J. Agric. Sci. Mansoura Univ., 27 (4): 2005 - 2017 , 2002

# EFFECT OF SEEDING RATE ON YIELD OF SOME FLAX CULTIVARS

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## ABSTRACT

Two field experiments were conducted at the Agric. Exp. and Res. Cent. Fac. Agric. Cairo Univ. during 1995/ 96 and 1996/97 seasons to study the influence of four flax cultivars. (Giza 6, Giza 7, Giza 8 and Riena) and seeding rates ( 40, 50, 60 and 70 Kg/fed) and their interaction on straw, fiber and seed yields. The experimental design was a randomized complete block design in a split-plot arrangements with four replications. The main findings of this study can be summarized as follows: cultivars were significantly different in total dry weight (TDW) at different ages. Where Giza 7 and Giza 8 were superior to the other cultivars in most instances, Riena gave the lowest TDW. TDW significantly decreased by increasing seeding rate. The highest TDW was obtained with Giza 8 x 40Kg seed/fed. Cultivars had a significant effect on technical length, straw and fiber yields/plant and per fed., harvest index % for fiber; length, percentage and fineness of fiber in both seasons and plant height in first season. Where Giza 7 was superior in the traits above mentioned except, Riena was superior in fiber percentage and Giza 8 was superior in fiber fineness. Also, cultivars had a significant effect on number of capsules/plant, seed index, seed yield/plant and fed, harvest index % for seed and seed oil percentage in both seasons. Where Giza 8 was significantly superior to other cultivars in the above traits mentioned.

A gradual and significant increments in plant height, technical length, fiber length as well as fiber fineness were obtained with increasing seeding rate from 40 up to 70 Kg/fed. Mean while, fiber percentage; straw, fiber and seed yields/fed significantly increased up to 60 Kg/ fed. On the other hand, a gradual and significant reduction had occurred in number of capsules/ plant; straw, fiber and seed yields / plant, seed index, harvest index % for fiber and seed as well as seed oil percentage with increasing seeding rate up to 70 kg/ fed. The data showed that Giza 8 and Giza 7x 40 Kg seed / fed produced higher straw and fiber yields / plant. Respectively. The highest seed yield / fed was obtained with Giza 8 x 60Kg seed/ fed. While Giza 7x 60Kg seed / fed produced highest straw and fiber yields/ fed.

## INTRODUCTION

Flax (*Linum usitatissimum* L.) is grown in Egypt as a dual-purpose field crop. Increasing flax production is an important goal since it is used widely as main source for fibers and oil. Also, it plays an important role in Egypt national economy through export as well as local industry. Flax production is not sufficient to provide the needs for paint oil in Egypt as well as fibers. Therefore, improvement of flax yield per unit area is required to meet demands for oil and fiber yields in Egypt in addition to export. This could be achieved by using high yielding cultivars and improving agronomic practices such as seeding rates.

Many investigators reported growth and yield differences among cultivars, such as EL-Farouk *et al.* (1984), Gaafar *et al.* (1985) and Eid (2001); They showed significant differences among flax strains and cultivars in dry weight / plant . Momtaz et al. (1990) found that Giza 7 cv surpassed Giza 8 in plant height, fiber yield and fiber percentage. On the other hand, means of seed yield / fed., seed index and oil percentage for Giza 8 cv were

higher than those of Giza 7. Moreover, Kineber (1994) showed that Giza 8 gave the highest number of capsules, seed yield / plant and seed yield / fed, followed by Giza 7. Aly and Awaad (1997) tested eight flax genotypes (Giza 5, Giza 6, Giza 7, Giza 8, Belink, Line 193 /1, Line 2419/1 and Line 2561/1). Giza 6 gave shortest plants and Giza 7 surpassed Giza 8 in long fiber percentage. Also, EL-Sweify *et al.* (1997) found that, Giza 7 had the longest stem and fibers. Furthermore, Kineber and EL-Kady (1998) and Eid (2001) concluded that significant differences were found between genotypes. Also, genotypes which gave the highest straw and seed yields / fed, were also superior in one or more of the measured yield components. However, flax genotypes which gave higher straw and seed yields / fed. did not rank first among other cultivars in growth attributes.

