_2 +37.37x_3 +263.24 x_4 +16.26 x_5 **(7,53) **(4.69) **(8.07) **(6.93)	0.83	53.58
K_2So_4	Y_e =387.23 + 3.64x_2 +15.63x_5 **(8.33)^2 **(6.97)	0.78	49.62
KCL	Y_e =292.25 + 14.87x_2 +36.84x_3 **(5.29) **(4.62)	0.46	22.31
Second: GIZA-8			
KOH	Y_e =378.23+ 2.23x_2 +12.34 x_5 **(6,58) **(7.22)	0.77	39.44
KNO_3	Y_e =431.42 + 738.24x_1 +3.23x_2 +41.96x_3 +314.27 x_4 +15.74 x_5 **(4,63) **(8.14)^2 **(2.51) **(7.39) **(5.78)	0.81	51.78
K_2So_4	Y_e =417.54 + 3.19x_2 +39.72x_3 +13.16x_5 **(6,18)^2 **(4.75) **(7.94)	0.69	44.37
KCL	Y_e =267.22 + 43.21x_3 +11.81x_5 **(5.33) **(6.46)	0.53	31.72
Third : Eriana			

KOH	Y_e =381.36 + 383.32x_1 +3.19 x_2 **(4.92) **(6.04)	0.48	25.69
KNO_3	Y_e =496.72 + 451.63x_1 +3.81x_2 +43.84x_3 +236.45x_4 +13.96 x_5 **(6,33) **(3.83) **(7.86) **(6.77) **(4.18)	0.75	44.32
K_2So_4	Y_e =364.35 + 2.63x_2 +193.27x_4 +12.69x_5 **(5.29) **(6.16) **(4.32)	0.61	35.62
KCL	Y_e =249.87 + 2.65x_2 +12.27 x_5 **(7.71) **(6.94)	0.73	41.53

Where: value between brackets calculated (T)

Y_e estimated value of fibers productivity for flax kg/f

X_1= productivity of Seed X_2 = productivity of strawton/f X_3 = oil percentage in seed

X_4 = oil productivity Kg/f X_5 =Fibers percentage

(**) significant at level 0.01

Source : collected from research sample

Economic return for using potassium fertilizers in the research sample:

From data of the research sample through the use of potassium fertilizer they are: potassium hydroxide (KOH), potassium nitrate (KNO_3), potassium sulphate (K_2SO_4) and potassium chloride(KCL) with equal quantities (1.120 kg/f) in the form of (potassium oxide) cost of fertilizer have been estimated to about L.E 16.1, 28.6, 8, 13.4 respectively where the fertilizer was sprayed on leaf with 800 ppm rate in the form of potassium oxide before flowering stage and fullness of capsules and as a result for that return and net return per feddan increased for flax cultivation in new lands with different values according to increasing the productivity of fibers and seeds for the cultivated verities.

Net return of flax crop in new lands

Net return of flax production per feddan was estimated according to the cultivated verities in research sample where equal quantities are used from (KOH, KNO_3, K_2SO_4, KCL). As a result from Table (11) it is clear that KNO_3 led to increasing in return and net return for all varieties in the experiment (Vaiking, Giza 8, Eriana). The total revenue per feddan amounted to about L.E 7787, 7909, 6887 respectively. Related to net return it is amounted to about L.E 1117, 1239, 217 per feddan and that refers to the increasing of net return per feddan in new lands in the experiment when KNO_3 was used. Afterwards the total revenue reached L.E 6583, 7698, 5824 and net return L.E -87, 1028, - 846 respectively.

When KOH was used the total revenue about L.E 6230, 6921, 6201 per feddan and net return L.E -440, 251, 469 but for KOH the total revenue reached L.E 6230, 6921, 6201 per feddan and net return L.E -440, 251,- 469 for the three verities of flax. At last for KCL the total revenue amounted to L.E6097, 6908, 5393 per feddan and net return L.E -573, 238, -1277.

From previous results it is proved that the use of (KNO_3, K_2SO_4, KCL,KOH) with Giza 8 led to increase net return per feddan which amounted L.E 1239, 238, 251, 1028 respectively, but the use of these fertilizer with Vaiking led to increase the net return with the first type of fertilizer only which amounted to L.E 1117 and the decreasing of net return when the other three types are used which amounted to about L.E -87, -573, -440 respectively. Finally, with Eriana variety only the first type of fertilizer led to increasing the net return which amount to about L.E 217 per feddan and decreasing with the other three types of fertilizer which reached to about L.E- 846, 469,- 1277 respectively.

Table 11 : Revenue and net return pound/feddan of flax crop in research sample in new lands

Flax varieties	KNO_3		K_2So_4		KOH		KCL	
	Revenue	Net return	Revenue	Net return	Revenue	Net return	Revenue	Net return
GIZA 8	7909	1239	7698	-1028	6921	251	6908	236
Vaiking	7787	1117	6583	-87	6230	-440	6097	-573
Eriana	6887	217	5824	-846	6201	-469	5393	-1277

Source:

1- Data from research sample

2- Ministry of Agriculture and land reclamation, Economic Affairs sector, Agricultural cost Bulletin.

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