J. Agric. Sci. Mansoura Univ., 31 (12): 7729 - 7741, 2006

EFFECT OF TILLAGE SYSTEMS, PREVIOUS CROP AND SEEDING RATES ON FLAX YIELD AND WATER CONSUMPTION

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ABSTRACT

Two field experiments were carried out during 2004/2005 and 2005/2006 seasons at Gemmiza Agriculture Research Station, El-Gharbia Governorate to study the effect of two previous crops (Maize and Rice), five tillage systems (Chisel plough (two passes), Chisel plough (one pass), Rotary plough, Chisel plough once followed by rotary plough and no tillage) and three seeding rates (70, 80 and 90 kg seed/fed) on yield components, technological characteristics of Sakha flax variety and water consumption.

The results of the present investigation indicated that: Sowing flax after Maize (C_1) had significant increase than sowing after Rice (C_2) in seedling emergence, plant height, technical length, straw yield/fed, fiber yield/fed, fiber length, fiber percentage and fiber fineness. Chisel plough once followed by rotary plough (t_4) surpassed the other tillage systems in all fiber yield and its components except stem diameter and straw yield/plant. Also, surpassed the other tillage systems in all technological characters expect seed oil percentage. On the other hand, no tillage (t_5) reached the highest values of stem diameter, straw yield/plant and all seed yield and its components. The statistical analysis showed significant differences of seed and fiber yield between all seed-bed preparation systems, all previous crop and seed rate. In general, it can be stated that raising flax fiber and seed yield can be achieved by using chisel plough two pass at sowing rate 80 kg seed / fed when the previous crop was maize. While, raising fiber and seed yield can be achieved by using chisel plough once followed by rotary plough at sowing rate 90 kg seed / fed.

INTRODUCTION

Flax (*linum usitatissimum L.*) is one of the ancient grown crops in several regions of the world for both fibers and seeds production. It is known in Egypt as a dual purpose field crop. It is the most important fiber crop, other than cotton, while it comes fourth after cotton, soybean and peanut regard to oil seed. Now, it is one of the most important economic crops in Egypt, where it plays an effective role in the national economy due to its importance in expiration and many local industries. So, the cultivated area in Egypt reach up to 70.000 feddan yearly.

Flax yield such as all agricultural crops depends on a great extent on many factors such as tillage system, previous crop and seeding rate.

Tillage requires the maximum energy amongst all agricultural operations. The chisel plough has proved to be among the least fuel consuming for shallow or deep primary tillage

Sharma et al.., (1984) mentioned that, energy requirement and cost of cultivation were high in conventional tillage systems. They also added that,

no tillage system required the least energy and cost of production, while these requirements were about 1.5 times higher in the conventional system.

Zein Al-Din (1985) found that, the minimum energy (kW.h/t) required for seed bed preparation generally was obtained with the using for chisel plough.

Abo-Habaga (2003) showed that, the rotary tiller is suitable tillage equipment for Egyptian condition.

El-Khatib, S.I. (2000) found that, the clod size was decreased by 20.96 % when using the chisel plough two passes as compared with one pass and by 43.12 % when using chisel plough two passes followed by disk harrow.

Abd El-Mageed and El-Sheikha (1993) reported that, the rotary plow alone gave the highest pulverization of soil and the least pulverization of soil was obtained by the treatment of chisel plow and rotary plow in separate trips.

Hammad et al. (1992) observed that, the rotary plough represented the highest level of fuel consumption (L/fed), followed by the moldboard and chisel ploughs respectively. But, when they took the whole system into consideration, the mold board plough represented the highest system in fuel consumption and the rotary was the lowest one.

Abd El-Wahab (1994), reported that, more than 50 % of the power required for agricultural production is consumed in soil tillage.

Abd Alla et al.., (1999) reported that, seed bed preparation by rotary tiller after chisel plough gave the best seed bed properties for planting wheat. The seed bed preparation by rotary tiller after chisel plough not only gave the highest wheat yield, but also take the lowest values of energy requirements.