With respect to seeding rates, in Egypt, EL-Ganayni *et al.* (1985); Abdalla *et al.* (1989); Shafshak *et al.* (1992); EL-Shimy et al. (1993); EL-Sweify (1993); Abdel – Fatah (1994); Esmail and Morsy (1994) and Abdel-Wahed (1996), reported that higher seeding rate up to 50 or 70 Kg/fed caused an increment for each of plant height, technical length, fiber length, straw yield, fiber yield as well as seed yield/fed, but led to lower number of capsules / plant, straw and seed yield/ plant. In Canada, Gubbels and Kenaschuk (1989) showed that 1000- seed weight and oil content decreased when sowing rate was raised from 200 to 800 seeds / $m^2$. Also, Stevenson and Wright (1996) concluded that increasing sowing rate from 300 to 900 seeds / $m^2$ improved flax seed yield by 180 Kg / ha. The objective of this investigation was to study the response of some flax cultivars to different seeding rates.

## MATERIALS AND METHODS

Two field experiments were conducted at Fac. Agric. Exp. Sta., Cairo Univ., Giza, Egypt, during 1995 / 96 and 1996 / 97 seasons to determine the response of four flax cultivars to seeding rates on growth, straw, fiber and seed yield and its contributing characters Each experiment contained four randomized blocks arranged in a split-plot design, with cultivars as main plots and seeding rates as sub-plots. The sub plot area was 2 x 3 m. (6 $m^2$). Cultivars were Giza 6, Giza 7, Giza 8 (local cultivars) and Riena (introduced cultivar, the seeds of this cultivar was obtained via. Fiber Res.Sec., ARC). Seeding rates were; 40; 50, 60 and 70 Kg. / fed. Flax seeds were broadcasted on22 and 26 in the two successive seasons, respectively. Calcium superphosphate (15.5 % $P_2 O_5$) was applied during seedbed preparation, at a rate of 100 Kg./fed. Urea (46 % N) was applied in two doses before first and second irrigation's at the rate of 45 Kg. N. /fed. Other agricultural practices were applied as usually done in the ordinary flax field.

With respect to the growth character, total dry weight (TDW) it was determined on the bases of ten guarded plants randomly taken from each sub-plot. Sampling commenced 60 days after sowing and continued, at about 15 days interval up to 120 days. Sampled plants were dried in a ventilated oven for 24 hours at 90 °C.

At maturity, ten guarded plants were handpulled, at random, from each sub-plot to record the following variables: plant height (cm), technical length (cm), straw yield / plant (gm), number of mature capsules / plant, weight of 1000 seeds (gm) and seed yield / plant (gm). Thereafter, that sample of ten plants was taken for retting at Fiber Res. Section, Agric. Res. Center. At Giza. Then, fibers were separated for the following variables: fiber yield / plant (gm), fiber length (cm), fiber percentage and fineness in metrical number ( M.N.) according to the method described and used by Radwan and Momtaz (1966). From each sub-plot, plants of one square meter were taken. Obtained plants were threshed then seeds and straw were separated. The following estimates were determined per plot and then converted to ton per fed: straw yield, fiber yield, seed yield along with:

$$\text{Harvest index \% (fiber)} = \frac{Fiber\ yield / fed.}{Bio.yield / fed.} \times 100$$

$$\text{Harvest index \% (seed)} = \frac{Seed\ yield / fed.}{Bio.yield / fed.} \times 100$$

(Where: biological yield = straw + seeds)

Retting the bundles of the flax straw and industrial preparations to exert flax fibers were conducted at Tanta Company for flax and oil. Seed oil content was determined as described by A.O.A.C. method (1984) by using the petroleum ether as an organic solvent in a Soxhlet apparatus.

