A STUDY ON THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE PRODUCTIVITY OF SOME FLAX VARIETIES

BY

MAYSA SAID ABD-AL-SADEK AHMAD

B.Sc. Agronomy, Fac. Agric. Cairo Univ. 1994

THESIS
Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE
IN
AGRONOMY

Department of Agronomy and Agricultural Mechanization
Faculty of Agriculture at Moshtohor Zagazig Univ.
(Banha Branch)

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INTRODUCTION

Flax (*Linum usitatissimum L.*) is one of the ancient grown crops in several regions of the world for both fiber and seed production. In Egypt, it ranked first as a bast fiber crop in relation to its cultivated area annually and importance. Flax plays a great role in the national economy in terms of increasing fiber exportation. It is necessary now to increase flax productivity from the relatively limited cultivated area which recorded about 30000 faddans in 1996/97 season. Thereby, this area must reach about 70000 faddans annually to cover the great gap between flax seed oil production and local consumption, where Egypt imports about 50 % of its local consumption from foreign countries.

Flax seed oil is considered the best dry oil used for painting and in different artificial products and in medicine purposes. The increase of flax seed and fiber could be achieved by growing promising genotypes characterized by high yielding ability or by improving agricultural treatments such as sowing dates and plant density (seeding rate).

The main adjectives of the present investigation are to study the effect of sowing dates and plant density as two important factors influencing environmental conditions on two flax varieties i.e., Giza 8 and Iriana. The effect of these two factors on the yield, yield components and quality of both seeds and fibers of the tested varieties are considered. These two varieties include a dual purpose variety represented by Giza8 and a fiber type represented by Iriana.

REVIEW OF LITERATURE

The review of literature of this study is classified according to the three studied factors i.e., varietal differences, sowing dates and plant density.

A. Varietal differences:

Spratt et al., (1963), reported that the highest number of capsules per plant was recorded with Kocket, Morine and Raja. Red wood had one seed per capsule more than Kocket and yielded more.

Gupta et al., (1964), found that great differences in straw yield components among varieties. The results showed that the highest seed yield and oil percentage were obtained by K_2 cv when they compared with 15 oil seed flax varieties.

Hermant (1966), reported that B_{42} and Reina cvs gave high production, whereas, B_{42} cv was the highest in straw and seed yields of flax.

Kumar and Singh (1967), showed that C.L.1426 variety had highest seed yield per plant and number of seeds per capsule, while C.I.378 variety had the heaviest weight of 1000 seeds.

Remussi et al., (1967), reported that many varieties of oil seed flax were different in 1000-seed weight. They added that this character was influenced mainly by variety. Oil content was also found to vary with variety.

Yousef (1968), found that the mean value of technical length for Giza 4 flax cv was 86.10 cm and seed yield per plant for the same variety was 0.284 g.

Al-Shamma and El-Hassan (1969), in Iraq, reported that Morocan 50 cv gave the highest percentage of oil (38.9-43.7%).

Vasilica (1976), found that fiber yields ranged from 646 kg/ha with Wiera to 1.07 t/ha with Primo and he noticed that seed yield ranged from 762 kg/ha with Fibra to 427 kg/ha with Wiera, when he compared 10 fiber flax varieties.

Momtaz et al., (1977), evaluated 36 oil seed flax varieties introduced from USA . They found that the most promising introduction was No.1049, yielding 1.76 g seed per plant and surpassed the remaining ones in this case.

Robles (1979), in Mexico, noticed that seed yield ranged from 2.27 t/ha with Guaycum cv to 3.34 t/ha with Alcorta cv and seed oil content ranged from 25.8% with Pavano cv to 36.6% with Buena cv when he evaluated 16 varieties of oil seed flax in varietal trail.

Momtaz et al., (1980), reported that Giza 5 and Giza 6 varieties have significantly higher straw yield than Giza 4 while Giza 6 has a significantly higher seed index (1000-seed weight) and seed yield than Giza 5 and Giza 4. They also found that Giza 5 had significantly higher fiber yield than the commercial variety Giza 4.

El-Farouk et al., (1982), indicated that Giza 6 was superior to Giza 5 in growth characters in terms of plant height, technical length, stem diameter and top branching zone length and outyielded Giza 5 in

seed, straw and fiber production. Fibers of Giza 5 were longer and finer than those of Giza 6.

El-Kalla and El-Kassaby (1982), compared some of flax varieties i.e., Iriana, Giza 4, Giza 5 and Giza 6 and found that Iriana fiber variety surpassed the other three local varieties i.e., Giza 4, Giza 5 and Giza 6 in plant height, technical stem length, and long fiber percentage, while Giza 6 variety produced the highest seed yield per faddan.

Abd-El-Raouf et al., (1983), evaluated 6 flax cvs and found that Hera cv produced the highest total fiber yield (521 kg/fad)

Salama (1983), found that flax variety Giza 5 outyielded Giza 6 in plant height, technical length, straw and fiber yields per faddan and fiber length. On the other hand, Giza 6 surpassed Giza 5 in seed and oil yields per faddan, number of capsules per plant, seed index, oil percentage and fiber fineness.

El-Kady (1985), reported that flax variety Giza 5 exceeded Giza 6 in technical stem length and fiber yield per plant. On the contrary, length of top branching zone, stem diameter, seed yield per plant, number of capsules per plant and seed index (1000-seed weight) in Giza 6 were higher than those obtained by Giza 5.

Hella et al., (1986), evaluated three flax varieties Giza 5, Giza 6 and Regeina in regard to flax yield and its components. They found that Regeina produced the highest values of technical stem length, stem diameter, straw yield per plant as well as per faddan, fiber length and fiber fineness.

El-Kady et al., (1988), evaluated three flax genotypes i.e., Belinka, Giza 5 and Fam. 2419/1. They found that Fam.2419/1 outyielded the other cultivars for straw yield per faddan, yield of seeds and seed index. However, Belinka variety surpassed the other cvs for technical length , fiber yield per faddan, fiber length and fiber fineness.

Salama (1988), evaluated three flax cultivars i.e., Giza 5, Giza 6 and Belinka. He found that Belinka variety surpassed Giza 6 in technical stem length and number of basal branches per plant, while Giza 6 had higher values of upper branching zone length, main stem diameter, straw yield per plant, number of capsules per plant, number of seeds per capsule, number of seeds per plant, seed index, seed yield per plant and seed yield per faddan, as compared with Giza 5 and Belinka. He also found that Belinka cv had higher values of fiber yield per plant and per faddan, fiber length, fiber percentage and fiber fineness.

Souror et al., (1988), compared some flax lines and Giza 5 cv. They found that families 193/1, 196/1, 2651/2, 237/1 and 2419/1 gave the highest values of technical stem length, straw yield per plant and fiber yield, while families 2419/1 and 2651/2 were higher values of number of capsules per plant, seed index and seed yield as compared with 193/1, 196/1 and 237/1 families. They also found that 2419/1 and 2651/2 families surpassed 193/1 in oil yield.

Hella et al., (1989), indicated that Giza 5 variety was higher in straw yield per plant as well as per faddan, number of capsules per plant, number of seeds per capsule, and number of seeds per plant than

Giza 6 variety while the latter was higher than Giza 5 variety in seed yield per plant, seed yield per faddan and seed index.

Momtaz et al., (1989), concluded that Giza 7 and Giza 8 flax varieties were significantly higher in straw yield per faddan, fiber yield per faddan, plant height, long fiber percentage, seed yield per faddan and seed index than the commercial variety Giza 5. In the same time, they observed significant differences between Giza 7 and Giza 8 for these mentioned characters in addition to oil percentage. On the other hand, means of seed yield per faddan, seed index and oil percentage for Giza 8 variety were higher than those of Giza 7 variety. They also noticed no significant differences between Giza 7 and the commercial variety Giza 5 in oil percentage, whereas Giza 8 variety was significantly higher in oil percentage than the commercial variety Giza 5.

El-Gazzar (1990), reported that Belinka variety had higher values in fiber percentage, fiber length, fiber yield per plant as well as per faddan and fiber fineness than the commercial variety Giza 5 and Fam. 2419/1 surpassed Belinka variety in oil content and oil yield per faddan.

Kineber (1991), compared eleven strains of flax with the commercial variety Giza 5 and found that S.193/1 significantly out-yielded Giza 5 by 27% with regard to straw yield per faddan and by 32% concerning fiber yield per faddan. He also found that technical stem length, straw yield per plant, fiber length and fiber fineness of S.193/1 were higher than in Giza 5. Also S.2561/1 surpassed the other strains in seed yield and its components i.e., number of capsules per

plant, seed yield per plant and seed yield per faddan followed by S. 162/12, S.2419/1 and S.2465/1.

El-Shimy et al., (1993), evaluated four flax genotypes. They found that significant differences among genotypes in all characters under study, where S. 162/12 ranked the first followed by Giza 5, S.2465/1 and S.2419/1 in relation to plant height, technical length, main stem diameter as well as straw and fiber yields per faddan. Meanwhile, Giza 5 variety was superior in number of capsules per plant and seed yield per faddan followed by S.162/12, S.2419/1 and S. 2465/1.

El-Sweify (1993), reported that Giza 7 flax variety recorded higher values of technical length, straw yield per plant and per faddan, fiber length, long fiber percentage and fiber fineness than S.2419/1. On the other hand, S.2419/1 was superior in main stem diameter, number of capsules per plant, seed yield per plant as well as per faddan, seed index, oil percentage and oil yield per faddan.

Mostafa (1994), evaluated 12 flax genotypes namely Giza 5 Giza 6, Giza 7, Giza 8, S.119/2, S.23/4, S.282/37/14/8, S.402/3/3/5, S.2465/1, S.2651/2, S.281/209/2/2 and S.329/5/3. He reported that there were significant differences between these genotypes where Giza 7 ranked first and was superior over the remaining genotypes in total plant height, technical stem length, straw yield per plant as well as per faddan and fiber yield per faddan.

El-Kady et al., (1995), evaluated six promising flax genotypes (S.355, S.342, Giza 7, Giza 8, S.2419 and S.297). They reported that S.341 was the best genotype in straw yield and its related characters,

El-Kilany et al., (1994), in Egypt, studied the effect of six sowing dates (on 10 th, 20 th and 30 th of October and 10 th, 20 th and 30 th November) on yield of flax. They concluded that the first three sowing dates gave higher straw yields than the later three ones.

Dixit et al., (1994), indicated that delaying sowing date after 25 Oct. decreased seed yield. They also found that seed yield was decreased by 75% when flax was sown on 15 Dec.

C. Plant density:

Nazif (1958), in Egypt, mentioned that the optimum rates of sowing per faddan for some varieties of flax were as follows: 80 kg for "Hinidi", 75 kg for Giza 4 and 60-65 kg for European types. He added that the very light rates of sowing did not give enough seed yields. Moreover, the straw produced in this case will be scarified owing to the extreme branching of the stems.

Garber (1960), found that the optimum seeding rate ranged from 150 to 160 kg/ha for fiber yield.

El-Hariri (1964), found that a high seeding rate of flax caused an increment in plant height. On the other hand, the seed yield/plant, number of capsules/plant and straw yield/plant at the low seeding rate exceeded those obtained from the highest one.

Horodyski and Sokolowski (1964), showed that the yield per unit area of flax straw increased with increasing seeding rate while the highest seed yield of flax occurred with the lowest rate.

Mokhtar (1965), in Egypt, reported that the seeding rate of 70-75 kg per faddan gave the best yields of straw, fiber and seeds per faddan.

El-Farouk (1968), found an increment in straw yield, seed yield/faddan and fiber percentage with increasing seeding rates up to 100 kg/faddan. Meanwhile, the reduction of seeding rate caused remarkable increases in stem diameter, number of capsules/plant, seed yield/plant, seed index and fiber fineness. He also concluded that the differences between the two seeding rates (60 and 80 kg/faddan) did not reach the level of significance.

El-Nakhlawy (1975), found that seed rate had a significant effect on total plant height, technical plant length, straw yield per faddan and seed yield per faddan. On the other hand, number of capsules per plant and oil percentage decreased with the increase of seed rate from 20 towards 50 kg/faddan.

Sin et al., (1975), noticed that stem yield per ha of fiber flax increased with increasing sowing density up to 2800 seeds/m^2, while seed oil of flax increased with increasing sowing density up to 1200 seeds/m^2.

El-Nakhlawy et al., (1978), studied the effect of four seeding rates on flax (20, 40, 60 and 80 kg/faddan). They mentioned that straw and seed yields per faddan increased by increasing plant density, while total and technical length/plant were slightly increased, but there was no significant difference in oil content between 20 and 40 kg/fad

Gad and El-Farouk (1978), found a significant effect of seeding rates on the total and technical plant length. There was an increase in both characters with increasing the seed rates, whereas number of capsules per plant decreased significantly with the increase of seed rate. The results revealed that the rate of 55 kg per faddan was the best seeding rates for seed, straw and fiber yields per faddan. In addition, fiber length increased with increasing the seed rate from 25 to 55 kg per faddan, whereas, the seeding rate of 70 kg per faddan gave the finest fibers. On the other hand, no definite effect was found for seeding rates on seed index and oil percentage.

Gubbeles (1978), indicated that seed yield and oil content were reduced with increasing sowing rate up to 1000 seeds/m^2.

Vasilica and Vasilica (1979), used two plant densities of 1000 and 3000 seeds/m^2 and obtained seed yields of 533 and 826 kg/ha, while fiber yields were 401 and 737 kg/ha, respectively.

Momtaz et al., (1980), indicated that flax variety Giza 6 was significantly higher in seed yield per faddan, seed index and oil percentage when seeding rate was 50 kg/faddan.

Momtaz et al., (1981), evaluated eight plant densities, namely, 250, 500, 750, 1000, 1250, 1500, 1750 and 2000 plants/m^2 for flax cv Giza 5. They found that there was an upward trend in the total and technical length per plant with increasing plant density, whereas stem diameter and number of capsules/plant significantly decreased with the increase in plant densities. The results also showed that 1500 plants/m^2 (60 kg/faddan) was the best plant density for straw, fiber yield/faddan and fiber percentage, while 2000 plants/m^2 (80kg/faddan) produced the highest mean fiber length and fiber fineness.

Zahran et al., (1984), studied the effect of six seeding rates (500, 1000, 1500, 2000, 2500 and 3000 seeds/m^2) on two flax cvs Giza 4 and Giza 5. They found that there was a downward trend between seeding rate and technical length, length of top capsule zone, straw and fiber yields per plant and stem diameter. While straw and fiber yields/faddan increased significantly as the seeding rate increased up to 2500 seeds/m^2. Seed yield and number of capsules/plant, seed index and oil seed percentage were decreased significantly as the plant population increased. On the other hand, positive relationship was observed between seed yield/faddan and seeding rate from 500 up to 1500 seeds/m^2 and the highest seed yield/faddan was obtained from 2000 seeds/m^2.

Guleria and Singh (1985), found that the highest fiber and seed yields were obtained with a seeding rate of 60 kg/ha

El-Shimy et al., (1985), found that a highly significant differences due to seeding rates. Technical length, straw yield/faddan, fiber length, fiber fineness and seed yield/faddan were increased with increasing seeding rate up to 60 kg/faddan. On the other hand, a rate of 40 kg/faddan caused a remarkable increase in main stem diameter, straw yield/plant and number of capsules/plant.

Hella et al., (1986), noticed that a significant effect of seeding rates on the stem diameter, straw yield/plant, fiber length, fiber fineness, seed yield/faddan and oil percentage. In addition, the technical length and the straw yield/faddan were increased with increasing the seed rate from 40 to 50 kg/faddan, whereas the seeding rate of 60 kg/faddan gave the longest and finest fibers. No significant effects on number of capsules and seed yield per plant were recorded between the two seeding rates of 50 and 60 kg/faddan.

Popa (1986), reported that increasing plant density to 1000 seeds/m^2 gave the highest value of straw and seed yield of flax.

Hassan and El-Farouk (1987), indicated that 35 kg seeds/faddan was the best rate for high fiber length in Belinka and Giza 6 varieties. Differential response concerning flax yield per faddan was observed and 50 kg/fad was the best for Giza 6 variety. Significant increases in fineness were detected by increasing seed rate up to 50 kg for Belinka and 65 kg for Giza 6. Whereas, the reverse was true for seed index for Belinka variety only.

Salama (1988), indicated that there was gradual increase of plant height, technical length, upper branching zone length, straw yield/faddan, seed yield/faddan, fiber yield/faddan, fiber length, fiber fineness, long fiber percentage and oil yield per faddan when seeding rate increased. On the other hand, there was a decrease in main stem diameter, straw yield/plant, number of capsules/plant, seed yield/plant, seed index and oil percentage with increasing seeding rates from 30 to 70 kg/faddan.