Helmy et al.., (2001) reported that, fuel consumption and energy requirements for rotary plough, chisel plough (one pass), chisel plough (two passes) and mold board plough with disc harrow were 4.2, 5.37, 9.37 and 10.87 (l/h) and 12.28, 13.35, 23.8 and 37.87 (kW.h/fed), respectively.

It has long been established that one of the major factors limiting the amount of growth per unit area is the density of stand. Many investigators *(El-Gazzar and Abou-Zaied 2001*) reported that, straw, fiber, seed yields/feddan, fiber percentage and quality increased by increasing seeding rate whereas, stem diameter, number of capsules/plant, seed index were decreased with increasing seeding rate.

Morad and El-Shazly (1994), found that, increasing soil moisture content significantly decreased soil penetration resistance after rotary plough.

Al-Tenbi (1999) found that, the soil penetration resistance after ploughing was less than before ploughing in all tillage treatments.

El-Raie et al.., (2003) found that, soil bulk density and penetration resistance were decreased after all seed bed preparation and planting systems used.

The main objective of this research was to study the effect of the previous crop, seed bed preparation systems and seeding rates on water requirement, water use efficiency and flax yield and its components.

MATERIALS AND METHODS

The present work was carried out on a clay loam soil at El-Gemmiza research station, El-Gharbia Governorate, Egypt during the growing seasons 2004/2005 and 2005/2006 to study the effect of previous crop, system of tillage and seeding rate on flax yield.

A split split plot design with three replicates was used. The main plots were devoted to the two previous crops, maize (C_1) and rice (C_2). The sub plots were allocated to the following tillage systems:

- Chisel plough (two passes). (t_1).
- Chisel plough (one pass). (t_2), this method is one commonly used by Egyptian farmers.
- Rotary plough (t_3).
- Chisel plough once followed by rotary plough (t_4).
- No tillage (t_5).

The sub sub plots were devoted to the following seeding rates (S_1(70), S_2(80) and S_3(90) kg seeds/feddan). Each sub plot was 7 m long and 6 m wide (1/100 feddan). The physical properties of the experimental field were measured and summarized in table (1). Calcium superphosphate (15.5 % p_2o_5) was applied at the time of seed bed preparation and at the rate 100 kg/feddan. Flax seed Sakha 1 variety were sown on 12 November in both seasons. The recommended cultural practices for growing flax were followed.

Table (1): The physical properties of the experimental soil

Fine sand	Coarse sand	Silt	Clay	Clay rate	Soil texture
14.64	0.68	40.83	43.85	0.75	Clay loam

- **Source of power:** A Nasr DM tractor 62 HP (57.84 Kw) 2300 engine rpm was used with the seed bed preparation systems.

- **Seed bed preparation implements:** the following equipment were used.
  - A mount chisel plough (El-Behira CD.) consisting of seven shanks arranged in three rows.
  - A rotary plough (Egyptian made) of 175 cm width.

- **Sowing machine:** Amounted seed drill (Sulky type) 21 rows, 12 cm.,distance between rows was used for planting flax.

At harvest time, ten individual plants were uprooted from each plot to determine yield components. Seed and straw yields of flax were recorded on a whole of sub sub plot basis converted to feddan.

Experimental measurements:

The following measurements arranged as follow:

1- The seedling emergence (e): five hundred seeds were germinated to determine the real seedling emergence before passing through planting

machine. Two weeks after sowing and irrigation. The seedling emergence was calculated by the following formula:

e = p/d

Where: p = average plant number per 1 m^2.

d = average number of delivered seeds per 1 m^2. The (d) value calculated during the seed drill calibration.

2-Penetration resistance was measured using the Japanese cone penetrometer. model SR-2Dik 5500 .

3-Water use efficiency: field water use efficiency was expressed as the weight of grain and water applied in the field. It can be obtained according to the following equation:

$$FwuE = \frac{GY}{WA}$$

Where: FwuE = field water use efficiency (kg/m^3).

WA = Water applied in the field (m^3/fed).

4-Fiber yield and its components

- o Total plant height (cm).
- o Technical stem length (cm).
- o Main stem diameter (mm).
- o Straw yield/plant (g).
- o Fiber yield/plant (g).
- o Straw yield/fed (ton).
- o Fiber yield/fed (kg).