The obtained data were statistically analyzed according to procedures described by Gomez and Gomez (1984). Treatment means were compared according to L.S.D. test at 0.05 level of significance

## RESULTS AND DISCUSSION

### 1- Growth character : Total dry weight / plant (g ):

#### 1-A- The cultivars:

Differences among cultivars with respect to total dry weight (TDW) at different plant ages in 1995 / 96 and 1996/97 seasons are presented in Table (1). The data revealed in both seasons that TDW for the four tested cultivars was progressively increased with increasing plant age up to 120 days after sowing (DAS). Cultivars were significantly different in their TDW values at different plant ages in both seasons. Giza 8 and Giza 7 ranked first for TDW at different plant ages, except Giza 7 at 60 DAS; while Riena gave the lowest value in this trait.

#### 1-B-Seeding rates: -

Mean values for TDW significantly decreased by increasing seeding rate of flax in both seasons (Table 1). This trend may be due to higher competition between plants per unit area for nutrimental elements and edaphic factors in case of high seeding rate; Rady (1986) and Abdel- Fatah (1994) mentioned that increasing seeding rate decreased TDW / plant.

**Table (1): Total dry weight (g) / plant of flax as influenced by cultivars and seeding rates at different plant ages in 1995 / 1996 and 1996/ 97 seasons.**

| Factors | 1995 / 96 | | | | | 1996 / 97 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Plant age (DAS) | 60 | 75 | 90 | 105 | 120 | 60 | 75 | 90 | 105 | 120 |
| Cultivars (A) | | | | | | | | | | |
| G.6 | 0.83 | 1.50 | 1.87 | 2.92 | 3.91 | 0.85 | 1.51 | 1.92 | 2.98 | 3.95 |
| G.7 | 1.05 | 1.72 | 2.15 | 3.92 | 5.12 | 1.10 | 1.73 | 2.18 | 3.94 | 5.14 |
| G.8 | 0.93 | 1.81 | 2.29 | 3.95 | 5.15 | 0.94 | 1.83 | 2.30 | 3.98 | 5.17 |
| Riena | 0.69 | 1.05 | 1.31 | 2.14 | 2.90 | 0.71 | 1.04 | 1.32 | 2.19 | 2.95 |
| L.S.D 0.05 | 0.06 | 0.09 | 0.11 | 0.10 | 0.18 | 0.05 | 0.12 | 0.15 | 0.21 | 0.22 |
| Seeding rates (B) | | | | | | | | | | |
| 40 | 0.95 | 1.59 | 2.00 | 3.35 | 4.40 | 0.98 | 1.60 | 2.01 | 3.39 | 4.42 |
| 50 | 0.91 | 1.55 | 1.94 | 3.27 | 4.32 | 0.94 | 1.56 | 1.97 | 3.32 | 4.39 |
| 60 | 0.86 | 1.51 | 1.89 | 3.20 | 4.23 | 0.88 | 1.49 | 1.91 | 3.24 | 4.26 |
| 70 | 0.78 | 1.43 | 1.80 | 3.11 | 4.13 | 0.81 | 1.46 | 1.83 | 3.14 | 4.15 |
| L.S.D 0.05 | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.01 | 0.02 | 0.01 | 0.03 | 0.03 |
| A x B | * | NS | NS | * | NS | NS | NS | * | * | NS |

* and Ns indicate significant and insignificant differences at 0.05 level of probability.

**1-C- The interaction**:

The interaction of cultivars x seeding rates revealed significant effect on TDW at 60 and 105 DAS; 90 and 105 DAS in the first and second seasons, respectively (Table 2). The data showed that, in most instances Giza 8x40Kg. seed/fed. had higher TDW than other combinations in both seasons.

**Table (2): Effect of cultivars x seeding rates interaction on total dry weight (g)/ plant at different plant ages in 1995 / 96 and 1996 / 97 seasons.**