Abd-Alla et el., (1989), stated that increasing seeding rate of flax Giza 6 or Belinka cvs from 35 to 65 kg/faddan resulted in an insignificant increase in total plant height by 9.5% and each of fiber length and fiber fineness by 9.3 and 9.81%, respectively. Whereas flowering zone length, stem diameter, capsules number/plant, seeds number/plant, straw yield/plant and seed yield/plant significantly decreased by 17.0, 8.4, 19.2, 16.6, 22.4 and 19.0%, respectively. They added that increasing seeding rates slightly decreased oil percentage of seeds.

Kwon et al., (1988), found that increasing plant density from 100 up to 1200 seeds/m^2 increased plant height, oil percentage and straw and seed yield. They concluded that the optimum seeding rate was 600 seeds/m^2.

Khalil (1990), found that straw yield of flax increased significantly by 7.9% and 13.1% while fiber yield increased by 16.0% and 35.3% when seeding rate was 70 and 90 kg/faddan, respectively. On the other hand, oil percentage significantly decreased by 0.17% and 0.50% when plant density increased to 70 or 90 kg/faddan, respectively.

Mostafa (1990), found that the highest seed rate increased the total length, technical length, upper branching zone length, straw yield per faddan, fiber yield per faddan, long fiber percentage, fiber length and fiber fineness. He also concluded that flax seed yield per faddan, seed oil percentage and oil yield per faddan were not affected by variation in seed rate from 30 to 60 kg/faddan, whereas straw yield per plant, number of capsules per plant and seed yield per plant were decreased by increasing seed rates.

Subotinas (1991), found that the best plant density was 20 million plants per hectare to produce highest fiber and seed yields.

Bassi and Badiyala (1992), found that sowing rates of 60, 80 and 100 kg/ha gave mean fiber yields of 434, 572 and 606 kg/ha and seed yields of 573, 780 and 931 kg/ha, respectively.

Dolgikh (1992), showed that the long fiber percentage was decreased with the increase of seeding rates from 25 up to 35 million seeds/ha.

Easson and Long (1992), found that the plant height, fiber stem diameter and fiber length decreased with higher sowing rates. Moreover, they added that the optimum plant density was 1800 plants/m^2.

Freer (1992), found that number of capsules per plant and seed yield per plant decreased with increasing plant density when flax was grown at 233-723 plants/m^2.

El-Shimy et al., (1993), indicated that there was a gradual increase in plant height, technical length, straw yield/faddan, fiber yield/faddan, long fiber percentage, oil yield/faddan and fiber length with increasing seeding rate. On the contrary, there was remarkable reduction in main stem diameter, straw yield/plant, number of capsules/plant, seed yield/plant, seed index and oil percentage with increasing seeding rates.

El-Sweify (1993), concluded that increasing plant density from 750 to 1000, 1250, 1750 and 2000 seeds/m^2 increased plant height, technical length, straw yield/faddan, fiber yield/faddan, long fiber percentage, oil yield/faddan, fiber length and fiber fineness. On the other hand, there was a reduction in the main stem diameter, straw yield/plant, number of capsules/plant, seed yield/plant, seed index and oil percentage with increasing plant density from 750 up to 2000 seeds/m^2.

Mahmoud (1993), found that the highest seed rate increased the total length, technical length, straw yield per faddan, fiber yield per faddan, long fiber percentage, seed yield per faddan, oil yield per faddan, fiber length and fiber fineness. Whereas, straw yield/plant, seed yield/plant and number of capsules/plant were decreased by increasing seed rates, while there was no significant effect on seed index and oil percentage.

Nada (1995), noticed that significant differences were recorded due to seeding rate with each of the following characters, i.e., plant height, technical length, straw yield/faddan, seed yield/faddan, oil yield/faddan, long fiber percentage and fiber fineness. These above mentioned traits were increased with increasing seeding rates up to 60 kg/faddan. On the contrary, a rate of 40 kg/faddan caused an increase in main stem diameter, straw yield/plant and seed yield/plant. She also found no significant effect of seeding rate on number of capsules per plant.

Amany El-Refaie (1996), found significant increases in plant height, technical length, straw yield per faddan, fiber yield per faddan, upper branching zone length, seed yield per faddan, oil yield per faddan, long fiber percentage and fiber fineness with increasing seeding rate. On the other hand, main stem diameter, number of capsules per plant, seed yield per plant and seed index decreased by increasing seeding rate, while oil percentage was not significantly affected.

MATERIALS AND METHODS

The present investigation was carried out at Gemmiza two successive seasons 1995/ 1996 and 1996/1997 to study the effect of sowing dates and plant density on flax yield and its components in addition to fiber and seed quality of two flax varieties i.e the newly commercial variety, Giza8 and the imported one Iriana which represented a dual purpose and fiber types , respectively. The description and general characteristic of the two tested varieties are given as follows :-

Giza 8:-

A dual purpose variety . it is selected from a cross between Giza 6 and Santa Catalina 6, an introduction from USA, it is high yielding in fiber and seeds with high oil content . At present time it covers great area of flax .

Iriana :-

A fiber flax type , imported from Holland , its flower is white in colour and of medium size .

Two field trials were undertaken at two successive seasons . The soil of the experimental site was silty clay in texture . The mechanical and chemical analysis of experimental soil are given in Table 1.

Table (1):- Mechanical and chemical analysis of the experimental soil (60cm soil depth) in the two growing seasons

Variables	Seasons	
	Mechanical analysis	
	1995/96	**1996/97**
Sand %	20.81	16.64
Silt %	32.47	35.10
Clay %	45.72	47.73
Error	1.00	0.53
Chemical Analysis		
Available N ppm	38.20	40.60
Available P ppm	19.30	13.20
Available K ppm	351	321
Calcium Carbonate %	3.61	3.88
Cl mequ/l.	3.60	3.20
HCo3	4.32	4.89
Ca^{++}	3.30	2.10
Mg^{++}	3.80	2.70
Na^{++}	3.20	4.20
SO_4^{-}	0.81	0.42
EC mmohs/cm	1.12	1.03
S.A.R %	1.87	2.04
S.S.P %	28.00	37

s was used for each trial. The main plots were randomly assigned to the two flax

varieties namely Giza 8 and Iriana, the sub-plots to sowing dates (25 Oct., 15 Nov. and 5 Dec.) and the sub-sub plots to the three plant densities i.e., 1125, 1500 and 1875 seeds/m^2 which represent the seeding rates of 45, 60 and 75 kg/fad , for Giza 8 cv and 24, 32 and 40 kg/fad , for Iriana cv. The sub sub-plot area was 6 m^2 (2 x 3m) or 1/700 faddan. Flax seeds of the two varieties were sown broadcast before irrigation.

Characters studied:

At full maturity, ten guarded plants were chosen at random from each sub-sub plot to be used in the studies of the morphological characters of flax. Flax yields for straw, seeds and fiber per faddan were calculated on the whole sub-sub plot area basis.

I. Straw Yield and its Related Characters:

1. Plant height (cm): measured from the cotyledonary node to the apical bud of each plant.

2. Technical stem length (cm): measured from the cotyledonary node to the first apical branch of the main stem.

3. Main stem diameter (mm): measured at the middle region of the main stem to the nearest 0.1mm.

4. Straw yield / plant(g): estimated as the total weight in grams of the air dried straw per plant after removing the capsules.

5. Straw yield /faddan (tons): estimated on the whole sub-sub plot area basis.

6. Fiber yield / faddan (kg): estimated on the whole sub-sub plot area basis.

II. Seed Yield and its Related Characters:

1. Number of capsules / plant.

2. Number of seeds / capsule.

3. Upper branching zone length (cm).

4. Seed yield / plant (g): as the total weight of the seeds per plant to the nearest 0.01gram.

5. Seed yield / faddan (kg): estimated on the whole sub-sub plot area basis.

6. Seed index (g): weight of 1000 seeds in grams.

III. Technological Characters:

1. Fiber length (cm).

2. Long fiber percentage: calculated according to the following formula:

$$\text{Long fiber \%} = \frac{\text{Long fiber yield/fad}}{\text{Straw yield/fad}} \times 100$$

3. Fiber fineness (Nm): in metrical number which was determined by using Radwan and Momtaz method (1966) according to the following formula:

$$Nm = \frac{N \times L}{G}$$

Where: Nm = metrical number.

N = number of fibers (20 fibers).

L = length of fiber in cm .

G = weight of fibers in mg.

4. Oil percentage, determined according to the method described by Horwits et al., (1965) using Soxhlet apparatus.

Statistical analysis:

Statistical analysis was carried out according to Snedecor and Cochran (1980).

Mean values were compared at 0.05 level of probability using the L.S.D. test of significance.

RESULTS AND DISCUSSION

I - Straw Yield And Its Related Characters :

1- Plant height :

Mean values of plant height as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 - 1996 and 1996 -1997 are presented in Table (2) .

Analysis of variance indicated significant differences between the two flax varieties i.e Giza8 and Iriana as well as due to sowing dates and plant density treatments in both seasons.

Regarding flax varieties, results reveal that the imported Iriana variety was superior over Giza8 in relation to total plant height character in both seasons. The mean values obtained by Iriana cv were 94.25 cm in the first season and 107.82 cm in the second one when compared with the shorter flax plants obtained by Giza8 which recorded 77.92 and 91.53 cm in the two successive seasons, respectively . These results which appeared as varietal differences are due to the genetical make up for each flax genotype.

The above mentioned data agreed with those obtained by Yousef (1968), El-Farouk et al, (1982), El-Kalla and El-Kassaby, (1982), Salama, (1983), Momtaz et al, (1989), El-Shimy et al, (1993), Sharief, (1993), Moawed (1996) Abou Zaied(1997) and El- Shimy et al, (1997).

Table(2): Mean values of plant height (cm) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	78.57	80.57	83.37	80.84	90.33	95.97	98.61	94.97
	15 Nov.	76.07	78.75	79.12	77.98	87.96	91.57	95.77	91.77
	5 Dec.	73.92	74.92	75.97	74.94	85.27	87.57	90.74	87.86
Mean		76.19	78.08	79.49	77.92	87.85	91.70	95.04	91.53
Iriana	25 Oct.	94.90	98.30	101.85	98.35	103.64	111.49	117.25	110.79
	15 Nov.	89.25	93.55	99.30	94.03	102.27	108.54	116.93	109.26
	5 Dec.	81.02	93.05	97.10	90.39	95.99	104.98	109.34	103.43
Mean		88.39	94.97	99.41	94.25	100.63	108.33	114.50	107.82
Overall mean	25 Oct.	86.73	89.43	92.61	89.56	96.99	103.73	107.93	102.88
	15 Nov.	82.66	86.15	89.21	86.00	95.12	100.06	106.35	100.51
	5 Dec.	77.47	83.98	86.53	82.66	90.63	96.28	100.04	95.65
Mean		82.28	86.52	89.45	86.08	94.25	100.02	104.77	99.68

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.496	0.541
B (Sowing date)	0.4496	0.2446
C (Density)	0.4476	0.2304
A x B	0.7501	0.34125
A x C	0.74495	0.5247
B x C	0.7044	0.3657
A x B x C	1.096	0.564

Concerning sowing dates effect, results showed a gradual decrement in plant height with delaying sowing date from 25 Oct. to 5 Dec. Plant height decreased from 89.56 to 82.66 cm in the first season and from 102.88 to 95.65 cm in the second one as sowing date was delayed from 25 Oct. to 5 Dec.

The present results reveal that delaying sowing date after Oct.25 caused a remarkable reduction in plant height. This reduction may be due to the fact that flax plants did not have enough time to achieve their maximum vegetative growth which mainly affected plant height and produced shorter plants . These findings are in agreement with those obtained by Al-Shamma and El-Hassan(1969), El-Farouk et al (1980), El-Haroun et al (1982), Kwon et al (1988), and Moawed (1996).

Results showed also that there were gradual increments in total plant height when plant density increased from 1125 to 1875 seeds/m^2 showing mean values of 82.28, 86.52 and 89.45 cm in the first season for the plant densities 1125, 1500 and 1825 seeds/m^2 respectively. The corresponding estimates in the second season were 94.25,100.02 and 104.77 cm for the respective sowing rates. Similar results were also obtained by El-Hariri (1964), El-Nakhlawy (1975), El-Nakhlawy et al (1978), Gad and El-Farouk (1978), Salama (1988), Abd-Alla et al (1989), Kwon et al (1989), Mostafa (1990), Easson and Long (1992), El-Shimy et al (1993) El-Sweify (1993), Mahmoud (1993), Nada (1995) and Amany El-Refaie (1996) .

All interaction combinations of the treatments under study had significant effect on total plant height which means that the three factors studied depended on each other in affecting this character . It could be concluded that the tallest flax plants of Giza8 variety were obtained by sowing on 25 Oct. combined with the highest plant density (1875 seeds /m^2) . The mean values recorded were 83.37 and 98.61 cm in the first and second seasons ,respectively. On the other hand, the shortest flax plants were obtained by sowing flax on 5 Dec. and seeding rate 1125 seeds/m^2 with average height of 73.92 and 85.27 cm in the first and second seasons, respectively.

For Iriana variety the tallest plants were obtained by sowing flax on 25 Oct. at plant density of 1875 seeds /m^2 but the shortest ones were obtained when planting flax on 5Dec. combined with 1125 seeds/m^2 showing an average of 81.02 and 95.99 cm in the first and second seasons, respectively.

It could be concluded that the maximum plant height was recorded by Iriana variety when sown on Oct.25 and seeding with 1875 seeds/m^2, being 101.85 and 117.25 cm in the first and second seasons, respectively .

On the other hand , the shortest plants were recorded by Giza8 variety sown on Dec.5 and seeding with 1125 seeds/m^2 recording an average of 73.92 and 85.27 cm in the first and second seasons, respectively .

2- Technical stem length (cm):

Means of technical stem length as affected by sowing dates and seeding rates of two flax varieties in the two successive seasons 1995-1996 and 1996-1997 are shown in Table (3).

Results indicate that there were significant differences between the two flax varieties under study, namely, Iriana and Giza8. Iriana recorded taller technical stem length than Giza8 in both seasons with mean values of 75.44 cm in the first season and 89.06 cm in the second one when compared with the relatively shorter flax plants obtained by Giza8 which recorded 62.46 and 73.42 cm in the two successive seasons, respectively.

These previously mentioned results which appeared as varietal differences are in similar trend with those of total plant height. The present results agreed with those obtained by El-Farouk et al (1982), El-Kalla and El-Kassaby (1982), Salama (1983), El-Kady (1985), Hella et al (1986), El-Kady et al (1988) , Salama (1988), Sorour et al (1988), Kineber (1991), El-Shimy et al (1993), El-Sweify (1993), Sharief (1993), El-Sweify and Mostafa (1996), Moawed (1996) and El-Shimy et al (1997).

Concerning sowing dates effect, results showed a gradual reduction in technical ;length with delaying sowing date from 25 Oct. to 5 Dec., where technical length decreased from 71.99 to 65.81 cm in the first season and from 83.61 to 77.97 cm in the second one as

Table(3): Mean values of technical stem length (cm) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	63.07	64.77	66.82	64.89	72.71	75.53	79.27	75.83
	15 Nov.	61.12	63.25	63.57	62.65	70.85	74.49	76.25	73.86
	5 Dec.	59.32	60.00	60.25	59.85	68.74	70.75	72.24	70.58
Mean		61.17	62.67	63.55	62.46	70.77	73.59	75.92	73.42
Iriana	25 Oct.	76.45	78.95	81.90	78.95	85.20	92.28	96.79	91.41
	15 Nov.	71.60	75.05	79.77	75.62	84.68	89.75	96.78	90.40
	5 Dec.	65.60	74.70	75.00	71.77	78.56	86.95	90.63	85.38
Mean		71.22	76.23	78.89	75.44	82.81	89.66	94.71	89.06
Overall mean	25 Oct.	69.76	71.86	74.36	71.99	78.95	83.90	88.00	83.61
	15 Nov.	66.36	69.15	71.67	69.05	77.76	82.12	86.51	82.13
	5 Dec.	62.46	67.35	67.62	65.81	73.65	78.85	81.43	77.97
Mean		66.19	69.45	71.21	68.95	76.78	81.62	85.31	81.24

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.325	0.578
B (Sowing date)	0.3759	0.2225
C (Density)	0.4043	0.1744
A x B	0.598	0.5397
A x C	0.5286	0.4928
B x C	0.992	0.2865
A x B x C	0.992	0.4928

sowing date was delayed from 25 Oct. to 5 Dec. All differences in technical length due to sowing date were significant in both seasons. The present results are due to the fact that flax plants when sown later will not achieve an adequate vegetative growth as plants sown earlier .

Thus a reduction in technical stem length will be excepted with late planting. These results are confirmed with those obtained by El-Farouk et al (1980), Kwon et al (1988), Abou Zaied (1991) and Moawed (1996).