5- Seed yield and its components:

- o Number of capsules/plant.
- o Seed index (1000 seed weight in gm).
- o Seed yield/plant (gm).
- o Seed yield/feddan (kg).

6- Quality characters:

- o Fiber length (cm).
- o Fiber percentage: according to the following formula:

Fiber (%) = (Fiber yield / Straw yield) × 100

- o Fiber fineness (Nm): according to the formula given by Radwan and Momtaz (1966).

Nm = N.L/G

Where: Nm = metrical number.

N = number of fibers (20 fibers of 10 cm each).

L = length of fibers (mm).

G = weight of fibers (mg).

- o Oil percentage: was determined by Soxhlet apparatus according to Horwitz *et al.* (1965).

Statistical analysis:

All data collected were subjected to statistical analysis as described by *Snedecor and Cocharn (1982).*

The mean values were compared according to Duncans Multiple Range Test *(Duncan, 1955)*.

RESULTS AND DISCUSSION

The germination ratio (g)

Effect of previous crop, ploughing method and seeding rates on seedling emergence is shown in table (2). The results revealed that, the seedling emergence of flax seeds at all plowing methods when the previous crop was maize were higher than when the previous crop was rice, as shown in fig. (1).

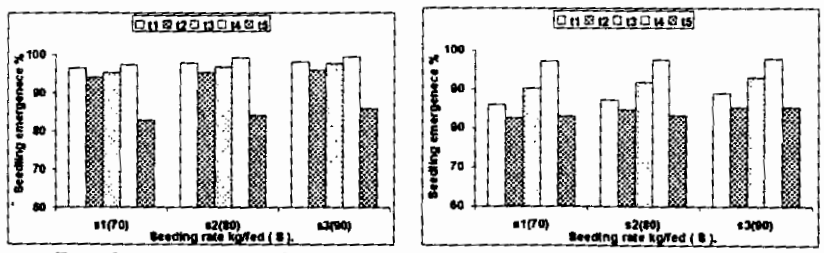
Table (2) shows also that, seedling emergence was significantly affected by tillage method. Chisel plough once followed by rotary plough tillage system surpassed the other systems; it may due to the best soil texture.

The highest value of seedling emergence (99.4 %) was obtained from chisel plough followed by rotary plough when the previous crop was maize and the seeding rate was 90 kg/fed. While the lowest seedling emergence (82.5 %) was obtained from chisel plough one pass when the previous crop was rice and the seeding rate was 70 kg/fed.

Table (2): The effect of previous crop, ploughing methods and seeding rates on germination ratio.

Previous crop	Seeding rates, kg/fed	Plowing method (T)				
		t_1	t_2	t_3	t_4	t_5
		Germination ratio				
Maize	70	96.5	94.2	95.3	97.3	82.7
	80	97.8	95.3	96.8	99.2	84.2
	90	98.1	96.0	97.6	99.4	85.9
Rice	70	86.0	82.5	90.3	97.2	83.0
	80	87.2	84.7	91.7	97.4	83.2
	90	89.0	85.3	93.1	97.8	85.4

t_1 = chisel plough (twice) t_2 = chisel plough 1st pass.
t_3 = rotary plough. t_4 = chisel plough 1st pass followed by rotary plough
t_5 = no tillage.



Previous crop maize Previous crop rice

Fig. 1: The effect of previous crop, ploughing methods and seeding rates on seedling emergence.

Fuel, power and energy consumption:

From the obtained data presented in table (3), it is clear that, the pervious crop had a highly significant effect on the rate of fuel consumption in (L/h) as well as fuel consumption per unit rate of work in (L/fed).

In the present study, the power requirements were evaluated as a function of the fuel consumption. Energy requirement for all tillage systems after rice is higher than after corn. This trend might be due to the highest soil humidity after rice is an uncourageous factor for blocky structure with sticky aggregates.

Table (3) showed also that, the arrangement of different seed bed preparation systems after both previous crop (maize, rice) according to the average values of fuel consumption (L/fed) and energy consumption (kW.h/fed) was found to be in the following descending order: chisel plough twice > chisel plough one pass followed by rotary plough > chisel plough (one pass) > rotary plough.