| Cultivars | 1995 / 96 Seeding rates ( Kg / Fed ) | | | | 1996 / 97 Seeding rates ( Kg / Fed ) | | | |
|---|---|---|---|---|---|---|---|---|
| | 40 | 50 | 60 | 70 | 40 | 50 | 60 | 70 |
| Age: | 60 DAS. | | | | 90 DAS. | | | |
| G.6 | 0.91 | 0.86 | 0.82 | 0.74 | 2.00 | 1.95 | 1.91 | 1.83 |
| G.7 | 1.14 | 1.10 | 1.02 | 0.94 | 2.25 | 2.21 | 2.16 | 2.10 |
| G.8 | 1.01 | 0.97 | 0.92 | 0.84 | 2.37 | 2.36 | 2.27 | 2.19 |
| Riena | 0.74 | 0.70 | 0.66 | 0.62 | 1.43 | 1.35 | 1.29 | 1.21 |
| L.S.D 0.05 | 0.02 | | | | 0.02 | | | |
| Age: | 105 DAS. | | | | 105 DAS. | | | |
| G.6 | 3.06 | 2.97 | 2.88 | 2.77 | 3.11 | 3.04 | 2.93 | 2.82 |
| G.7 | 4.02 | 3.95 | 3.90 | 3.80 | 4.06 | 3.98 | 3.90 | 3.81 |
| G.8 | 4.04 | 3.98 | 3.94 | 3.86 | 4.07 | 4.01 | 3.94 | 3.88 |
| Riena | 2.26 | 2.19 | 2.10 | 1.99 | 2.30 | 2.23 | 2.16 | 2.07 |
| L.S.D 0.05 | 0.02 | | | | 0.02 | | | |

**2- Straw yield and its components and fiber quality : -**

**2-A- The cultivars: -**

The response of straw yield and its components and fiber quality of flax to cultivars are presented in Tables 3 and 4. Cultivars had a significant effect on technical length, straw and fiber yield/plant and feddan, harvest index % for fiber, fiber length, fiber percentage, fiber fineness in both seasons and plant height in first season. The obtained data revealed that the tested

cultivars differed in their plant height. Giza 8 gave significantly the tallest plants (101.42 cm) and Riena was the shortest one (92.58 cm) compared to other cultivars in first season. But, insignificant differences were found between cultivars in plant height in second season.

**Table (3): Straw yield and its contributing variables of flax as influenced by cultivars and seeding rates in 1995 / 96 and 1996 / 97 seasons.**

| Variables | Season | Cultivars (A) | | | | L.S.D 0.05 |
|---|---|---|---|---|---|---|
| | | G. 6 | G. 7 | G. 8 | Riena | |
| Plant height (cm) | 1995 / 96 | 96.42 | 100.25 | 101.42 | 92.58 | 1.1 |
| | 1996 / 97 | 98.83 | 103.33 | 103.25 | 95.00 | NS |
| Technical length (cm) | 1995 / 96 | 79.58 | 88.49 | 83.08 | 76.67 | 2.96 |
| | 1996 / 97 | 82.25 | 92.42 | 85.58 | 77.58 | 3.16 |
| Straw yield / plant (g) | 1995 / 96 | 2.06 | 2.93 | 3.23 | 1.72 | 0.31 |
| | 1996 / 97 | 2.11 | 2.99 | 3.32 | 1.77 | 0.35 |
| Straw yield / fed. (ton) | 1995 / 96 | 2.132 | 3.275 | 3.133 | 1.350 | 0.215 |
| | 1996 / 97 | 2.433 | 3.450 | 3.308 | 1.517 | 0.35 |
| | | Seeding rates Kg / Fed (B) | | | | |
| Variables | Season | 40 | 50 | 60 | 70 | L.S.D 0.05 |
| Plant height (cm) | 1995 / 96 | 90.75 | 95.50 | 99.75 | 104.67 | 1.92 |
| | 1996 / 97 | 94.42 | 97.50 | 101.58 | 106.92 | 1.50 |
| Technical length (cm) | 1995 / 96 | 78.58 | 80.24 | 84.33 | 84.67 | 1.78 |
| | 1996 / 97 | 80.17 | 82.67 | 85.67 | 89.33 | 0.65 |
| Straw yield / plant (g) | 1995 / 96 | 2.61 | 2.51 | 2.46 | 2.37 | 0.05 |
| | 1996 / 97 | 2.65 | 2.59 | 2.52 | 2.43 | 0.04 |
| Straw yield / fed. (ton) | 1995 / 96 | 2.082 | 2.392 | 2.808 | 2.608 | 0.092 |
| | 1996 / 97 | 2.333 | 2.625 | 2.983 | 2.767 | 0.070 |

**NS indicate insignificant differences at 0.05 level**

Technical length of Giza 7 cv. was significantly superior to all other cvs; Whereas Riena cv gave the shortest technical length in both seasons. However, the remaining cvs could be arranged in a descending order as follows: Giza 8 and Giza 6 cvs in both seasons. These results demonstrated the existence of obvious genetic differences among the four tested cvs. In this respect, the results obtained by Eid (1996) and Kineber and EL- Kady (1998) are in line with the above mentioned findings.