Concerning plant density, results illustrated a significant differences among the three plant densities in both seasons. Moreover, there are progressive increases in technical length with increasing the plant density from 1125 to 1500 and 1875 seeds/m^2 . The averages of technical stem length were 61.17, 59.34 and 63.55 cm in the first season, while in the second one the respective means were 70.77, 73.59 and 75.92 cm for Giza8 variety. For Iriana variety the means of technical stem length of the previously mentioned densities were 71.22, 76.23 and 78.89 cm in the first season, being 82.81, 89.66 and 94.71 cm in the second season, respectively. It is clear that the increase in plant density per unit area produced taller technical stem length with each of the two flax varieties under study. This behavior may be due to that flax plants at dense planting are searching for light which results in remarkable elongation. This finding is in harmony with those obtained by El-Nakhlawy (1975), El-Nakhlawy et al (1978), Gad and El-Farouk (1978), Zahran et al (1984), El-Shimy et al (1985), Hella et al (1986), Salama (1988), Mostafa (1990), El-Shimy et al (1993), Nada (1995) and Amany El-Refaie (1996) .

All interaction combinations of the treatments under study significantly affected technical length. It could be concluded that the tallest technical stem length plants of Giza8 variety were obtained by sowing on 25 Oct., combined with the plant density of 1875 seeds /m^2 where the mean values were 66.82 and 79.27 cm in the first and second seasons, respectively. On the other hand, the shortest technical stem length plants were obtained by sowing on 5Dec. at 1125 seeds/m^2, recording averages of 59.32 and 68.74 cm, in the first and second seasons, respectively. For Iriana variety, the tallest technical stem length plants were obtained by sowing flax plants on 25 Oct., at plant density of 1875 seeds /m^2, while the shortest technical stem length was obtained by the latest sowing date on 5 Dec., combined with the lowest plant density of 1125 seeds/m^2. The mean values of this trait were 65.60 and 78.56 cm, in the first and second seasons, respectively.

The second order interaction indicated that the maximum technical stem length was recorded by Iriana variety sown on Oct.25 and seeding with 1875 seeds/m^2 being 81.90 and 96.79 cm in the first and second seasons, respectively.

3- Main stem diameter (mm) :

Mean values of main stem diameter as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 -1996 and 1996-1997 are presented in Table (4).

Table(4): Mean values of main stem diameter (mm) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	2.90	2.83	2.68	2.80	3.46	3.35	3.07	3.29
	15 Nov.	2.88	2.75	2.63	2.75	3.35	3.32	3.02	3.23
	5 Dec.	2..83	2.73	2.58	2.71	3.30	3.22	3.00	3.17
Mean		2.87	2.77	2.63	2.75	3.37	3.30	3.03	3.23
Iriana	25 Oct.	2.10	2.04	2.01	2.05	3.10	3.20	3.02	3.10
	15 Nov.	2.10	2.03	2.01	2.04	3.09	3.15	3.00	3.08
	5 Dec.	2.06	2.01	1.99	2.02	3.07	3.12	2.98	3.06
Mean		2.08	2.02	2.00	2.03	3.08	3.16	3.00	3.08
Overall mean	25 Oct.	2.50	2.43	2.34	2.42	3.27	3.27	3.04	3.19
	15 Nov.	2.49	2.39	2.32	2.40	3.22	3.23	3.01	3.15
	5 Dec.	2.44	2.37	2.28	2.36	3.18	3.17	2.99	3.11
Mean		2.48	2.40	2.31	2.39	3.22	3.22	3.01	3.15

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.041	Ns
B (Sowing date)	0.0257	0.0748
C (Density)	0.0285	0.0628
A x B	Ns	0.01388
A x C	0.05135	0.12445
B x C	Ns	Ns
A x B x C	Ns	Ns

Analysis of variance showed significant differences between the two flax varieties Giza8 and Iriana as well as due to sowing dates and plant density treatments in both seasons, except with the varietal differences in the second season which did not reach the level of significance .

Regarding flax varieties, Iriana variety recorded thinner measurements in both seasons, with the mean values of 2.03 mm in the first season and 3.08 mm in the second one when compared with the thicker plants obtained by Giza8 which recorded 2.75 mm in the first season and 3.23 mm in the second one. It must be mentioned that the thinner flax plants obtained by Iriana variety are considered as more superior plants for bast fiber production in comparison with the thicker ones which produce coarse fibers. Many investigators observed varietal differences in main stem diameter such as El-Farouk et al (1982), El-Kady (1985), Hella et al (1986), Salama (1988), El-Shimy et al (1993), El- Sweify (1993), Sharief (1993), Moawed (1996) and Abou Zaied (1997) .

Concerning sowing dates effect, results showed a gradual decrement in stem diameter with delaying sowing date from 25 Oct. to 5 Dec. in both seasons. The main stem diameter decreased from 2.42 to 2.36 mm in the first season and from 3.19 to 3.11 mm in the second one as sowing date was delayed from 25 Oct. to 5 Dec. . The results mentioned here may be due to the fact that late sown flax plants did not achieve their adequate vegetative growth and consequently produced thinner flax plants compared with early sown plants. These results confirm those obtained by Kwon et al (1988), Abou Zaied (1991) and Moawed (1996) .

Data indicated that the dense planting produced more thinner flax plants . The measurements of main stem diameter were 2.48, 2.40 and 2.31 mm in the first season being 3.22, 3.22 and 3.01 mm in the second one at the plant density of 1125, 1500 and 1875 seeds/m^2, respectively. This result indicate that lower plant density reduces competition among growing plants for light, water and nutrients and consequently thicker plants are produced. On the other hand, dense planting increase plant competition for environmental factors and induce elongation of plants and thinner plants are produced. These findings are in agreement with those obtained by El-Farouk (1968), Momtaz et al (1981), El-Shimy et al (1985), Hella et al (1986), Salama (1988), Abd-Alla (1989), Easson and Long (1992), El-Shimy et al (1993), El-Sweify (1993), Nada (1995), and Amany El-Refaie (1996).

The interaction between variety and density in both seasons and variety and sowing date only in second season had significant effect on main stem diameter but the interaction between sowing date and density as well as the second order interaction had no significant effect on main stem diameter . The maximum main stem diameter was obtained by sowing on 25 Oct., combined with plant density of 1125 seeds /m^2 in the two flax varieties in both seasons . The highest main stem diameter for Giza8 was 2.9 and 3.46 mm being 2.10 and 3.10 mm for Iriana , in the first and second seasons, respectively. On the other hand, the lowest mean values were 2.58 and 3.00 mm for Giza8 and 1.99 and 2.98 mm for Iriana in the first and second seasons, respectively which were obtained by sowing on 5 Dec. at the highest plant density (1875 seeds /m^2).

4 - Straw yield / plant (g) :

Mean values of straw yield / plant in the two successive seasons as affected by variety, sowing date and plant density are presented in Table (5).

Analysis of variance showed that there were significant varietal differences between the two flax varieties under study in both seasons. Plants of Iriana variety recorded higher mean values for straw yield/plant (3.16 and 3.66 g) than Giza8 (2.61 and 2.98 g) in the first and second seasons, respectively. These results agreed with those obtained by Salama (1983), Hella et al (1986),Salama (1988), Sorour et al (1988), Hella et al (1989), Kineber (1991), El-Sweify (1993), El-Kady et al (1995), Moawed (1996) and Abu Zaied (1997).

Results indicated that there were significant differences in straw yield/ plant, regarding sowing dates in both seasons. Straw yield/plant significantly reduced as sowing date delayed from 25 Oct. to 5 Dec. This character reduced from 3.00 to 2.77 g in 1995-1996 and from 3.48 to 3.12 g in 1996-1997 season as sowing date was delayed from Oct.25 to Dec.5 . This result may be due to positive effects of early sowing on plant height, stem diameter and all growth parameters which are reflected in dry matter accumulation in plant . These results are in harmony with those obtained by Kwon et al (1988) and El-Kilany et al (1994).

Table(5): Mean values of straw yield/plant (g) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	2.80	2.71	2.64	2.72	3.26	3.14	3.05	3.15
	15 Nov.	2.66	2.64	2.56	2.62	3.11	3.06	2.94	3.03
	5 Dec.	2.51	2.51	2.49	2.50	2.93	2.92	2.36	2.74
Mean		2.66	2.62	2.56	2.61	3.10	3.04	2.78	2.98
Iriana	25 Oct.	3.42	3.30	3.14	3.29	4.01	3.80	3.61	3.82
	15 Nov.	3.34	3.15	3.00	3.16	3.90	3.65	3.45	3.67
	5 Dec.	3.26	3.12	2.74	3.04	3.61	3.66	3.25	3.51
Mean		3.34	3.19	2.96	3.16	3.84	3.70	3.44	3.66
Overall mean	25 Oct.	3.11	3.00	2.89	3.00	3.63	3.47	3.33	3.48
	15 Nov.	3.00	2.90	2.78	2.89	3.50	3.35	3.20	3.35
	5 Dec.	2.88	2.81	2.61	2.77	3.27	3.29	2.80	3.12
Mean		3.00	2.90	2.76	2.89	3.46	3.37	3.11	3.32

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.037	0.064
B (Sowing date)	0.0211	0.0348
C (Density)	0.0181	0.0366
A x B	Ns	Ns
A x C	0.028	0.0715
B x C	0.0293	Ns
A x B x C	0.044	0.09

Data revealed that straw yield/ plant was significantly affected by plant density in the two successive seasons. Increasing plant density from 1125 to 1875 seeds/m^2 significantly reduced straw yield/plant in both seasons. The estimates obtained were 3.00, 2.90 and 2.76 g in the first season, being 3.46,3.37 and 3.11 g in the second season for the plant densities 1125, 1500 and 1875 seeds/m^2 respectively. Reduction in straw yield/ plant as a result of increasing plant density was obtained by El- Hariri (1964), Mokhtar (1965), El-Shimy et al (1985), Hella et al (1986), Salama (1988), Abd Alla et al (1989), Mostafa (1990), El-Shimy et al (1993), El-Sweify (1993), Mahmoud (1993), and Nada (1995).

All interaction combinations had significant effect on straw yield /plant in both seasons, except with the interaction between variety and sowing date in both seasons and sowing date and density in the second one which did not reach the level of significance. It is clear that the highest mean values of straw yield/ plant were obtained by sowing flax on 25Oct., combined with the lowest plant density of 1125 seeds/m^2. The interaction between variety and density indicated that Iriana variety was more sensitive for dense planting than Giza8. Results in Table 5 showed that increasing plant density from 1125 to 1500 and 1875 seeds/m^2 reduced straw yield / plant in 1995/ 96 season in Giza8 variety by 1.50 and 2.29 % respectively, corresponding to 4.49 and 7.21 % with Iriana variety.

In 1996 / 1997 season the reductions in straw yield / plant due to increasing plant density were 1.94 and 8.55 % with Giza8 as against 3.65 and 7.03 % with Iriana. This great variation indicates a quite different varietal response to plant density.

The second order interaction indicated that the maximum straw yield / plant was 3.42 and 4.01 g in the first and second seasons, respectively which were recorded by Iriana variety sown on Oct.25 and seeding with 1125 seeds/m^2.

On the other hand, the minimum straw yield / plant was recorded by Giza8 sown on Dec.5 and seeding with 1875 seeds/m^2, being 2.49 and 2.36 g in 1995-1996 and 1996 -1997 seasons, respectively.

5 - Straw yield (ton / fad) :

Mean values of straw yield (ton / fad) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995-1996 and 1996 - 1997 are presented in Table (6).

Analysis of variance indicated significant differences in straw yield/ fad between the two flax varieties i.e Giza8 and Iriana as well as due to sowing date and plant density treatments in both seasons.

Regarding flax varieties, the imported Iriana was superior over Giza8 in relation to straw yield (ton/ fad) in both seasons with mean values of 3.48 ton/ fad in the first season and 4.06 ton /fad in the second one, compared with Giza8 which recorded 2.87 and 3.33 ton/ fad in the two successive seasons, respectively. These results which appeared as varietal differences are due to the genetical make up of each flax variety. The above mentioned results are due to the better vegetative growth of Iriana variety and agree with those obtained by Salama (1983), Hella et al (1986), El-Kady et al (1988),Salama (1988),

Table(6): Mean values of straw yield/fad. (tons) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96				1996/97			
		Plant density			Mean	Plant density			Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	2.91	2.98	3.08	2.99	3.36	3.46	3.63	3.48
	15 Nov.	2.81	2.91	2.92	2.89	3.39	3.34	3.42	3.38
	5 Dec.	2.73	2.77	2.77	2.75	3.03	3.22	3.15	3.13
Mean		2.81	2.88	2.92	2.87	3.26	3.34	3.36	3.33
Iriana	25 Oct.	3.45	3.63	3.76	3.61	4.01	4.22	4.45	4.23
	15 Nov.	3.31	3.45	3.67	3.47	3.82	4.06	4.34	4.07
	5 Dec.	3.02	3.44	3.59	3.35	3.50	3.95	4.16	3.87
Mean		3.26	3.51	3.67	3.48	3.77	4.08	4.32	4.06
Overall mean	25 Oct.	3.18	3.30	3.42	3.30	3.68	3.84	4.04	3.85
	15 Nov.	3.06	3.18	3.29	3.18	3.60	3.70	3.88	3.73
	5 Dec.	2.87	3.10	3.18	3.06	3.26	3.58	3.59	3.48
Mean		3.04	3.19	3.30	3.18	3.51	3.71	3.84	3.69

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.0400	0.2000
B (Sowing date)	0.0227	0.0810
C (Density)	0.0181	0.0769
A x B	Ns	Ns
A x C	0.0399	0.1436
B x C	0.0399	Ns
A x B x C	0.4400	0.1880

Hella et al (1989), Momtaz et al (1989), El-Gazzar (1990). Kineber (1991), El-Shimy et al (1993), El-Sweify (1993), El-Kady et al (1995), El-Sweify and Mostafa (1996), Moawed (1996) and Abou Zaied (1997)

Concerning dates effect, the results showed a gradual decrement in straw yield (ton/ fad) with delaying sowing date from 25 Oct. to 5 Dec. Straw yield per faddan decreased from 3.30 to 3.06 ton / fad in the first season and from 3.85 to 3.48 in the second one as sowing date was delayed from 25Oct. to 5 Dec. The reduction in straw yield due to late sowing is mainly due the decrease in growth characters. The same trend was observed by El-Farouk et al (1980), El-Haroun et al (1982) and Kwon et al (1988) who reported an increase in straw yield due to early sowing of flax .

Results showed that there are progressive increases in straw yield per faddan with increasing plant density with the two flax varieties studied in both seasons.

The average values obtained for this character were 3.04, 3.19 and 3.30 ton/ fad in the first season, corresponding to 3.51, 3.71 and 3.84 ton/fad in the second season, for the plant densities 1125,1500 and 1875 seeds /m^2, respectively. It must be mentioned here, that the straw yield per plant discussed before decreased with increasing plant density, but straw yield / faddan showed an opposite trend.

This behavior occurred because of the great number of flax plants per faddan grown at the higher plant densities which compensate the lower straw yield / plant. These results are in harmony with those obtained by Horodyski and Sokolowski (1964),

Mokhtar (1965), El-Farouk (1968) El-Nakhlawy (1975), El-Nakhlawy et al (1978), Gad and El-Farouk (1978), Momtaz et al (1981),Zahran et al (1984), El- Shimy et al (1985), Hella et al (1986), Hassan and El-Farouk (1987), Salama (1988), Mostafa (1990), El- Shimy et al (1993), El-Sweify (1993), Mahmoud (1993), Nada (1995) and Amany El-Refaie (1996).

The interaction between varieties and density and the second order interaction had significant effect on straw yield /fad in both seasons. Also variety × density had significant effect on straw yield/ fad in the first season only . The maximum straw yield / fad was obtained by sowing on 25 Oct., combined with the highest plant density (1875 seeds/m^2) with the two flax varieties in the both seasons.

The interaction between variety and density was quite evident where Iriana variety showed greater response to plant density than Giza8. The increase in plant density from 1125 to 1500 and 1875 seeds/m^2 increased straw yield/ fad in 1995 / 96 season by 2.49 and 3.91 % with Giza8 compared with 7.8 and 12.58 % with Iriana. The corresponding increases in 1996 /1997 season in straw yield / fad due to increasing plant density were 2.45 and 3.07 % for Giza8 as against 9.81 and 12.38 % for Iriana. From this result the significant variety × density interaction is clearly demonstrated. The second order interaction indicated that the maximum straw yield/ fad was 3.76 and 4.45 t/ fad in the first and second seasons, respectively which were recorded by Iriana sown on Oct.25 and seeds at 1875 seeds/m^2 .

On the other hand, the minimum straw yield was 2.73 and 3.03 t/fad in the two successive seasons which was obtained by Giza8 sown on Dec.5 and second at 1125 seeds/m^2 .

6- Fiber yield / fad (kg) :

Means of fiber yield/ fad as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/1996 and 1996/1997 are presented in Table (7)

Analysis of variance showed that there was a significant difference between the two flax varieties under this study (Giza8 and Iriana) in the two seasons .