Soil penetration resistance :-

Data demonstrated in Table (3) showed that the effect of different seed bed preparation system and previous crop kind on soil penetration resistance.

The results indicated that the application of tillage treatments cause lower soil penetration values.

Table (3): Effect of different seed bed preparation system and previous crop kind on soil penetration resistance as well as fuel, power and energy consumption (over both seasons).

Previous crop	operation	Fuel cons., (L/h)	Fuel cons., (L/fed)	Power, (kW)	Energy, (kW.h/fed)	Soil penetration resistance, (MPa)
Maize	Chisel plow 1st pass (T_2)	6.20	5.90	19.84	18.90	2.04
	Chisel plow 2nd pass	6.35	5.20	20.32	16.66	
	Chisel plow twice (T_1)		11.10		35.56	2.14
	Rotary plow 1st pass (T_3)	5.55	5.72	17.76	18.31	1.95
	Rotary plow after chisel plow	5.10	4.55	16.32	14.57	
	Chisel plow 1st pass + rotary plow (T_4)		10.45		33.47	1.78
	No tillage (T_5)					2.76
Rice	Chisel plow 1st pass (T_2)	8.35	8.88	26.72	28.43	2.21
	Chisel plow 2nd pass	7 80	7.09	24.96	22.69	
	Chisel plow twice (T_1)		15.97		51.12	2.28
	Rotary plow 1st pass (T_3)	8.50	10.12	27.20	32.38	2.03
	Rotary plow after chisel plow	6.89	7.49	22.05	23.97	
	Chisel plow 1st pass + rotary plow (T_4)		16.37		52.40	1.75
	No tillage (T_5)					3.19

The effect of different seed bed preparation systems on decreasing the values of penetration resistance can be arranged in the following descending order :

$$T_4 > T_3 > T_2 > T_1$$

Effects on yield and yield components :-

Effect of previous crop ©:

Data in tables (4, 5 and 6) indicated that, previous crop significantly affected in all characters under study, except seed oil percentage. Growing flax after corn (C_1) significantly increased most of fiber yield and its components i.e, plant height, technical stem length, straw yield/feddan, fiber yield/plant and fiber yield/feddan, also most of quality characters i.e, fiber length, fiber percentage and fiber fineness increased. This trend might be due to the highest residual nitrogen in soil and good soil texture after corn which increasing flax growth and yield, on the other hand, high soil humidity after rice is an encourageous factor for blocky structure with sticky aggregates which is undesirable for emergence, root and plant growth, it produced a little number of plants in m^2 which increased stem diameter, the weight of individual plant (straw yield/plant) and all of seed yield and its components i.e. number of capsules/plant, seed index (weight of 1000 seed), seed yield/plant and seed yield/feddan.

Effect of tillage systems (T):

Results in tables (4, 5 and 6) showed that, plant height, technical length, straw yield/feddan, fiber yield/plant, fiber yield/feddan, fiber length and fiber fineness were significantly increased by using chisel plough once followed by rotary plough (t_4) followed by chisel plough two passes (t_1), rotary plough (t_3), chisel plough one pass (t_2) and no tillage (t_5) respectively. Stem diameter, straw yield/plant, number of capsules/plant, seed yield/plant and seed yield/feddan gave the highest values by using no tillage (t_5) compared with the other tillage systems. On the other hand, seed index, fiber percentage and seed oil percentage insignificantly affected by tillage systems.

Effect of seeding rates (S):

Results in tables (4, 5 and 6) showed that, increasing seeding rates from 70 to 80 and 90 kg seeds/feddan increased significantly plant height, technical length, straw yield/feddan, fiber yield/plant, fiber yield/feddan, fiber length and fiber fineness. This trend might be due to the high competition and consequently flax plants tended to elongate searching for light which increase fiber length. On the other hand, stem diameter, straw yield/plant, number of capsules/plant, seed yield/plant and seed yield/feddan gave the highest values when sowing flax with 70 kg seeds/feddan. This trend might be due to decreasing number of plants/m^2 which increases the competition among flax plants for water, light and nutrients. This competition leads in a marked reduction in stem diameter, straw yield/plant and number of capsules/plant which increase seed yield/plant and seed yield/feddan. These results agree with those of *El-Gazzar and Abou-Zaid (2001)* .

T4-5-6

Table (4): Fiber yield and its components

variables	Previous crop		Sig.	L.S.D	Tillage system					Sig.	L.S.D	Seeding rate			Sig.	L.S.D	Interaction			
	C_1	C_2			T_1	T_2	T_3	T_4	T_5			S_1	S_2	S_3			C.T	C.S	T.S	C.T.S
Plant height (cm)	89.3	80.2	**	1.71	86.2	84.3	85	86.8	83.7	**	0.1	80.3	84.8	89.7	**	0.71	N.S	**	**	N.S
Technical length (cm)	79.4	74	**	1.12	77.3	75.9	76.8	78.5	74	**	0.11	72.8	77.1	79.6	**	0.61	N.S	**	*	N.S
Stem diameter(mm)	1.17	1.48	**	0.07	1.28	1.36	1.32	1.25	1.39	**	0.01	1.4	1.36	1.2	**	0.02	**	**	N.S	N.S
Straw yield/plant(gm)	1.14	1.32	**	0.03	1.07	1.41	1.12	1.02	1.53	**	0.02	1.38	1.24	1.07	**	0.05	N.S	**	N.S	N.S
Straw yield/fed(ton)	3.01	2.962	**	0.087	3.241	2.857	2.98	3.36	2.482	**	0.041	2.79	2.881	3.277	**	0.053	**	**	**	N.S
Fiber yield/plant(gm)	0.23	0.2	**	0.01	0.24	0.19	0.21	0.26	0.17	**	0.042	0.19	0.21	0.23	**	0.01	N.S	**	N.S	N.S
Fiber yield/fed(kg)	458	421	**	0.009	456	421	435	476	416	**	0.092	396	438	486	**	0.013	**	**	**	N.S

Table (5): Seed yield and its components

variables	Previous crop		Sig.	L.S.D	Tillage system					Sig.	L.S.D	Seeding rate			Sig.	L.S.D	Interaction			
	C_1	C_2			T_1	T_2	T_3	T_4	T_5			S_1	S_2	S_3			C.T	C.S	T.S	C.T.S
Number of capsules/plant	5.4	6.3	**	0.37	5.4	6.6	5.9	4.6	6.8	**	0.2	7.1	5.7	4.6	**	0.31	*	N.S	N.S	N.S
Seed index	9.79	10.11	*	0.1	9.85	9.9	9.89	9.84	10.27	N.S	N.S	10.1	9.95	9.8	N.S	N.S	N.S	N.S	N.S	N.S
Seed yield/plant(gm)	0.38	0.48	**	0.03	0.41	0.43	0.4	0.36	0.45	*	0.01	0.51	0.43	0.35	*	0.07	*	N.S	N.S	N.S
Seed yield/fed(kg)	611.8	627.7	**	2.3	607.8	631.7	617.2	599.3	640.8	*	0.4	651.7	620.1	588.5	**	11.7	*	N.S	N.S	N.S

Table (6): Quality characters

variables	Previous crop		Sig.	L.S.D	Tillage system					Sig.	L.S.D	Seeding rate			Sig.	L.S.D	Interaction			
	C_1	C_2			T_1	T_2	T_3	T_4	T_5			S_1	S_2	S_3			C.T	C.S	T.S	C.T.S
Fiber length(cm)	70.9	64.8	**	1.9	68.9	66.9	67.7	79.8	65.8	**	0.07	64.1	68.5	72.1	**	0.14	N.S	N.S	N.S	N.S
Fiber percentage %	14.55	14.01	**	0.28	14.41	14.12	14.28	14.47	14.11	N.S	N.S	14.15	14.28	14.41	N.S	N.S	N.S	N.S	N.S	N.S
Fiber fineness (Nm)	185.1	170.9	**	7.4	181.4	175.1	178	183.6	71.9	**	0.2	102.6	176	179.4	**	1.31	*	*	*	N.S
Seed oil percentage %	39.05	38.91	N.S	N.S	39.27	38.48	39.96	39.32	38.67	N.S	N.S	39.11	38.98	38.85	N.S	N.S	N.S	N.S	N.S	N.S

The interaction effects:

Table (7) indicated that, the interaction between previous crop and tillage system had a significant effect on stem diameter, straw yield/feddan, fiber fineness, number of capsules/plant, seed yield/plant and seed yield/feddan. The highest values of stem diameter, number of capsules/plant, seed yield/plant and seed yield/feddan were achieved by sowing flax after rice with no tillage (t_5) system, while sowing flax after corn with chisel plough once followed by rotary plough (t_4) recorded the lowest values of these characters.