Results showed that the imported Iriana was superior over Giza8 in relation to fiber yield / fad in both seasons, with the mean values of 443.9 Kg in the first season and 495.99 Kg in the second one, when compared with the lower values obtained by Giza8, which recorded 306.89 and 410.72 Kg in the two successive seasons, respectively. These results are mainly due to the superiority of Iriana variety in the straw yield/fad .

The present results agree with those obtained by El-Kady et al (1988), Salama (1988), Momtaz et al (1989), El Gazzar (1990), Kineber (1991) and El- Shimy et al (1993).

Concerning sowing dates effect, results showed significant differences and a gradual decrement in fiber yield/ fad with delaying sowing date from 25 Oct. to 5 Dec.

Table(7): Mean values of fiber yield/fad. (kgs) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96				1996/97			
		Plant density			Mean	Plant density			Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	320.53	332.53	349.83	334.29	408.50	419.67	435.02	421.06
	15 Nov.	297.93	319.60	335.80	317.78	394.95	418.62	436.37	416.65
	5 Dec.	234.00	271.15	300.70	268.61	360.50	392.05	430.92	394.49
Mean		284.15	307.76	328.77	306.89	387.98	410.11	434.10	410.72
Iriana	25 Oct.	416.18	479.66	501.09	465.64	477.02	547.52	580.77	535.11
	15 Nov.	401.20	447.68	499.65	449.51	460.95	496.65	560.25	505.95
	5 Dec.	385.38	417.55	446.85	416.59	458.55	416.02	466.25	446.94
Mean		400.92	448.29	482.52	443.91	465.50	486.73	535.76	495.99
Overall mean	25 Oct.	368.36	406.10	425.46	399.97	442.76	483.34	507.89	477.99
	15 Nov.	349.56	383.64	417.73	383.64	427.95	457.63	498.31	461.29
	5 Dec.	309.69	344.35	373.77	342.60	409.52	404.03	448.58	420.71
Mean		342.36	378.03	405.66	375.40	426.74	448.33	484.93	453.33

L.S.D. 0.05	1995/96	1996/97
A (Varities)	4.9720	4.3060
B (Sowing date)	8.4660	4.5162
C (Density)	2.6988	4.9039
A x B	Ns	7.2713
A x C	5.9120	7.7385
B x C	4.3117	7.6238
A x B x C	6.3660	12.0120

A remarkable reduction in fiber yield/ fad, from 399.97 to 342.60 Kg in the first season and from 477.99 to 420.71 Kg in second one was recorded as sowing date was delayed from Oct.25 to Dec5. The results are excepted since straw yield was greatly reduced by delaying sowing date. Similar results were also obtained by El-Farouk et al (1980), Rosnovskii and Bondorenko (1985), Kwon et al (1988), Abou Zaied (1991) and Moawed (1996).

Fiber yield per faddan was significantly affected by plant density. Fiber yield increased with increasing the number of flax plants per unit area. The mean values obtained in this case were 342.36, 378.03 and 405.66 Kg / fad in the first season, while they were 426.74, 448.33 and 484.93 Kg / fad in the second one for the plant density of 1125,1500 and 1875 seeds /m^2, respectively. The present results are mainly due to the increase in straw yield due to the increase in plant density. Similar results were also obtained by Garber (1960), Mokhtar (1965), Sin et al (1975), Gad and El-Farouk (1978), Gubbeles (1978), Momtaz et al (1981), Zahran et al (1984), Khalil (1990), Subotinas (1991), Bassi and Badiyala (1992), El-Shimy et al (1993), Mahmoud (1993) and Amany El-Refaie (1996).

All interaction combinations of the treatments under study had significant effect on fiber yield / fad except the interaction between variety and sowing date in the first season which was non significant. It could be concluded that the highest mean values of fiber yield/ fad of Giza8 variety were obtained by sowing on 25 Oct. combined with plant density of 1875 seeds/m^2 with the mean values of 349.83 and 435.02 kg/fad in the first and second seasons, respectively. On the other hand, the lowest values of fiber yield / fad of Giza8 were

obtained when flax was sown on 5 Dec. at 1125 seeds/m^2, with averages of 234.00 and 360.50 kg /fad in the first and second seasons, respectively .

For Iriana variety, the highest mean values were obtained by sowing flax on 25 Oct. with a plant density of 1875 seeds/m^2 with average yield of 501.09 and 580.77 kg/fad in the first and second seasons, respectively. But the lowest mean values obtained when planting flax on 5Dec. combined with 1125 seeds/m^2 with averages of 385.38 and 468.55 kg in the two successive seasons, respectively.

The interaction between variety and density indicated that Iriana variety response to plant density was much greater than Giza8. Increasing plant density from 1125 to 1500 and 1875 seeds/m^2 increased fiber yield/fad by 8.31 and 15.70 % in 1995-1996 season, and 5.70 and 11.89 % in 1996-97 season, respectively with Giza8. The corresponding increases for Iriana were 11.82 and 20.35 % in the first season, and 4.56 and 15.09 % in the second season, respectively.

The interaction between sowing date and density indicated that the effect of sowing date on fiber yield / fad was more evident at the population density of 1500 seeds/m^2 where the yield reduction reached 15.21 and 16.41 % in the first and second seasons. respectively, due to delaying sowing from Oct.25 to Dec.5 .

The corresponding reductions in fiber yield were only 10.86 and 5.5 % in the two successive seasons at a density of 1125 seeds/m^2, being 12.12 and 11.68 % at 1500 seeds/m^2 in the two successive seasons .

The second order interaction showed that the highest fiber yield/ fad was produced by Iriana variety sown on Oct.25 and seeded at 1875 seeds/m^2, being 501.09 and 580.77 kg /fad in 1995 / 96 and 1996 / 97 seasons, respectively.

On the other hand, the lowest fiber yield was 234.00 in the first season and 360.50 kg / fad in the second one which was produced by Giza8 sown on Dec.5 and seeded at 1125 seeds/m^2 .

Generally it could be concluded that straw yield and its components indicated significant differences between the two flax varieties namely Giza8 and Iriana as well as among sowing dates and plant densities in both seasons, except with the main stem diameter trait which was significantly affected in the second season only .

Concerning the two flax varieties, Iriana variety surpassed Giza 8 and achieved maximum estimates in total plant height, technical stem length, straw yield/ plant as well as per faddan and fiber yield/ fad, but Iriana variety was thinner in stem diameter .

In respect to sowing dates effect, the early planting of flax (25^{th} October) increased vegetative growth period and was superior either when compared with the intermediate date (15^{th} Nov.) or the latest one (5^{th} Dec.) in all straw characters studied in both seasons.

For plant density effect, data illustrated that the greatest plant density per unit area (1875 seeds/m^2) recorded maximum estimates in total plant height, technical stem length, straw and fiber yields/faddan, while the same plant density resulted in minimum mean values in

relation to the main stem diameter and straw yield/ plant in comparison with the lowest plant density (1125 seeds /m^2) .

Meanwhile, sowing flax plants at the plant density of 1500 seeds/m^2 produced intermediate estimates between the highest plant density and lowest one .

II - Seed Yield And Its Related Characters:

1- Number of capsules / plant:

Mean values of number of capsules / plant as affected by sowing dates, plant density of the two flax varieties in the two successive seasons 1995 / 96 and 1996 / 97 are presented in Table (8).

Analysis of variance indicated significant differences between the two flax varieties i.e. Giza8 and Iriana only in the first season , while sowing date and plant density treatments, showed significant effect on number of capsules / plant in both seasons .

For flax varieties, results revealed that the local variety Giza8 was superior over Iriana in relation to number of capsules/plant in both seasons. The mean values of this character for Giza8 cv were 8.20 and 10.38 in the two successive seasons, when compared with the lower number of capsules/plant obtained by Iriana which recorded 6.41 and 7.91 capsules/plant in the two successive seasons, respectively. These results which appeared as varietal differences are due to genetical make up for each flax genotype, agree with those obtained by Spratt et al (1963) Salama (1983), El-Kady (1985), Salama (1988), Sorour et al (1988), Hella et al (1989), Kineber (1991),

Table(8): Mean values of number of capsules/plant as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	12.83	9.35	6.80	9.66	16.05	11.60	8.05	11.90
	15 Nov.	8.78	8.18	6.18	7.71	12.75	9.65	8.05	10.15
	5 Dec.	8.75	7.35	5.61	7.23	11.00	9.04	7.21	9.08
Mean		10.12	8.29	6.19	8.20	13.27	10.10	7.77	10.38
Iriana	25 Oct.	7.88	7.05	5.33	6.75	11.34	8.28	6.10	8.57
	15 Nov.	7.55	6.88	5.28	6.57	9.77	8.18	6.02	7.99
	5 Dec.	6.53	6.66	4.58	5.92	8.98	7.43	5.15	7.18
Mean		7.32	6.86	5.06	6.41	10.03	7.96	5.75	7.91
Overall mean	25 Oct.	10.35	8.20	6.06	8.20	13.69	9.94	7.07	10.23
	15 Nov.	8.16	7.53	5.73	7.14	11.26	8.91	7.03	9.07
	5 Dec.	7.64	7.00	5.09	6.57	9.99	8.23	6.18	8.13
Mean		8.71	7.57	5.62	7.30	11.64	9.03	6.76	9.14

L.S.D. 0.05	1995/96	1996/97
A (Varities)	1.2880	Ns
B (Sowing date)	0.5507	0.6783
C (Density)	0.6866	0.7876
A x B	1.2569	Ns
A x C	Ns	Ns
B x C	Ns	1.2085
A x B x C	Ns	Ns

El-Shimy et al (1993), El-Sweify (1993), Sharief (1993), Moawed (1996), Abou Zaied (1997) and El-Shimy et al (1997).

Concerning sowing dates effects, results showed a gradual decrements in number of capsules / plant with delaying sowing date from 25 Oct. to 5 Dec., with a range of 8.20 to 6.57 capsules / plant in the first seasons, and from 10.23 to 8.13 capsules / plant in the second one, respectively. The present results revealed that delaying sowing date after Oct.25 caused a remarkable reduction in number of capsules / plant . The same trend was observed by kwon et al (1988) and Samui and Bondopadhyay (1992).

Results showed that there were gradual decrements in number of capsules / plant when plant density increased from 1125 to 1500 and 1875 seeds /m^2. The mean values obtained were 8.71 , 7.57 and 5.62 capsules / plant for the plant density of 1125 , 1500 and 1875 seeds/m^2 respectively, in the first season being 11.64, 9.03 and 6.76 capsules / plant in the second season . The results agree with those obtained by Horodyski and Sokolowski (1964), El-Farouk (1968), El-Nakhlawy (1975), Gad and El-Farouk (1978), Momtaz et al (1981), Zahran et al (1989), El-Shimy et al (1985), Hella et al (1986), Salama (1988), Abd-Alla et al (1989), Mostafa (1990), Freer (1992), El-Shimy et al (1993), El-Sweify (1993), Mahmoud (1993), Nada (1995) and Amany El-Refaie (1996).

The interaction between variety × sowing date in the first season and sowing date × density in the second one had significant effect on number of capsules / plant but the remaining interactions did not reach the level of significance . In general, the highest capsules

number / plant for Giza8 variety was obtained by sowing on 25 Oct., combined with the lowest plant density (1125 seeds/m^2) with mean values of 12.83 and 16.05 in the two successive seasons. The lowest mean values were obtained by sowing flax on 5 Dec. at 1875 seeds/m^2 with averages of 5.61 and 7.21 in 1995 / 96 and 1996 / 97 seasons, respectively .

For Iriana variety , the highest capsules number was obtained by sowing flax on 25 Oct. with plant density of 1125 seeds /m^2 (7.88 and 11.34), but the lowest mean values were obtained when planting flax on 5 Dec., combined with 1875 seeds /m^2, the average being 4.58 and 5.15 capsules / plant in the two successive seasons , respectively .

2- Number of seeds / capsule :

Mean values of number of seeds / capsule as affected by sowing dates, plant density and two flax varieties in the two successive seasons of 1995/96 and 1996/ 97 are presented in Table (9).

Analysis of variance indicated significant differences between the two flax varieties i.e Giza 8 and Iriana as well as among sowing date and plant density treatments in both seasons.

Regarding flax varieties , results. revealed that Giza8 was superior over Iriana in number of seeds/capsule, in both seasons. The mean values obtained by Giza8 cv, were 7.02 and 8.30 seeds / capsule in the first and second seasons, respectively, when compared with the lower mean values obtained by Iriana which recorded 6.26 and 6.74 seeds / capsule in two successive seasons, respectively. These results agree with those obtained by Spratt et al (1963), Kumar and Singh

Table(9): Mean values of number of seeds/capsule as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	Mean	1996/97 Plant density 1125	1500	1875	Mean
Giza 8	25 Oct.	9.65	8.45	7.65	8.58	9.48	8.40	7.55	8.48
	15 Nov.	7.50	6.75	5.85	6.70	9.38	8.30	7.28	8.32
	5 Dec.	7.18	5.70	4.45	5.78	9.10	8.20	6.99	8.10
Mean		8.11	6.97	5.98	7.02	9.32	8.30	7.27	8.30
Iriana	25 Oct.	7.95	7.28	6.50	7.24	7.40	7.35	6.50	7.08
	15 Nov.	7.45	6.12	5.23	6.27	7.33	6.67	6.10	6.70
	5 Dec.	6.28	5.28	4.33	5.29	7.20	6.40	5.76	6.45
Mean		7.22	6.22	5.35	6.26	7.31	6.81	6.12	6.74
Overall mean	25 Oct.	8.80	7.86	7.07	7.91	8.44	7.87	7.02	7.78
	15 Nov.	7.47	6.44	5.54	6.48	8.40	7.48	6.69	7.51
	5 Dec.	6.73	5.49	4.39	5.54	8.15	7.30	6.37	7.27
Mean		7.66	6.59	5.66	6.63	8.31	7.55	6.69	7.52

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.6890	0.3810
B (Sowing date)	0.5084	0.1100
C (Density)	0.4547	0.1350
A x B	Ns	Ns
A x C	Ns	0.3434
B x C	Ns	Ns
A x B x C	Ns	Ns

(1967), Salama (1988), Hella et al (1989), Moawed (1996), Abou Zaied (1997) and El-Shimy et al (1997).

Concerning sowing dates effect, results showed a gradual decrement in number of seeds per capsule with delaying sowing date from 7.91 to 5.54 seeds / capsule in the first season and from 7.78 to 7.27 seeds / capsule in the second season for sowing on 25 Oct. and 5 Dec. respectively. It is clear that delaying sowing date after the first one caused relatively remarkable reduction in number of seeds / capsule as a result of reducing the vegetative growth period. Similar results were obtained by El-Haroun et al (1982), Kwon et al (1988) and Samui and Bondopadhyay (1992) .

Results showed that the number of seeds / capsule decreased with increasing plant density per unit area (from 1125 to 1875 seeds /m^2) with the mean number of 7.66, 6.59 and 5.66 seeds / capsule in the first season and respective estimates in the second one of 8.31, 7.55 and 6.69 seeds / capsule for the three plant densities of 1125 , 1500 and 1875 seeds / m^2. The reduction in seeds number / capsule is due to the increase in plant competition. Many investigators found similar results among them are Horodyski and Sokolowski (1964) and Abd-Alla et al (1989).

All interaction combinations of the treatments under study had no significant effect on this trait in both seasons, except variety × density interaction in the second one which reached the level of significance. It could be concluded that the highest mean values of number of seeds / capsule for Giza8 variety were obtained by sowing on 25 Oct. combined with the lowest plant density of 1125 seeds/ m^2

(9.65 and 9.48) seeds / capsule in both seasons, but the lowest mean values were obtained by sowing flax seeds on 5 Dec. at 1875 seeds /m^2 , with averages of 4.45 and 6.99 seeds / capsule in the two successive seasons, respectively. The same treatments which recorded either maximum number of seeds / capsule or the minimum estimates for Giza 8 occurred also with Iriana variety. The corresponding values were 7.95 and 7.40 seeds / capsule as the highest values in 1995 / 96 and 1996 / 97 season, respectively, whereas the lowest values were 4.33 and 5.76, respectively.

3- Apical branching zone length :

Mean values of apical branching zone length trait as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 / 1997 are presented in Table (10) .

Analysis of variance indicated significant differences between the two flax varieties i.e. Giza 8 and Iriana as well as sowing dates and plant density treatments in the first season only, but in the second one the differences in apical branching zone length did not reach the level of significance.