Data in table (7) showed also the interaction between previous crop and tillage systems had a significant effect on straw yield/feddan, fiber yield/feddan and fiber fineness. The highest values of straw yield/feddan, fiber yield/feddan and fiber fineness were achieved by sowing flax after corn with chisel plough once followed by rotary plough (t_4), while sowing flax after rice with no tillage record the lowest values of these characters.

Table (7): Effect of interaction between previous crop and tillage systems on yield components

variables	C	T					L.S.D
		T_1	T_2	T_3	T_4	T_5	
Stem diameter (mm)	C_1	1.23	1.27	1.25	1.21	1.28	0.01
	C_2	1.38	1.42	1.40	1.37	1.44	0.01
Straw yield/fed (ton)	C_1	3.126	2.934	2.995	3.185	2.746	0.017
	C_2	3.102	2.910	2.971	3.161	2.722	0.023
Fiber yield/fed (kg)	C_1	457	440	447	467	437	2.1
	C_2	439	421	428	449	419	1.5
Fiber fineness (Nm)	C_1	183.3	180.1	181.6	184.4	178.5	0.61
	C_2	172.2	173.0	174.5	177.3	171.4	0.57
Number of capsules/plant	C_1	5.4	6.0	5.7	5.0	6.1	0.13
	C_2	5.9	6.5	6.1	5.5	6.6	0.11
Seed yield/plant(gm)	C_1	0.40	0.41	0.39	0.37	0.42	0.01
	C_2	0.45	0.46	0.44	0.42	0.47	0.01
Seed yield/fed (kg)	C_1	609.8	616.8	614.5	605.6	626.3	0.12
	C_2	617.8	624.7	622.5	613.5	634.3	0.11

C: Previous crop. T: Tillage systems.

Data in table (8) indicated that, the interaction between previous crop and seeding rates had a significant effect on plant height, technical length, stem diameter, straw yield/feddan, fiber yield/plant, fiber yield/feddan, fiber fineness. Sowing flax after corn with 90 kg seed/feddan recorded the highest values of plant height, technical length, straw yield/feddan, fiber yield/feddan, fiber fineness, while sowing after rice with 70 kg seed/feddan produced the highest values of stem diameter, while the lowest on of stem diameter produced by sowing flax after corn with 90 kg/feddan. It means that, the soil after corn was better than after rice which produced high values of germination ratio particularly when growing flax with 90 kg seed/feddan which gave the highest yields of straw and fiber.

Table (8):Effect of interaction between previous crop and seeding rates on yield components

Interaction between C&S variables	C	S			L.S.D
		S_1	S_2	S_3	
Plant height (cm)	C_1	84.8	87.1	89.5	0.14
	C_2	80.2	82.5	85.0	0.16
Technical length (cm)	C_1	76.1	78.3	79.5	0.21
	C_2	73.4	75.6	76.8	0.24
Stem diameter (mm)	C_1	1.29	1.26	1.19	0.01
	C_2	1.44	1.42	1.34	0.01
Straw yield/fed (ton)	C_1	2.900	2.946	3.144	0.04
	C_2	2.876	2.922	3.120	0.03
Fiber yield/plant(gm)	C_1	0.21	0.22	0.23	0.01
	C_2	0.19	0.20	0.21	0.01
Fiber yield/fed (kg)	C_1	427	448	472	0.013
	C_2	409	429	454	0.012
Fiber fineness (Nm)	C_1	176.9	180.6	182.3	1.31
	C_2	169.8	173.5	175.2	1.18

C: Previous crop. **S: Seeding rates.**

Data in table (9) indicated that, the interaction between tillage system and seeding rate had a significant effect on plant height, technical length, straw yield/feddan and fiber fineness. Growing flax by 90 kg/feddan seed bed preparation of chisel plough once followed by rotary plough produced the highest values of all these characters, while growing flax by 70 kg seed/feddan with no tillage produced the lowest values of these characters. It means that, the good seed bed preparation gave the highest values of germination ratio which produced a high yield of straw and fiber when sowing flax with 90 kg seed/feddan.