Regarding flax varieties, results revealed that the imported Iriana was the greater apical branching zone length in both seasons. The mean values obtained by Iriana were 18.80 cm in the first season and 18.75 cm in the second one when compared with the shorter flax plants obtained by Giza8 which recorded 15.40 and 18.10 cm in the two successive seasons, respectively. This finding is in harmony with those obtained by Spratt et al., (1963) , Kumar and Singh (1967),

Table(10): Mean values of apical branching zone length (cm) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			1995/96 Mean	1996/97 Plant density			1996/97 Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	15.50	15.80	16.66	15.99	17.62	19.34	20.44	19.13
	15 Nov.	14.95	15.50	15.55	15.33	17.11	17.08	19.52	17.90
	5 Dec.	14.60	14.92	15.72	13.08	16.53	16.82	18.50	17.28
Mean		15.02	15.41	15.97	15.46	17.08	17.75	19.48	18.10
Iriana	25 Oct.	18.45	19.35	22.10	19.96	18.44	19.21	20.46	19.37
	15 Nov.	17.65	18.50	19.95	18.70	17.59	18.79	20.15	18.80
	5 Dec.	15.42	18.35	19.53	17.76	17.43	18.03	18.71	18.05
Mean		17.17	18.73	20.52	18.80	17.82	18.67	19.77	18.75
Overall mean	25 Oct.	16.97	17.57	19.38	17.97	18.03	19.27	20.45	19.25
	15 Nov.	16.30	17.00	17.75	17.02	17.35	17.93	19.83	18.37
	5 Dec.	15.01	16.63	17.62	16.42	16.98	17.42	18.60	17.66
Mean		16.09	17.06	18.25	17.14	17.45	18.21	19.62	18.42

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.2520	Ns
B (Sowing date)	0.1600	Ns
C (Density)	0.1293	Ns
A x B	Ns	Ns
A x C	0.2665	Ns
B x C	0.2111	Ns
A x B x C	0.3170	Ns

Salama (1983), El-Kady (1985), Salama (1988), Hella et al (1989) Moawed (1996) and Abou Zaied (1997).

Concerning sowing dates effect, results showed a gradual decrement in apical zone length with delaying sowing date from 25Oct. to 5 Dec. Apical zone length decreased from 17.97 to 16.42 cm in the first season, and from 19.25 to 17.66 cm in the second one as sowing date was delayed from Oct.25 to Dec5. The difference in the second season was not significant. Similar results were also obtained by El-Haroun et al (1982) and Samui and Bondopadhyay (1992).

The results showed also a gradual reduction in apical zone length when plant density increased from 1125 to 1875 seeds /m^2, with the mean values of 16.09, 17.04 and 18.25 cm in the first season for plant densities 1125,1500 and 1875 seeds /m^2 . The respective estimates in the second season were 17.45, 18.21 and 19.62 cm, respectively which were not significantly different. Similar results were also obtained by Horodyski and Sokolowski (1964) and Abd-Alla et al (1989).

All interaction combinations of the treatments under study had significant effect on apical branching zone length in the first season except that between variety and sowing date . In the second season all interactions had insignificant effect on this character . It could be concluded that the tallest apical branching zone length for Giza8 variety was obtained by sowing on 5th.Dec. combined with the lowest plant density (1875 seeds / m^2) with mean values of 16.66 and 20.44 cm in the first and second seasons, respectively. On the other hand, the shortest apical branching zone length was obtained by sowing flax

on 25 th Oct. at 1125 seeds/m^2 with averages of 14.60 and 16.53 cm in the two successive seasons, respectively.

For Iriana variety the tallest apical branching zone length was obtained by sowing flax on 5th Dec., at plant density of 1875 seeds / m^2 with average values of 20.10 and 20.46 cm in the first and second seasons, respectively, but the shortest ones were obtained when planting flax on 25th Oct., combined with 1125 seeds /m^2 with averages of 15.42 and 17.43 cm in the two successive seasons, respectively.

4-Seed yield / plant (g) :

Mean values of seed yield / plant as affected by sowing dates, plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 /1997 are presented in Table (11).

Analysis of variance indicated significant differences between the two flax varieties as well as due to sowing dates and plant density treatments in both seasons.

Regarding flax varieties, results revealed that Giza8 was superior over Iriana in relation to seed yield per plant in both seasons. The mean values obtained by Giza8 were 1.61 and 1.89 g when compared with Iriana which recorded 1.15 and 1.37 g in the two successive seasons, respectively. The present results agree with those obtained by Kumar and Singh (1967) Yousef (1968),Momtaz and Allam (1977), Momtaz et al (1980), El-Kady (1985), El-Kady et al (1988), Salama (1988), Hella et al (1989), El-Sweify (1993), Abou Zaied (1997) and El-Shimy et al (1997).

Table(11): Mean values of seed yield/plant (g) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			1995/96 Mean	1996/97 Plant density			1996/97 Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	1.82	1.72	1.59	1.71	2.21	2.03	1.84	2.02
	15 Nov.	1.80	1.59	1.47	1.62	2.12	1.87	1.69	1.89
	5 Dec.	1.69	1.58	1.26	1.51	2.00	1.85	1.45	1.77
Mean		1.77	1.63	1.44	1.61	2.11	1.92	1.66	1.89
Iriana	25 Oct.	1.31	1.23	1.18	1.24	1.59	1.47	1.36	1.47
	15 Nov.	1.19	1.18	1.11	1.16	1.45	1.39	1.29	1.38
	5 Dec.	1.08	1.07	1.05	1.07	1.31	1.27	1.21	1.26
Mean		1.19	1.16	1.11	1.15	1.45	1.38	1.29	1.37
Overall mean	25 Oct.	1.56	1.47	1.38	1.47	1.90	1.75	1.60	1.75
	15 Nov.	1.49	1.38	1.29	1.39	1.78	1.63	1.49	1.63
	5 Dec.	1.38	1.32	1.15	1.28	1.65	1.56	1.33	1.51
Mean		1.48	1.39	1.27	1.38	1.78	1.64	1.47	1.63

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.0400	0.0470
B (Sowing date)	0.0166	0.0181
C (Density)	0.0168	0.0176
A x B	Ns	0.0441
A x C	0.0388	0.0434
B x C	0.0265	0.0278
A x B x C	0.0410	0.0430

Concerning sowing dates effect, results showed a gradual decrement in seed yield per plant with delaying sowing date from 25Oct. to 5 Dec. Seed yield per plant decreased from 1.47 to 1.28 g in the first season and from 1.75 to 1.51 g in the second one as sowing was delayed from Oct.25 to Dec.5 respectively . The present results revealed that delaying sowing date after Oct.25 caused remarkable reduction in seed yield per plant due to the reduction in the vegetative growth period. The present results agree with those obtained by El-Haroun et al (1982), Kwon et al (1988). Samui and Bondopadhyay (1992).

The results indicated that there are gradual decrements in seed yield per plant when plant density increased from 1125 to 1875 seeds /m^2 with the mean values of 1.48, 1.39 and 1.27 g in the first season respectively.

The respective estimates in the second season were 1.78, 1.64 and 1.47 g for the plant density of 1125 , 1500 and 1875 seeds/m^2 respectively, the reduction in seed yield / plant at dense planting is mainly due to the increase in plant competition . Similar results were also reported by El-Hariri (1964), Horodyski and Sokolowski (1964), El-Farouk (1968), Zahran et al (1984), Hella et al (1986), Salama (1988), Abd-Alla et al (1989), Mostafa (1990), Freer (1992), El-Shimy et al (1993), El-Sweify (1993), Nada (1995) and Amany El-Refaie (1996).

All interaction combinations of the treatments under study had significant effect on seed yield per plants except with variety × sowing date which was not significant in the first season. It means that the

three factors studied depended on each other in affecting this character. It could be concluded that the maximum mean values of seed yield/plant of Giza8 variety were obtained by sowing on 25 Oct. combined with the lowest plant density of 1125 seeds /m^2. The mean values recorded were 1.82 and 2.21 g in the first and second seasons, respectively. while the minimum values were obtained by sowing on 5 Dec., at 1875 seeds / m^2, with averages of 1.26 and 1.45 g in the two successive seasons, respectively.

For Iriana variety, the highest mean values were obtained by sowing flax on 25 Oct. at plant density of 1125 seeds/m^2 with an average of 1.31 and 1.59g , respectively, while the lowest mean values were obtained when planting flax on 5 Dec., combined with 1875 seeds / m^2 with averages of 1.05 and 1.21 g in the two successive seasons , respectively .

The second order interaction indicated that the maximum seed yield / plant was 1.82 and 2.21g in the first and second seasons, respectively which was recorded with Giza8, sown on Oct.25 and seeded at 1125 seeds / m^2. On the other hand, the minimum seed yield was 1.26 and 1.45 g in 1995 / 96 and 1996 / 97 seasons, respectively, which was obtained by Iriana, sown on Dec.5 and seeded at 1875 seeds / m^2.

5- Seed index (g) :

Mean values of seed index as affected by sowing date and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 / 1997 are presented in Table (12).

Statistical analysis indicated significant differences between the two flax varieties i.e, Giza8 and Iriana as well as due to sowing date and plant density treatments in both seasons. .

For flax varieties, results revealed that the local variety Giza8 achieved a greater seed index and surpassed Iriana in both seasons. The mean values of this character for Giza8 were 8.25 and 8.62 g when compared with the lower mean values by Iriana which recorded 5.73 and 5.80 g in the two successive seasons, respectively. The present results agreed with those obtained by Kumar and Singh (1967), Remussi et al (1967), Momtaz et al (1980), Salama (1983), El-Kady (1985), El-Kady et al (1988), Salama (1988), Sorour et al (1988), Hella et al (1989), Momtaz et al (1989), El-Sweify (1993), Moawed (1996), and Abou Zaied (1997).

Concerning sowing dates effect, results showed a gradual reduction in seed index with delaying sowing date from 25 Oct. to 5 Dec. The estimates obtained were 7.33, 6.93 and 6.71 g in the first season and 7.45, 7.22 and 6.96 g in the second season for the three sowing dates 25 Oct., 15 Nov. and 5 Dec., respectively. The reduction in seed index due to delaying sowing date is mainly due to the reduced vegetative growth period which leads to a decrease in dry matter accumulation. Similar results were also reported by El-Nakhlawy et al (1978), El-Farouk et al (1980), El-Haroun et al (1982), Kwon et al

Table(12): Mean values of seed index (g) as affected by sowing dates and plant density of the ... varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96				1996/97			
		Plant density			Mean	Plant density			Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	8.39	8.39	8.35	8.37	8.87	8.75	8.31	8.64
	15 Nov.	8.29	8.27	8.27	8.28	8.86	8.72	8.29	8.62
	5 Dec.	8.14	8.12	8.10	8.12	8.85	8.66	8.28	8.59
Mean		8.27	8.25	8.24	8.25	8.86	8.71	8.29	8.62
Iriana	25 Oct.	6.40	6.28	6.19	6.29	6.37	6.27	6.11	6.25
	15 Nov.	5.95	5.81	5.04	5.60	5.94	5.87	5.67	5.83
	5 Dec.	5.46	5.32	5.14	5.31	5.47	5.33	5.16	5.32
Mean		5.94	5.80	5.45	5.73	5.93	5.82	5.65	5.80
Overall mean	25 Oct.	7.39	7.33	7.27	7.33	7.62	7.51	7.21	7.45
	15 Nov.	7.12	7.04	6.65	6.93	7.40	7.24	6.98	7.22
	5 Dec.	6.80	6.72	6.62	6.71	7.16	6.99	6.72	6.96
Mean		7.10	7.03	6.84	6.99	7.39	7.24	6.97	7.21

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.0820	0.0730
B (Sowing date)	0.0158	0.0367
C (Density)	0.0183	0.0425
A x B	0.1248	0.7675
A x C	0.0629	0.0824
B x C	0.0283	Ns
A x B x C	Ns	Ns

(1988), Abou Zaied (1991), Samui and Bondopadhyay (1992) and Moawed (1996) .

Results showed also that seed index decreased with the increase in plant density from 1125 to 2250 seeds/m^2. The mean values obtained were 7.10 , 7.03 and 6.84 g in the first season, corresponding to 7.39, 7.24 and 6.97 g in the second season for the plant density of 1125, 1500 and 1875 seeds/m2, respectively. The reduction in seed index due to the increase in population density is a result of the increase in the competition among growing plants for light, water and nutrients. Similar results were also reported by Horodyski and Sokolowski (1964), El-Farouk (1968), Gad and El-Farouk (1978), El-Farouk et al (1980), Zahran et al (1984), Salama (1988), El-Shimy et al (1993), El-Sweify (1993), Moawed (1996), and Amany El-Refaie (1996).

Variety × sowing date and variety × density interactions in both seasons in addition to sowing date × density in the first season had significant effect on seed index . On the other hand, the second order interaction had no significant effect on seed index in both seasons .

Results showed that the highest mean values of seed index for Giza8 variety were recorded by sowing on 25 Oct. combined with the lowest plant density of 1125 seeds /m^2 which recorded 8.39 and 8.87 g but the lowest mean values were obtained by sowing on 5 Dec. at 1875 seeds/m^2 with averages of 8.10 and 8.28 g in the first and second seasons, respectively. For Iriana variety, the highest mean values of seed index were obtained by sowing on 25 Oct. with plant density of 1125 seeds/m^2 with averages of 6.40 and 6.37 g, but the lowest mean values were obtained when planting on 5 Dec., combined with 1875

seeds/m^2 with averages of 5.04 and 5.16 g in the two successive seasons, respectively.

The previous results indicated that sowing on 25 Oct. (the earliest date) combined with the lowest plant density caused an increment in seed index in both seasons. Meanwhile , the latest sowing date combined with the highest plant density caused opposite trend.

6- Seed yield / faddan (kg) :

Mean values of seed yield / fad as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 /1997 are presented in Table (13) .

Analysis of variance indicated significant differences between the two flax varieties Giza8 and Iriana as well as due to sowing date and plant density treatments in both seasons.

Regarding flax varieties, results revealed that Giza8 variety was superior over Iriana in relation to seed yield / fad in both seasons. The mean values obtained by Giza8 were 589.77 and 677.07 kg / fad while the imported Iriana recorded 485.40 and 560.88 kg in the two successive seasons, respectively .

The present results indicated the superiority of Giza8 in seed yield over Iriana . The previous results showed that Giza8 was superior in number of capsules / plant , number of seeds / capsules , seed yield / plant and seed index , consequently a higher seed yield / fad is excepted . The present results agree with those obtained by El-Kalla and El-Kassaby (1982) , El-Kady et al (1988),

Table(13): Mean values of seed yield/fad (kg) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density 1125	1500	1875	1995/96 Mean	1996/97 Plant density 1125	1500	1875	1996/97 Mean
Giza 8	25 Oct.	586.50	617.23	639.45	614.39	663.50	709.70	735.38	702.86
	15 Nov.	546.90	587.50	623.93	586.11	628.90	675.57	717.45	673.97
	5 Dec.	512.55	584.28	609.68	568.83	589.95	672.05	701.10	654.37
Mean		548.65	596.33	624.35	589.77	627.45	685.77	717.97	677.07
Iriana	25 Oct.	493.85	506.18	523.18	507.73	568.00	582.15	601.63	583.93
	15 Nov.	477.80	494.35	496.60	489.58	549.47	568.52	571.10	563.03
	5 Dec.	448.33	470.35	457.98	458.88	519.35	540.92	546.80	535.69
Mean		473.33	490.29	492.58	485.40	545.61	563.86	573.18	560.88
Overall mean	25 Oct.	540.17	561.70	581.31	561.06	615.75	645.92	668.47	643.38
	15 Nov.	512.35	540.92	560.26	537.84	589.18	622.04	644.27	618.49
	5 Dec.	480.44	527.31	533.83	513.86	554.65	606.48	623.95	595.02
Mean		510.98	543.31	558.46	537.58	586.53	624.81	645.56	619.16

L.S.D. 0.05	1995/96	1996/97
A (Varities)	10.4760	15.4940
B (Sowing date)	6.5602	7.4239
C (Density)	7.1264	7.1798
A x B	Ns	Ns
A x C	12.9455	15.6100
B x C	Ns	Ns
A x B x C	17.4560	17.5870

Salama (1988), Sorour et al (1988), Hella et al (1989), Momtaz et al (1989), Kineber (1991), El-Shimy et al (1993), El-Sweify (1993), Sharief (1993), Samui et al (1995), El-Sweify (1996), Abou Zaied (1997) and El-Shimy et al (1997) .

Concerning sowing date effects, results showed a gradual decrement in seed yield / fad with delaying sowing date from 25 Oct. to 5 Dec. Seed yield per plant decreased from 561.06 to 513.86 kg / fad in the first season, and from 643.38 to 595.02 kg / fad in the second one as sowing date was delayed from Oct.25 to Dec. 5 .

The present results revealed that delaying sowing date after Oct.25 caused a remarkable reduction in seed yield per faddan, due to a reduction in the vegetative growth period . These findings are confirmed with those obtained by Mothur et al (1984), Sharma and Roy (1987), Kowen et al (1988), Samui and Bondopadhyay (1992) and Warma and Pothak (1993).

The results revealed that there was a gradual increase in seed yield per faddan when plant density increased from 1125 to 1875 seeds /m^2 with the mean values of 510.98, 543.31 and 558.46 kg / fad. for the plant densities of 1125, 1500 and 1875 seeds /m^2 in the first season, respectively, corresponding to 586.53, 624.81 and 645.56 kg / fad in the second season. In spite of the decrease in seed yield per plant (g) with increasing plant density per unit area, but an opposite trend had happened in seed yield / faddan due to the greater number of flax plants per unit area with increasing plant density which compensates the reduction in seed yield / plant. Similar results were reported by Mokhtar (1965), El-Farouk (1968), El-Nakhlawy (1975),

El-Nakhlawy et al (1978), Vasilica and Vasilica (1979), Momtaz et al (1980), Zahran et al (1984), El-Shimy et al (1985), Hella et al (1986), Hassan and El-Farouk (1987), Salama (1983), Kwon et al (1988), Subotinas (1991), Bassi and Badiyala (1992), Nada (1995) and Amany El-Refaie (1996) .

The interaction between variety and densities as well as the second order interaction had significant effect on seed yield / fad, but variety × sowing date as well as sowing date × density had insignificant effect in both seasons. It could be concluded that the highest mean values of this character were obtained by Giza8 variety when flax was sown on 25 Oct., combined with the highest plant density of 1875 seeds /m^2 with the mean values of 639.45 and 735.38 kg / fad in the first and second seasons, respectively. On the other hand, the lowest mean values were obtained by sowing flax on 5 Dec. at 1125 seeds /m^2 with the averages of 512.55 and 589.95 kg / fad in the two successive seasons, respectively. Iriana variety yielded its maximum mean values (523.18 and 601.63 kg seeds faddan) by sowing flax on 25 Oct. at plant density of 1875 seeds /m^2, but the lowest mean values were obtained when planting flax on 5 Dec. combined with 1125 seeds/fad with averages of 448.33 and 519.35 kg/fad in the two successive seasons, respectively.

The second order interaction indicated that the maximum seed yield / fad was 639.45 and 735.38 kg in the first and second seasons, respectively which was recorded by Giza8, sown on Oct.25 and seeded at 1875 seeds /m^2.

On the other hand, the minimum seed yield / fad was obtained by Iriana sown on Dec.5 at 1125 seeds / m^2, being 448.33 and 519.35 kg in 1995 / 1996 and 1996 / 1997 seasons, respectively.

Generally, it can be concluded that there are significant differences between the two flax varieties, Giza8 and Iriana in all seed characters studied in both seasons except with number of capsules / plant and apical branching zone length in the second season where the differences did not reach the level of significant. The local flax variety Giza8 was superior to the imported Iriana in all seed yield and its components i.e., number of capsules / plant, number of seeds / capsule, apical branching zone length seed index and seed yield / plant as well as per faddan.

There are considerable reductions in all seed characters previously mentioned as affected by delaying sowing date. In addition the three sowing dates (25 Oct., 15 Nov. and 5 Dec) significantly differed in their effect on seed traits in both seasons except with the apical branching zone length which was not significantly affected in the second season .

Concerning plant density effect, most of seed characters under study were significantly affected by the three plant densities i.e, 1125,1500 and 1875 seeds /m^2, except with the apical branching zone length which was not significantly affected in the second season Moreover, the mean values of these characters decreased with increasing plant density towards the highest seed rate. On the other hand, seed yield / faddan was increased with increasing plant density .

III. Technological Characters :

1 - Fiber length (cm):

Mean values of fiber length as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 / 1997 are presented in Table (14) .

Analysis of variance indicated significant differences between the two flax varieties i.e, Giza8 and Iriana as well as due to sowing date and plant density treatments in both seasons .

Regarding flax varieties, results revealed that Iriana was superior over Giza8 in fiber length character in both seasons. The mean values obtained by Iriana were 73.83 and 86.94 cm compared with the shorter mean values obtained by Giza8 which recorded 60.78 and 71.56 cm in the two successive seasons, respectively. These results indicated that Iriana is superior as fiber flax variety. The results agree with those obtained by Salama (1983), Hella et al (1986), El-Kady et al (1988), Salama (1988), El-Gazzar (1990), Kineber (1991), El-Sweify (1993), El- Sweify and Mostafa (1996), Moawed (1996), Abou Zaied (1997) and El-Shimy et al (1997) .

Concerning sowing dates effect, fiber length was decreased from 69.97 to 64.61 cm in the first season and from 81.66 to 76.03 cm in the second one when sowing was delayed from Oct.25 to Dec.5, respectively. It is clear that delaying sowing date after Oct.25 caused a remarkable reduction in fiber length. This result is due to the good effects of a longer growth period on fiber formation. Similar results were obtained by El- Farouk et al (1980), Samia Hassan and El-Farouk

Table(14): Mean values of fiber length (cm) as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			1995/96 Mean	1996/97 Plant density			1996/97 Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	61.33	62.91	65.10	63.11	70.52	73.67	77.67	73.95
	15 Nov.	59.49	61.56	61.89	60.96	68.66	72.53	74.40	71.86
	5 Dec.	57.53	58.53	58.75	58.27	67.18	69.22	70.23	68.88
Mean		59.45	61.00	61.91	60.78	68.79	71.81	74.10	71.56
Iriana	25 Oct.	73.21	77.16	80.16	76.84	83.44	90.17	94.53	89.38
	15 Nov.	69.72	73.47	77.96	73.72	82.43	87.61	94.69	88.24
	5 Dec.	63.85	72.90	76.11	70.95	76.42	84.42	88.74	83.19
Mean		68.92	74.51	78.07	73.83	80.76	87.40	92.65	86.94
Overall mean	25 Oct.	67.27	70.03	72.63	69.97	76.98	81.92	86.10	81.66
	15 Nov.	64.58	67.51	69.92	67.36	75.54	80.07	84.54	80.05
	5 Dec.	60.69	65.71	67.43	64.61	71.80	76.82	79.48	76.03
Mean		64.18	67.76	69.99	67.31	74.77	79.60	83.37	79.25

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.7990	0.6490
B (Sowing date)	0.5198	0.3633
C (Density)	0.4452	0.3132
A x B	Ns	0.7224
A x C	0.8828	0.6665
B x C	1.0910	0.7670
A x B x C	0.7188	0.5050

(1982), Kwoen et al (1988) and Moawed (1996).

The results indicated also that fiber length increased with increasing plant density per unit area (from 1125 to 1875 seeds/m^2), with the measurements of 64.18, 67.76 and 69.99 cm in the first season, and 74.77, 79.60 and 83.37 cm in the second season for the three plant densities of 1125, 1500 and 1875 seeds/m^2 , respectively. It is quite evident that dense planting increased plant height, technical length and consequently fiber length should by increased. The increase in population density led to the elongation of plants searching for light as a result of the greater competition among growing plants. The present results are in agreement with those obtained by Gad and El-Farouk (1978), El-Shimy et al (1985), Hella et al (1988), Hassan and El-Farouk (1987), Salama (1988), Abd-Alla et al (1989), Easson and Long (1992), El-Shimy et al (1993), El-Sweify (1993), Mahmoud (1993) and Amany El-Refaie (1996).

Statistical analysis indicated thet all interactions between the experimental factors had significant effects on fiber length with one exception between variety and sowing date in the first season. It could be concluded that the highest mean values of fiber length for Giza8 variety were obtained by sowing on 25 Oct. combined with the highest plant density of 1875 seeds/m^2 (65.10 and 77.67 cm) but the lowest mean values were obtained by sowing flax on 5 Dec. at 1125 seeds/m^2 with averages of 57.53 and 67.18 cm, in the first and second seasons, respectively. The corresponding mean values of this character obtained by Iriana variety were 80.16 and 94.69 cm for the tallest fiber length and 63.85 and 76.42 cm for the shortest length in the first and

second seasons, respectively. The second order interaction indicated that the longest fibers were produced by Iriana sown on Oct.25 and seeded at 1875 seeds /m^2, being 80.16 and 94.69 cm in the first and second seasons, respectively.

On the other hand, the shortest fibers were obtained by Giza8 sown on Dec.5 and seeded at 1125 , being 57.53 and 67.18 cm in 1995 /1996 and 1996 / 1997 seasons, respectively .

2- Long fiber percentage:

Mean values of long fiber percentage as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996 / 1997 are presented in Table (15).

Analysis of variance indicated significant differences between the two flax varieties as well as due to sowing date and plant density treatments in both seasons.

Regarding flax varieties, results revealed that Iriana was superior over Giza8 in long fiber percentage character in both seasons. The mean values obtained by Iriana were 12.79 and 12.83 % while the corresponding values of Giza8 recorded 10.90 and 12.27 % in the two successive seasons, respectively. These findings are in harmony with those obtained by El-Kalla and El-Kassaby (1982), Salama (1988), Momtaz et al (1989), El-Gazzar (1990), El-Sweify (1993), El- Sweify and Mostafa (1996) , Moawed (1996), Abou Zaied (1997) and El-Shimy et al (1997) .

Table(15): Mean values of long fiber percentage as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			Mean	1996/97 Plant density			Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	11.76	12.03	12.65	12.15	12.95	13.03	13.27	13.08
	15 Nov.	10.51	10.94	11.50	10.98	12.03	12.52	12.75	12.43
	5 Dec.	9.34	9.54	9.84	9.57	10.73	11.33	11.85	11.30
Mean		10.54	10.83	11.33	10.90	11.90	12.29	12.62	12.27
Iriana	25 Oct.	13.80	13.95	13.98	13.91	13.62	13.84	13.94	13.80
	15 Nov.	12.15	13.04	13.60	12.93	12.07	12.28	13.17	12.51
	5 Dec.	11.17	11.50	11.89	11.52	11.67	12.21	12.71	12.20
Mean		12.37	12.83	13.15	12.79	12.45	12.78	13.27	12.83
Overall mean	25 Oct.	12.78	12.99	13.31	13.03	13.28	13.43	13.61	13.44
	15 Nov.	11.33	11.99	12.55	11.96	12.05	12.40	12.96	12.47
	5 Dec.	10.25	10.52	10.86	10.54	11.20	11.77	12.28	11.75
Mean		11.45	11.83	11.78	11.84	12.18	12.53	12.95	12.55

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.0490	0.0510
B (Sowing date)	0.0501	0.0321
C (Density)	0.0291	0.0299
A x B	0.0811	0.0605
A x C	0.0554	0.0573
B x C	0.0517	0.0476
A x B x C	0.0710	0.0730

Concerning sowing dates effect, results showed decrement in long fiber percentage from 13.03 to 10.54 % in the first season and from 13.44 to 11.75 % in the second one, respectively with delaying sowing date from 25 Oct. to 5 Dec. It is clear that delaying sowing date after Oct.25 caused a remarkable reduction in long fiber percentage, probably due to the reduction in the vegetative growth period. The present results agree with those obtained by Kwon et al (1988).

The results showed also that the long fiber percentage increased with increasing plant density per unit area (from 1125 up to 1875 seeds /m^2). Long fiber % were 11.45, 11.83 and 11.78 % in the first season, being 12.18, 12.53 and 12.95 % in the second season for the three plant densities of 1125, 1500 and 1875 seeds/m^2, respectively. Similar results were also obtained by El-Farouk (1968), Momtaz et al (1981), Salama (1988), Dolgikh (1992) El-Shimy et al (1993), El-Sweify (1993), Mahmoud (1993), Nada (1995) and Amany El-Refaie (1996).

All interaction combinations of the experimental factors under study had significant effect on long fiber percentage. It could be concluded that the highest ratios in this character for Giza8 variety were obtained by sowing on 25Oct. combined with the maximum plant density of 1875 seeds/m^2 (12.65 and 13.27 %) and the lowest percentages were obtained by sowing flax on 5 Dec. at 1125 seeds/m^2 with averages of 9.34 and 10.73 % in the two successive seasons, respectively. The same treatments which recorded either maximum long fiber percentages or minimum estimates for Giza8 occurred also

with Iriana variety, with the maximum values of 13.98 and 13.94 %, but the minimum values were 11.17 and 11.67 % in the two successive seasons, respectively .

3- Fiber fineness (N m):

Mean values of fiber fineness as affected by sowing dates and plant density of the two flax varieties in two successive seasons 1995 / 1996 and 1996 / 1997 are presented in Table (16) .

Statistical analysis indicated significant differences between the two flax varieties i.e, Giza8 and Iriana as well as due to sowing dates and plant density treatments in both seasons .

Regarding flax varieties, the imported Iriana was superior over Giza 8 in relation to fiber fineness in both seasons, with the mean values of 188.85 Nm in the first season and 193.93 Nm in the second one when compared with the lower mean values obtained by Giza8 which recorded 174.95 and 179.02 Nm in two successive seasons, respectively. The present results agreed with those obtained by Salama (1983), Hella et al (1986), El-Kady et al (1988), Salama (1988). El-Gazzar (1990) Kineber (1991), El-Sweify (1993), Moawed (1996) and Abou Zaied (1997).

Concerning sowing dates effect, results showed a gradual increase in fiber fineness with delaying sowing date from 25 Oct. to 5 Dec. with the estimates of 171.45 to 190.34 (Nm) in the first season and from 176.75 to 193.45 (Nm) in the second one .These findings are

Table(16): Mean values of fiber fineness (Nm) as affected by sowing dates and plant density of the two ... varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			1995/96 Mean	1996/97 Plant density			1996/97 Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	161.43	164.43	169.50	165.12	164.35	168.07	172.82	168.41
	15 Nov.	174.46	176.78	179.02	176.75	180.49	182.72	183.75	182.32
	5 Dec.	181.18	183.15	184.64	182.99	181.37	189.45	188.19	186.33
Mean		172.35	174.79	177.72	174.95	175.40	180.08	181.58	179.02
Iriana	25 Oct.	175.74	177.85	179.81	177.81	181.14	184.73	189.41	185.09
	15 Nov.	187.25	191.09	194.87	191.07	194.63	194.85	198.95	196.14
	5 Dec.	196.19	197.44	199.48	197.70	200.05	200.05	201.60	200.57
Mean		186.39	188.79	191.38	188.85	191.94	193.21	196.65	193.93
Overall mean	25 Oct.	168.58	171.14	174.65	171.45	172.74	176.40	181.11	176.75
	15 Nov.	180.85	183.93	186.94	183.91	187.56	188.78	191.35	189.23
	5 Dec.	188.68	190.29	192.06	190.34	190.71	194.75	194.89	193.45
Mean		179.37	181.79	184.55	181.90	183.67	186.64	189.11	186.45

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.8920	1.3340
B (Sowing date)	0.5450	1.6526
C (Density)	0.6080	1.4212
A x B	1.0425	Ns
A x C	Ns	2.2732
B x C	1.4890	3.4810
A x B x C	0.9420	2.2925

in harmony with those obtained by Kwon et al (1988) and Moawed (1996) .

Results showed also that finer fibers were obtained by increasing plant density from 1125 to 1875 seeds /m^2. The mean values obtained were 179.37, 181.79 and 184.55 (Nm) in the first season while in the second one the estimates were 183.67,186.64 and 189.11 (Nm) for the plant density of 1125,1500 and 1875 seeds /m^2 respectively. The same trend was observed by El-Farouk (1968), Momtaz et al (1981), El-Shimy et al (1985), Hella et al (1986), Hassan and El-Farouk (1987), Salama (1988), Abd-Alla et al (1989), El-Sweify (1993), Mahmoud (1993) and Nada (1995) .

All interaction combinations had significant effect on fiber fineness character except with the interactions between variety and sowing date in the second season in addition to variety × density interaction in the first one which did not reach the level of significance. Results showed that the highest mean values were obtained by sowing on 5 Dec. combined with the highest plant density of 1875 seeds /m^2 which recorded 184.64 and 189.45 (Nm), but the lowest mean values were obtained by sowing on 25 Oct . at 1125 seeds/m^2 with averages of 161.43 and 164.35 (Nm) in the two successive seasons, respectively. For Iriana variety, the highest mean values of fiber fineness were obtained by sowing on 5 Dec. with plant density of 1875 seeds/m^2, with averages of 199.48 and 201.60 (Nm), but the lowest mean values were obtained when flax was sown on 25 Oct . at 1125 seeds/m^2 ,with averages of 175.74 and 181.14 (Nm) in the two successive seasons respectively.

The second order interaction indicated that the maximum fineness was 199.48 and 201.60 Nm in the first and second seasons respectively , which were recorded with Iriana sown on 5 Dec and seeded at 1875 seeds/m^2 .

On the other hand , the minimum fineness was recorded by Giza8 sown on Oct.25 at 1125 seeds /m^2 , being 161.43 and 164.35 Nm in 1995 / 1996 season, respectively .

4- Oil percentage:

Mean values of oil percentage as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995 / 1996 and 1996/ 1997 are presented in Table (17) .