Table (9): Effect of interaction between tillage systems and seeding rates on yield components.

Variables		T_1	T_2	T_3	T_4	T_5	L.S.D
Plant height (cm)	S_1	83.1	82.3	82.7	83.6	82.0	0.01
	S_2	85.5	84.6	84.9	85.8	84.3	0.05
	S_3	88.0	87.0	87.4	88.3	86.7	0.03
Technical length (cm)	S_1	75.0	74.4	74.8	75.7	73.4	0.02
	S_2	77.2	76.5	77.0	77.8	77.8	0.04
	S_3	78.5	77.8	78.2	79.1	76.8	0.02
Straw yield/fed (ton)	S_1	3.016	2.824	2.885	3.075	2.636	0.031
	S_2	3.061	2.869	2.931	3.121	2.682	0.019
	S_3	3.259	3.067	3.129	3.319	2.880	0.025
Fiber yield/fed (kg)	S_1	426	409	416	436	406	1.01
	S_2	447	430	437	457	421	1.00
	S_3	471	454	461	481	451	1.02
Fiber fineness (Nm)	S_1	172.0	168.9	170.3	173.1	167.3	0.31
	S_2	178.7	175.6	177.0	179.8	174.0	0.40
	S_3	180.4	177.3	178.7	181.5	175.7	0.24

Water requirements (Cu) and water use efficiency (WUE):

Data in table (10) showed that, all seed bed preparation system treatments led to increase in water consumption (Cu) at both previous crop compared with the control (no tillage treatment). While water use efficiency (WUE) take the opposite trend where the different tillage treatments significantly increased.

Table (10): Water consumption use (Cu) m^3/fed for different seed bed preparation systems

Previous crop	Seed bed preparation method	Irrigation No.				Total
		1	2	3	4	
Maize	A	560.0	441.2	460.3	436.6	1898.1
	B	531.4	421.3	440.0	430.0	1822.7
	C	500.8	390.2	402.8	395.3	1689.1
	D	508.6	408.6	423.1	418.6	1758.9
	E	429.5	332.0	375.0	350.0	1479.5
Rice	A	481.30	350.70	362.7	353.6	1548.30
	B	418.35	315.60	335.0	325.0	1393.95
	C	412.60	293.50	313.0	297.0	1316.10
	D	419.20	302.10	322.0	313.0	1356.30
	E	405.05	278.16	267.0	220.0	1170.21

A, B, C, D and E are as in table (1).

Results revealed high significant effects for seed bed preparation system on the applied water. The largest amount of the applied water for flax crop was 1898.1 m^3/fed using chisel plough (twice) at maize previous crop. While the smallest amount of the applied water was about 1270.2 m^3/fed for no tillage treatment at rice previous crop.Seed bed preparation system had a highly significant effect on water use efficiency for both previous crops.Fig. (2).

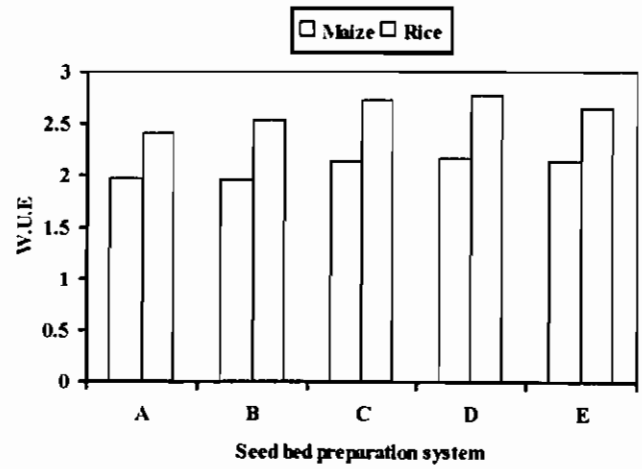


Fig. (2): Effect of different seed bed preparation systems on W.U.E, yield components of flax crop

The highest values of water use efficiency (2.16 and 2.78 kg/m^3) were obtained using chisel plough followed by rotary plough when the previous crop was corn and rice, respectively. The primary reason for increased efficiency was due to increase seed and straw yield and decrease water requirements.