Statistical analysis indicated significant differences between the two flax varieties i.e Giza8 and Iriana as well as due to sowing date and plant density treatments in both seasons .

Giza8 variety recorded higher oil percentages and surpassed Iriana in the two successive seasons, the mean values obtained by Giza8 were 41.96 % in the first season and 42.00 % in the second one when compared with the lower mean values of oil percentage obtained by Iriana which recorded 36.98 and 37.13 % in the two successive seasons, respectively. These results which appeared as varietal differences are due to the genetical make up for each flax genotype. The above mentioned results agreed with those obtained by Gupta et al (1964), Hassan (1969), Robles (1979), Momtaz et al (1989), El-Gazzar (1990), El-Sweify (1993) and Abou Zaied (1997).

Table(17): Mean values of oil percentage as affected by sowing dates and plant density of the two flax varieties in the two successive seasons 1995/96 and 1996/97

Varieties	Sowing dates	1995/96 Plant density			Mean	1996/97 Plant density			Mean
		1125	1500	1875		1125	1500	1875	
Giza 8	25 Oct.	42.87	42.49	42.20	42.52	42.94	42.51	42.22	42.56
	15 Nov.	42.84	42.46	42.17	42.48	42.89	42.47	42.19	42.52
	5 Dec.	41.39	40.94	40.31	40.88	41.41	40.97	40.40	40.93
Mean		42.36	41.96	41.56	41.96	42.41	41.98	41.60	42.00
Iriana	25 Oct.	37.96	37.84	37.34	37.71	37.98	37.86	37.34	37.73
	15 Nov.	37.44	37.20	37.30	37.31	38.02	37.73	37.31	37.68
	5 Dec.	36.81	35.69	35.25	35.92	36.87	35.74	35.32	35.98
Mean		37.40	36.91	36.63	36.98	37.62	37.11	36.65	37.13
Overall mean	25 Oct.	40.41	40.15	39.77	40.11	40.46	40.18	39.78	40.14
	15 Nov.	40.14	39.83	39.73	39.90	40.45	40.10	39.75	40.10
	5 Dec.	39.10	38.31	37.78	38.39	39.14	38.35	37.86	38.45
Mean		39.88	39.43	39.09	39.47	40.02	39.54	39.13	39.56

L.S.D. 0.05	1995/96	1996/97
A (Varities)	0.1080	0.1430
B (Sowing date)	0.0963	0.0824
C (Density)	0.0814	0.0876
A x B	Ns	Ns
A x C	Ns	Ns
B x C	0.1318	0.1368
A x B x C	0.1490	0.2150

Concerning sowing dates effect, results showed a remarkable reduction in oil percentage with delaying sowing date from 25 Oct. to 5 Dec. Delaying sowing from Oct.25 to Nov.15 and 5 Dec. reduced oil % from 40.11 to 39.90 and 38.39 % in the first season, and from 40.14 to 40.10 and 38.45 % in the second season, respectively.

Similar results were also reported by El-Haroun et al (1982) and Kwon et al (1988) .

The results showed also that oil percentage decreased with increasing plant density from 1125 up to 1875 seeds/m^2 in both seasons .

The mean values obtained were 39.86, 39.43 and 39.09 % in the first season, corresponding to 40.02, 39.54 and 39.13 % in the second season for the plant density of 1125, 1500 and 1875 seeds/m^2 , respectively. Similar results were also reported by El-Nakhlawy (1975), Gad and El-Farouk (1978), Momtaz et al (1980), Hella et al (1986), Salama (1988), Abd-Alla (1989), Kwon et al (1988), Khalil (1990) Mostafa (1990), El-Shimy et al (1993), El-Sweify (1993) and Mahmoud (1993) .

The results indicated that sowing date × density interaction as well as the second order interaction (variety × sowing date × density) significantly affected oil % in both seasons .

Sowing date × density interaction showed that the effect of density on oil % was more evident with the delayed sowing on 5 Dec. and with early sowing on Oct.25. The highest oil % was 40.41 and 40.46 % in the first and second seasons , respectively which was recorded

with sowing on Oct.25 and seeding with 1125 seeds /m^2 . On the other hand , the lowest oil % was recorded when sowing was on 5 Dec. at 1875 seeds/m^2 , being 37.78 and 37.86 % in 1995 / 1996 and 1996 / 1997 seasons, respectively .

The second order interaction indicated that the maximum oil % was 42.87 and 42.94 % in the first and second seasons, respectively. which were recorded with Giza8 sown on Oct.25 and seeding with 1125 seeds /m^2 . On the other hand, the minimum oil % was obtained by Iriana sown on 5 Dec. and seeding with at 1875 seeds/m^2 , being 35.25 and 35.32 % in 1995 / 1996 and 1996 / 1997 seasons, respectively .

Generally:

The above mentioned technological characters showed significant differences between the two flax varieties i.e., Giza8 and Iriana in both seasons. The imported Iriana surpassed the other variety in fiber length, long fiber percentage and fiber fineness (fiber characters) . On the other hand, Giza8 variety was superior in seed oil percentage .

For sowing dates effect, data indicated that the earliest date (25 Oct.) achieved best technological results in comparison with the later two sowing dates under study, but fiber fineness character showed opposite trend where it increased with delaying sowing towards the latest date (5 Dec). This behavior may be due to that flax fiber cells having fewer cellulosic layers which precipitated in secondary cell walls, because the flax plants having shorter growth period .

There are significant differences occurred among the three plant densities in all technological characters studied in both seasons. Mean values of the fiber fineness increased with increasing plant density up to the highest rate per unit area (1875 seeds /m^2) On the other hand , seed oil percentage was reduced when plant density increased .

SUMMARY

A STUDY ON THE EFFECT OF SOME ENVIRONMENTAL FACTORS ON THE PRODUCTIVITY OF SOME FLAX VARIETIES

A field experiment was conducted in Gemmiza Agricultural Research Station in 1995/1996 and 1996 /1997 seasons to study the response of two flax varieties to sowing dates, planting density and their interactions .

The two varieties were : the local dual purpose variety "Giza8" and the introduced fiber flax type " Iriana ".

Sowing dates were: Oct.25, Nov.15 and Dec.5. Planting densities included seeding 1125,1500 and 1875 seeds / m^2, represented seeding rates of 45,60 and 75 kg /fad for Giza8 corresponding to 24 ,32 and 40 kg/ fad for Iriana .

A spilt- spilt plot design in four replications was used, the main plots were randomly assigned to the two varieties, the sub plots to sowing dates and the sub-sub plots to plant densities.

Data on straw, fiber and seed yields as well as their related characters were collected.

Technological characters were also considered Results could be summarized as follows :

1- Iriana variety significantly surpassed Giza 8 in plant height, technical stem length, straw yield /plant, straw yield/ fad and fiber yield /fad in both seasons.

On the other hand, Giza 8 was of thicker stem diameter compared with Iriana.

2- Giza 8 produced greater number of capsules/ plant and more seeds number/capsules than Iriana in both seasons .

On the other hand , Iriana variety significantly surpassed Giza8 in apical branching zone length in both seasons .

3- Giza 8 significantly surpassed Iriana in seed yield / plant, seed index, seed yield/ fad and oil percentage in both seasons .

4- Iriana variety as a fiber flax type was superior in fiber length, long fiber percentage and fiber fineness compared with Giza 8 in both seasons .

5- Early planting of flax on Oct.25 favorably affected plant height, technical stem length, stem diameter, straw yield/ plant as well as per fad, number of capsules/ plant, number of seeds/capsules, apical branching zone length, seed yield/ plant, seed yield fad and seed index compared with late sowing on Nov.15 and Dec.5 in both seasons of experimentation.

6- Technological characters of fibers were positively affected by early sowing on Oct.25 where significant increases were recorded in fiber length, long fibers percentage and fiber fineness compared with delayed sowing .

7- Oil percentage was significantly increased by earlier sowing on Oct.25 compared with late sowing in both seasons.

8- Increasing planting density from 1125 to 1500 and 1875 seeds/ m^2 significantly increased total plant height, technical stem length, straw yield /fad, fiber yield /fad and seed yield/ fad in both seasons.

9- On the other hand , increasing planting density significantly reduced stem diameter, straw yield/ plant, number of capsules/ plant, number of seeds / capsule , seed yield / plant and seed index in both seasons .

10- Fiber length, long fibers percentage and fiber fineness were positively affected by dense planting where significant increases were recorded due to increasing number of seeds/ m^2 to 1875 seeds/ m^2 .

On the other hand oil % was reduced due to intensive planting in both seasons.

11- The effect of the interactions between the experimental factors significantly affected many of the studied characters as shown in Tables 18 and 19 where a summary indicating the highest response values, significance and combination of factors of the interaction effects on the studied characters of flax in both seasons. It was evident that the best combination for producing the highest straw and fiber yields of the best technological characters was achieved by growing Iriana variety early on Oct.25 at the highest planting density of 1875 seeds / m^2. For producing the highest seed and oil yield, the results

indicated that growing Giza8 variety on Oct.25 at 1875 seeds / m^2 is recommended.

Table (18) : Highest response value, significance and combination of factors of the interaction effects on the studied characters of flax in 1995 / 1996 season .

Characters	Interactions			
	Variety × Dates	Variety × Density	Dates × Density	Variety × Dates × Density
Total plant height (cm)	* 98.35 Iriana, Oct.25	* 99.41 Iriana, 1875/m^2	*92.61 Oct.25, 1875/m^2	*101.85 Iriana. Oct.25, 1875/m^2
Technical stem length (cm)	* 78.95 Iriana , Oct.25	* 78.89 Iriana,1875/m^2	* 74.36 Oct.25, 1875/m^2	* 81.90 Iriana / Oct.25, 1875/m^2
Main stem diameter (mm)	2.80 NS Giza8, Oct.25	* 2.87 Giza8 ,1125/m^2	2.50 NS Oct.25, 1125/m^2	2.90 NS Giza8 , Oct.25,1125/m^2
Straw yield / plant (g)	3.29 NS Iriana, Oct.25	* 3.34 Iriana, 1125/m^2	* 3.11 Oct.25, 1125/m^2	* 3.42 Iriana, Oct.25,1125/m^2
Straw yield / fad (t)	3.61 NS Iriana, Oct.25	* 3.67 Iriana, 1875/m^2	* 3.42 Oct.25 1875/m^2	* 3.76 Iriana, Oct.25,1875/m^2
Fiber yield/ fad (kg)	465.64 NS Iriana, Oct.25	* 482.52 Iriana, 1875/m^2	*425.46 Oct.25, 1875/m^2	*501.09 Iriana, Oct.25,1875/m^2
Number of capsules / plant	* 9.66 Giza8, Oct.25	10.12 NS Giza8,1125/ m^2	10.35 NS Oct.25,1125/m^2	12.83NS Giza8 Oct.25,1125/m^2
Number of seeds / capsule	8.58 NS Giza 8 , Oct.25	8.11 NS Giza8, 1125/m^2	8.80 NS Oct.25,1125/m^2	9.65 NS Giza8, Oct.25,1125/m^2
Apical branching zone length (cm)	19.65 NS Iriana, Oct.25	* 20.52 Iriana, 1875/m^2	* 19.38 Oct.25, 1125/m^2	* 22.16 Iriana, Oct.25,1875/m^2
Seed yield / plant (g)	1.71 NS Giza8, Oct.25	* 1.77 Giza8,1125 /m^2	* 1.56 Oct.25, 1125/m^2	* 1.82 Giza8, Oct.25,1125/m^2
Seed index (g)	* 8.37 Giza8,Oct.25	*8.27 Giza8, 1125/m^2	* 7.39 Oct.25,1125/m^2	8.39 NS Giza8, Oct.25,1125/m^2
Seed yield / fad (kg)	614.39 NS Giza8,Oct.25	* 624.35 Giza8, 1875/m^2	581.31 NS Oct.25,1875/m^2	* 639.45 Giza8, Oct.25,1875/m^2
Fiber length	76.84 NS Iriana, Oct.25	* 78.07 Iriana, 1875/m^2	* 72.63 Oct.25 1875/m^2	* 80.16 Iriana, Oct.25, 1875/m^2
Long fiber percentage	* 13.91 Iriana , Oct.25	* 13.15 Iriana, 1875/m^2	* 13.31 Oct.25,1875/m^2	* 13.98 Iriana, Oct.25,1875/m^2
Fiber fineness (Nm)	* 197.70 Iriana, Dec.5	191.38 NS Iriana, 1875/m^2	* 192.06 Dec.5, 1875/m^2	*199.48 Iriana, Dec.5, 1875/m^2
Oil percentage (%)	42.52 NS Giza8,Oct.25	42.36 NS Giza8, 1125/m^2	* 40.41 Oct.25,1125/m^2	* 42.87 Giza8, Oct.25,1125/m^2

Table (19) : Highest response value, significance and combination of factors of the interaction effect on the studied characters of flax in 1996 / 1997 season .

Characters	Interactions			
	Variety × Dates	Variety × Density	Dates × Density	Variety × Dates × Density
Total plant height (cm)	* 110.79 Iriana, Oct.25	* 114.50 Iriana, 1875/m^2	* 107.93 Oct.25, 1875/m^2	* 117.25 Iriana, Oct.25, 1875/m^2
Technical stem length (cm)	* 91.41 Iriana, Oct.25	* 94.71 Iriana, 1875/m^2	* 88.00 Oct.25, 1875/m^2	* 96.79 Iriana Oct.25, 1875/m^2
Main stem diameter (m.m)	*3.29 Giza8, Oct.25	*3.37 Giza8,1125/m^2	3.27 NS Oct.25,1125/m^2	3.46 NS Giza8, Oct.25,1875/m^2
Straw yield / plant (g)	3.82 NS Iriana, Oct.25	* 3.84 Iriana, 1125/m^2	3.63 NS Oct.25,1125/m^2	* 4.01 Iriana, Oct.25, 125/m^2
Straw yield / fad (t)	4.23 NS Iriana, Oct.25	* 4.32 Iriana, 1875/m^2	4.04 NS Oct.25,1875/m^2	* 4.45 Iriana, Oct.25,1875/m^2
Fiber yield fad (kg)	* 535.11 Iriana, Oct.25	* 535.76 Iriana, 1875/m^2	* 507.89 Oct.25,1875/m^2	* 580.77 Iriana, Oct.25,1875/m^2
Number of capsules / plant	11.90 NS Giza8,Oct.25	13.27 NS Giza8, 1125/m^2	* 13.69 Oct.25,1125/m^2	16.05 NS Giza8 Oct.25,1125/m^2
Number of seeds / capsule	8.48 NS Giza8, Oct.25	*9.32 Giza8, 1125/m^2	8.44 NS Oct.25,1125/m^2	9.48 NS Giza8, Oct.25,1125/m^2
Apical branching zone length (cm)	19.37 NS Iriana, Oct.25	19.77 NS Iriana, 1875/m^2	20.45 NS Oct.25,1125/m^2	20.46 NS Iriana, Oct.25,1875/m2
Seed yield / plant (g)	* 2.02 Giza8, Oct.25	* 2.11 Giza8, 1125/m^2	* 1.90 Oct.25,1125/m^2	* 2.21 Giza8, Oct.25,1125/m^2
Seed index (g)	* 8.64 Giza8, Oct.25	* 8.86 Giza8, 1125/m^2	7.62 NS Oct.25,1125/m^2	8.87 NS Giza8, Oct.25,1125/m^2
Seed yield / fad (kg)	702.86 NS Giza8, Oct.25	* 717.97 Giza8, 1875/m^2	668.47 NS Oct.25, 1875/m^2	* 735.38 Giza8, Oct.25,1875/m^2
Fiber length (cm)	* 89.38 Iriana, Oct.25	* 92.65 Iriana, 1875/m^2	* 86.10 Oct.25,1875/m^2	* 94.53 Iriana, Oct.25,1875/m^2
Long fiber percentage	* 13.80 Iriana ,Oct.25	* 13.27 Iriana, 1875/m^2	* 13.61 Oct.25,1875/m^2	* 13.94 Iriana, Oct.25,1875/m^2
Fiber fineness (Nm)	200.57 NS Iriana, Dec.5	* 196.65 Iriana, 1875/m^2	* 194.89 Dec.5, 1875/m^2	* 201.60 Iriana. Dec.5, 1875/m^2
Oil percentage (%)	42.56 NS Giza8, Oct.25	42.41 NS Giza8, 1125/m^2	* 40.46 Oct.25,1125/m^2	* 42.94 Giza8, Oct.25,1125/m^2

ACKNOWLEDGEMENT

It gives me immense pleasure to express my deep sense of gratitude to ***Dr. Salah El-Din A. Shafshak*** *professor of Agronomy, Faculty of Agric. Moshtohor, Zagazig University for his supervisions, valuable advice and continuous help during this investigation.*

The writer wishes to express her appreciation and gratitude to ***prof. Dr. Gamal M. Shams El-Din****, Agronomy Department, Faculty of Agric. Moshtohor, Zagazig University for his supervision valuable advice and continuous help during this investigation and preparation of the manuscript.*

Thanks are also due to ***prof. Dr. M. El-Farouk****, Director of Fiber Crops Research Section, Agricultural Research Center for suggesting the problem, supervision and continuous help through the experimental work and the preparation of this manuscript.*

Sincere thanks are also due to ***prof. Dr. G.H. El-Shimy*** *and the staff members of Fiber Crops Research Section, A.R.C., for their valuable advice, continuous help during this work.*

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الملخص العربى

" دراسة عن تأثير بعض العوامل البيئية على إنتاجية بعض أصناف الكتان"

أجريت تجربة حقلية فى محطة البحوث الزراعية بالجميزة خلال الموسمين الزراعيين ١٩٩٥/١٩٩٦ , ١٩٩٦/١٩٩٧ وذلك لدراسة استجابة صنفين من الكتان لمواعيد الزراعة والكثافة النباتية والتفاعل بينها . وقد استخدم صنف الكتان جيزة ٨ (صنف محلى ثنائى الغرض) والصنف ايريانا (صنف مستورد وطراز ليفى) وكانت مواعيد الزراعة فى ٢٥ أكتوبر , ١٥ نوفمبر , ٥ ديسمبر وكثافة النباتات هى ١١٢٥ , ١٥٠٠ , ١٨٧٥ بذرة / متر مربع حيث أن هذه الكثافات تعادل ٤٥ , ٦٠ , ٧٥ كيلوجرام / فدان للصنف جيزة ٨ فى حين كانت للصنف ايريانا ٢٤ , ٣٢ , ٤٠كيلوجرام / فدان على التوالى .

استخدم التصميم التجريبى للقطع المنشقة مرتين ذات الأربع مكررات وقد خصصت القطع الرئيسية لصنفى الكتان والقطع الشقية الأولى لمواعيد الزراعة والقطع الشقية الثانية للكثافة النباتية .

تضمنت الدراسة تقدير كمية محصول القش والألياف والبذور والصفات المرتبطة بها بالإضافة الى الصفات التكنولوجية .

وفيما يلى ملخص للنتائج المتحصل عليها :

١. تفوق الصنف ايريانا معنويا على الصنف جيزة ٨ فى صفات طول النبات , الطول الفعال , محصول القش / نبات , محصول القش / فدان , محصول الألياف / فدان فى كلا الموسمين . وعلى الجانب الآخر فقد تفوق الصنف جيزة ٨ فى صفة سمك النبات حيث كانت نباتاته اسمك بالمقارنة بالصنف ايريانا .

٢. أعطى الصنف جيزة ٨ تقديرات أعلى من الصنف ايريانا فى كل من عدد الكبسولات / نبات وعدد البذور / كبسولة . بينما تفوق الصنف ايريانا على الصنف جيزة ٨ بفرق معنوى فى صفة طول منطقة التفريع القمى فى كلا الموسمين.

٣. تفوق الصنف جيزة ٨ معنويا على الصنف ايريانا فى محصول البذرة / نبات , ودليل البذرة (وزن الألف بذرة / جم) , محصول البذور / فدان , النسبة المئوية للزيت فى كلا الموسمين تحت الدراسة .

٤. تفوق الصنف ايريانا (صنف ليفى) على الصنف جيزة ٨ فى طول الألياف , النسبة المئوية للألياف الطويلة , نعومة الألياف فى كلا الموسمين .

٥. الزراعة المبكرة للكتان كان لها تأثير ايجابي على طول النبات , الطول الفعال , سمك الساق , محصول القش / نبات , محصول القش / فدان , عدد الكبسولات / نبات , عدد بذور الكبسولة , طول المنطقة الثمرية , محصول البذور / نبات و للفدان , دليل البذرة (وزن الألف بذرة) وذلك بالمقارنة بميعادى الزراعة فى ١٥ نوفمبر , ٥ ديسمبر فى كلا موسمى الزراعة .

٦. تأثرت الصفات التكنولوجية للألياف تأثيرا إيجابيا ومعنويا بالزراعة فى ٢٥ أكتوبر لصفات طول الألياف , النسبة المئوية للألياف الطويلة , نعومة الألياف بالمقارنة بميعادى الزراعة المتأخرين عن ذلك .

٧. زادت النسبة المئوية للزيت زيادة معنوية نتيجة الزراعة المبكرة فى ٢٥ أكتوبر بالمقارنة بالميعادين الآخرين تحت الدراسة فى كلا الموسمين .

٨. زيادة الكثافة النباتية من ١١٢٥ الى ١٥٠٠ , ١٨٧٥ بذرة / متر مربع أدت الى زيادة معنوية فى كل من طول النبات , الطول الفعال , محصول القش / فدان , محصول الألياف / فدان , محصول البذرة / فدان فى كلا الموسمين .

٩. وجد نقص معنوى بزيادة الكثافة النباتية فى صفات سمك الساق , محصول القش / نبات , عدد بذور الكبسولة , محصول البذرة / نبات , ودليل البذرة فى كلا الموسمين .

١٠. تأثرت إيجابيا صفات طول الألياف , النسبة المئوية للألياف الطويلة , نعومة الألياف بزيادة الكثافة النباتية الى أعلى معدل وهو ١٨٧٥ بذرة / متر مربع وكانت الزيادة معنوية . فى حين وجد نقص فى النسبة المئوية للزيت نتيجة لذلك فى كلا الموسمين .

١١. كان تأثير التفاعل بين المعاملات التجريبية معنويا على صفات عديدة كما هو موضح فى الجدولين التاليين المدون بهما أعلى القيم المتحصل عليها وتأثير التفاعلات المشتركة على صفات الكتان تحت الدراسة فى كلا الموسمين .

ويظهر من النتائج بأن أفضل معاملات لانتاج أعلى محصول من القش والألياف وكذلك الصفات التكنولوجية قد تحققت من زراعة الصنف ايريانا فى الميعاد المبكر وهو ٢٥ أكتوبر وبأعلى كثافة نباتية (١٨٧٥ بذرة / متر مربع).

١٢. وأن أعلى محصول من البذور والزيت قد تحقق بزراعة الصنف جيزة ٨ فى الميعاد المبكر والزراعة بأعلى كثافة نباتية أيضا .

جدول ١٨: ملخص لتأثيرات التفاعل بين العوامل التجريبية على الصفات المدروسة لبيان أعلى القيم الناتجة وبيـــان للتفاعلات المعنوية فى موسم ١٩٩٦/٩٥

الصفات	التفاعل			
	الصنف X ميعاد الزراعة	الصنف X الكثافة	ميعاد الزراعة X الكثافة	الصنف X ميعاد الزراعة X الكثافة
الطول الكلى (سم)	*٩٨,٣٥ اريانا X ١٠/٢٥	*٩٩,٤١ اريانا X ١٨٧٥/م٢	* ٩٢,٦١ ١٠/٢٥ X ١٨٧٥/م٢	* ١٠١,٨٥ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
الطول الفعال (سم)	*٧٨,٩٥ اريانا X ١٠/٢٥	*٧٨,٨٩ اريانا X ١٨٧٥/م٢	*٧٤,٣٦ ١٠/٢٥ X ١٨٧٥/م٢	* ٨١,٩٠ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
قطر الساق (مم)	٢,٨٠ جيزة ٨ X ١٠/٢٥	*٢,٨٧ جيزة ٨ X ١١٢٥م٢	٢,٥٠ ١٠/٢٥ X ١١٢٥/م٢	٢,٩٠ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
محصول القش للنبات (جم)	٣,٢٩ اريانا X ١٠/٢٥	*٣,٣٤ اريانا X ١١٢٥/م٢	*٣,١١ ١٠/٢٥ X ١١٢٥/م٢	*٣,٤٢ اريانا X ١٠/٢٥ X ١١٢٥/م٢
محصول القش للفدان (طن)	٣,٦١ اريانا X ١٠/٢٥	*٣,٦٧ اريانا X ١٨٧٥/م٢	*٣,٤٢ ١٠/٢٥ X ١٨٧٥/م٢	*٣.٧٦ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
محصول الألياف للفدان (كجم)	٤٦٥,٦٤ اريانا X ١٠/٢٥	*٤٨٢,٥٢ اريانا X ١٨٧٥/م٢	*٤٢٥,٤٦ ١٠/٢٥ X ١٨٧٥/م٢	*٥٠١,٠٩ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
عدد الكبسولات للنبات	*٩,٦٦ جيزة ٨ X ١٠/٢٥	١٠,١٢ جيزة ٨ X ١١٢٥م٢	١٠,٣٥ ١٠/٢٥ X ١١٢٥/م٢	١٢.٨٣ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
عدد بذور الكبسولة	٨,٥٨ جيزة ٨ X ١٠/٢٥	٨,١١ جيزة ٨ X ١١٢٥م٢	٨,٨٠ ١٠/٢٥ X ١١٢٥/م٢	٩,٦٥ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
طول المنطقة الثمرية (سم)	١٩,٣٧ اريانا X ١٠/٢٥	*١٩,٧٧ اريانا X ١٨٧٥/م٢	*٢٠,٤٥ ١٠/٢٥ X ١١٢٥/م٢	*٢٠,٤٦ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
محصول البذرة للنبات (جم)	١,٧١ جيزة ٨ X ١٠/٢٥	*١,٧٧ جيزة ٨ X ١١٢٥م٢	*١,٥٦ ١٠/٢٥ X ١١٢٥/م٢	*١,٨٢ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
وزن ١٠٠٠ بذرة (جم)	*٨,٣٧ جيزة ٨ X ١٠/٢٥	*٨,٢٧ جيزة ٨ X ١١٢٥م٢	*٧,٣٩ ١٠/٢٥ X ١٨٧٥/م٢	*٨,٣٩ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
محصول البذور للفدان (كجم)	٦١٤,٣٩ جيزة ٨ X ١٠/٢٥	*٦٢٤,٣٥ جيزة ٨ X ١٨٧٥م٢	٥٨١,٣١ ١٠/٢٥ X ١٨٧٥/م٢	*٦٣٩,٤٥ جيزة ٨ X ١٠/٢٥ X ١٨٧٥/م٢
طول الألياف (سم)	٧٦,٨٤ اريانا X ١٠/٢٥	*٧٨,٠٧ اريانا X ١٨٧٥/م٢	*٧٢,٦٣ ١٠/٢٥ X ١٨٧٥/م٢	*٨٠,١٦ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نسبة الألياف الطويلة (%)	*١٣,٩١ اريانا X ١٠/٢٥	*١٣,١٥ اريانا X ١٨٧٥/م٢	*١٣,٣١ ١٠/٢٥ X ١٨٧٥/م٢	*١٣,٩٨ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نعومة الألياف (Nm)	*١٩٧,٧٠ اريانا X ١٠/٢٥	١٩١,٣٨ اريانا X ١٨٧٥/م٢	*١٩٢,٠٦ ١٠/٢٥ X ١٨٧٥/م٢	*١٩٩,٠٦ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نسبة الزيت (%)	٤٢,٥٢ جيزة ٨ X ١٠/٢٥	٤٢,٣٦ جيزة ٨ X ١١٢٥م٢	*٤٠,٤١ ١٠/٢٥ X ١١٢٥/م٢	*٤٢,٨٧ جيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢

جدول ١٩: ملخص لتأثيرات التفاعل بين العوامل التجريبية على الصفات المدروسة لبيان أعلى القيم الناتجة وبيـــان للتفاعلات المعنوية فى موسم ١٩٩٧/٩٦

الصفات	التفاعل			
	الصنف X ميعاد الزراعة	الصنف X الكثافة	ميعاد الزراعة X الكثافة	الصنف X ميعاد الزراعة X الكثافة
الطول الكلى (سم)	*١١٠,٧٩ اريانا X ١٠/٢٥	*١١٤,٥٠ اريانا X ١٨٧٥/م٢	* ١٠٧,٩٣ ١٠/٢٥ X ١٨٧٥/م٢	* ١١٧,٢٥ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
الطول الفعال (سم)	*٩١,٤١ اريانا X ١٠/٢٥	*٩٤,٧١ اريانا X ١٨٧٥/م٢	*٨٨,٠٠ ١٠/٢٥ X ١٨٧٥/م٢	* ٩٦,٧٩ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
قطر الساق (مم)	*٣,٢٩ حيزة ٨ X ١٠/٢٥	*٣,٣٧ حيزة ٨ X ١١٢٥م٢	٣,٢٧ ١٠/٢٥ X ١١٢٥/م٢	٣,٤٦ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
محصول القش للنبات (جم)	٣,٨٢ اريانا X ١٠/٢٥	*٣,٨٤ اريانا X ١١٢٥/م٢	٣,٦٣ ١٠/٢٥ X ١١٢٥/م٢	*٤,٠١ اريانا X ١٠/٢٥ X ١١٢٥/م٢
محصول القش للفدان (طن)	٤,٢٣ اريانا X ١٠/٢٥	*٤,٣٢ اريانا X ١٨٧٥/م٢	٤,٠٤ ١٠/٢٥ X ١٨٧٥/م٢	*٤,٤٥ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
محصول الألياف للفدان (كجم)	*٥٣٥,١١ اريانا X ١٠/٢٥	*٥٣٥,٧٦ اريانا X ١٨٧٥/م٢	*٥٠٧,٨٩ ١٠/٢٥ X ١٨٧٥/م٢	*٥٨٠,٧٧ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
عدد الكبسولات للنبات	١١,٩٠ حيزة ٨ X ١٠/٢٥	١٣,٢٧ حيزة ٨ X ١١٢٥م٢	*١٣,٦٩ ١٠/٢٥ X ١١٢٥/م٢	١٦,٠٥ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
عدد بذور الكبسولة	٨,٤٨ حيزة ٨ X ١٠/٢٥	*٩,٣٢ حيزة ٨ X ١١٢٥م٢	٨,٤٤ ١٠/٢٥ X ١١٢٥/م٢	٩,٤٨ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
طول المنطقة الثمرية (سم)	١٩,٩٦ اريانا X ١٠/٢٥	*٢٠,٥٢ اريانا X ١٨٧٥/م٢	١٩,٣٨ ١٠/٢٥ X ١١٢٥/م٢	٢٠,١٠ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
محصول البذرة للنبات (جم)	*٢,٠٢ حيزة ٨ X ١٠/٢٥	*٢,١١ حيزة ٨ X ١١٢٥م٢	*١,٩٠ ١٠/٢٥ X ١١٢٥/م٢	*٢,٢١ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
وزن ١٠٠٠ بذرة (جم)	*٨,٦٤ حيزة ٨ X ١٠/٢٥	*٨,٨٦ حيزة ٨ X ١١٢٥م٢	٧,٦٢ ١٠/٢٥ X ١١٢٥/م٢	٨,٨٧ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢
محصول البذور للفدان (كجم)	٧٠٢,٨٦ حيزة ٨ X ١٠/٢٥	*٧١٧,٩٧ حيزة ٨ X ١٨٧٥م٢	٦٦٨,٤٧ ١٠/٢٥ X ١٨٧٥/م٢	*٧٣٥,٣٨ حيزة ٨ X ١٠/٢٥ X ١٨٧٥/م٢
طول الألياف (سم)	*٨٩,٣٨ اريانا X ١٠/٢٥	*٩٢,٦٥ اريانا X ١٨٧٥/م٢	*٨٦,١٠ ١٠/٢٥ X ١٨٧٥/م٢	*٩٤,٥٣ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نسبة الألياف الطويلة (%)	*١٣,٨٠ اريانا X ١٠/٢٥	*١٣,٢٧ اريانا X ١٨٧٥/م٢	*١٣,٦١ ١٠/٢٥ X ١٨٧٥/م٢	*١٣,٩٤ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نعومة الألياف (Nm)	٢٠٠,٥٧ اريانا X ١٠/٢٥	*١٩٦,٦٥ اريانا X ١٨٧٥/م٢	*١٩٤,٨٩ ١٠/٢٥ X ١٨٧٥/م٢	*٢٠١,٦٠ اريانا X ١٠/٢٥ X ١٨٧٥/م٢
نسبة الزيت (%)	٤٢,٥٦ حيزة ٨ X ١٠/٢٥	٤٢,٤١ حيزة ٨ X ١١٢٥م٢	*٤٠,٤٦ ١٠/٢٥ X ١١٢٥/م٢	*٤٢,٩٤ حيزة ٨ X ١٠/٢٥ X ١١٢٥/م٢

دراسة عن تأثير بعض العوامل البيئية على انتاجية بعض أصناف الكتان

رسالة مقدمة من

مايسه سعيد عبد الصادق أحمد

بكالوريوس فى العلوم الزراعية (شعبة محاصيل)-جامعة القاهرة ١٩٩٤

استيفاء لمتطلبات الحصول على درجة

الماجستير

فى العلوم الزراعية (محاصيل)

قسم المحاصيل والميكنة الزراعية

كلية الزراعة بمشتهر

جامعة الزقازيق

فرع بنها

١٩٩٩