Conclusion

In conclusion the results of the present investigation indicated that the use of chisel plough 1st pass followed by rotary plough at sowing rate 90 kg seed/fed proved to the most suitable treatment for best straw and seed production when the previous crop was rice. While using chisel plough two passes at sowing rate 80 kg seed/fed proved to the most suitable treatment for best straw and seed production when the previous crop was maize.
The flax yield and its water consumption were influenced by different tillage systems (chisel plough twice, chisel plough one pass, chisel plough one pass followed by rotary plow, rotary plow and no tillage).

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تأثير نظم اعداد مرقد البذرة والمحصول السابق ومعدلات التقاوي على استهلاك الماء وانتاجية محصول الكتان

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١. معهد بحوث المحاصيل الحقلية.

٢. معهد بحوث الهندسة الزراعية.

محصول الكتان يعتبر ثاني محاصيل الألياف في العالم بعد القطن من حيث المساحة المنزرعة وثالثها بعد القطن من حيث الانتاج العالمي وترتيبه الرابع بين محاصيل الزيوت البذرية بعد القطن وفول الصويا والفول السوداني . ويهدف البحث لدراسة تأثير المحصول السابق (ذرة - أرز) وطريقة اعداد مرقد البذرة (المحراث الحفار وجهين – المحراث الحفار وجه واحد – المحراث الدوراني – المحراث الحفار وجه واحد يعقبه محراث دوراني – بدون حرث). وثلاث معدلات تقاوي (٧٠ – ٨٠ – ٩٠ كجم/فدان) على الاحتياجات المائية وكفاءة استهلاك المياه وانتاجية محصول الكتان.

وكانت أهم النتائج المتحصل عليها:

١-وجد أن معدل ظهور البادرات عند استخدام المحراث الحفار وجه واحد يعقبه محراث دوراني أعلى منها في باقي معاملات اعداد مرقد البذرة المستخدمة. وكانت أفضل نسبة ظهور البادرات هى ٩٩,٤ ٪ عندما كان المحصول السابق ذرة ومعدل تقاوي ٩٠ كجم/فدان. وأقل نسبة ظهور البادرات ٨٢,٣ ٪ باستخدام المحراث الدوراني وجه واحد عندما كان المحصول السابق أرز ومعدل تقاوي ٧٠ كجم/فدان.

٢-بلغت أقصى احتياجات مائية لمحصول الكتان عقب محصول الذرة ١٨٩٨,١ م٣/ف وذلك باستخدام معاملة الحرث بالمحراث الحفار (مرتين) بينما بلغت أقل احتياجات مائية عقب محصول الأرز ١٢٧٠,٢١ م٣/ف باستخدام معاملة (بدون حرث). وكانت أعلى كفاءة في استخدام المياه (٢,١٦ ، ٢,٧٨ كجم / م٣) باستخدام المحراث الحفار يعقبه محراث دوراني عندما كان المحصول السابق ذرة وارز على التوالي .

٣-زراعة الكتان بعد محصول الذرة الشامية أعطى أعلى انتاجية من محصول الألياف ٤٥٦ كجم/ف.

٤-كان للتفاعل بين عوامل الدراسة الثلاث تأثيرا معنويا على معظم الصفات المدروسة ويمكن التوصية باستخدام المحراث الحفار وجهين مع معدل تقاوي ٨٠ كجم/فدان اذا كان المحصول السابق ذرة واستخدام طريقة الحرث (محراث حفار وجه واحد يعقبه محراث دوراني) ومعدل تقاوي ٩٠ كجم/ف اذا كان المحصول السابق أرز وذلك للحصول على أعلى محصول من القش والبذور.