Data presented in Tables 3 and 4 revealed significant differences between cultivars in straw yield / plant. Where Giza 8 and Giza 7 were significantly superior and Riena was the lowest, compared with the tested cultivars in this trait. The results indicated that fiber yield/ plant straw and fiber yield/fed. significantly varied among the four tested cultivars. It was obvious that Giza 7 and Giza 8 provided the highest fiber yield/plant as well as straw and fiber yields/fad. By contrast, Riena cv gave the lowest values in these traits. These results are in line with those obtained by Momtaz et al (1990) and Kineber and EL-Kady (1998). Generally, the results of straw and fiber yields are quite expected since both are directly related to the yield previously recorded for the individual plant in most instances.

**Table (4): Fiber yield and fiber quality of flax as affected by cultivars and seeding rates in 1995 / 96 and 1996 / 97 seasons.**

| Variables | Season | Cultivars (A) | | | | L.S.D |
|---|---|---|---|---|---|---|
| | | G. 6 | G. 7 | G. 8 | Riena | 0.05 |
| Fiber yield / plant ( g ) | 1995 / 96 | 0.26 | 0.48 | 0.35 | 0.25 | 0.06 |
| | 1996 / 97 | 0.31 | 0.53 | 0.40 | 0.29 | 0.11 |
| Fiber yield / fed ( ton ) | 1995 / 96 | 0.359 | 0.640 | 0.579 | 0.266 | 0.045 |
| | 1996 / 97 | 0.402 | 0.678 | 0.616 | 0.309 | 0.075 |
| Harvest index % ( fiber ) | 1995 / 96 | 13.07 | 15.25 | 13.28 | 15.05 | 1.51 |
| | 1996 / 97 | 13.17 | 15.74 | 13.66 | 16.48 | 1.87 |
| Fiber length ( cm ) | 1995 / 96 | 68.33 | 77.00 | 67.00 | 60.67 | 5.13 |
| | 1996 / 97 | 71.08 | 78.50 | 69.75 | 63.67 | 4.14 |
| Fiber ( % ) | 1995 / 96 | 14.17 | 16.17 | 13.25 | 17.18 | 0.95 |
| | 1996 / 97 | 13.50 | 15.75 | 13.00 | 16.92 | 1.14 |
| Fiber fineness ( N.M ) | 1995 / 96 | 167.92 | 181.17 | 184.50 | 107.58 | 4.48 |
| | 1996 / 97 | 170.33 | 183.33 | 187.33 | 108.67 | 5.45 |
| | | Seeding rates Kg / Fed (B) | | | | |
| Variables | Season | 40 | 50 | 60 | 70 | L.S.D 0.05 |
| Fiber yield / plant ( g ) | 1995 / 96 | 0.38 | 0.35 | 0.32 | 0.29 | 0.01 |
| | 1996 / 97 | 0.43 | 0.40 | 0.37 | 0.34 | 0.02 |
| Fiber yield / fed ( ton ) | 1995 / 96 | 0.415 | 0.450 | 0.493 | 0.486 | 0.014 |
| | 1996 / 97 | 0.465 | 0.492 | 0.534 | 0.513 | 0.018 |
| Harvest index % ( fiber ) | 1995 / 96 | 14.74 | 14.12 | 14.33 | 13.45 | NS |
| | 1996 / 97 | 15.55 | 14.66 | 14.60 | 14.23 | 0.80 |
| Fiber length ( cm ) | 1995 / 96 | 63.01 | 67.03 | 70.30 | 72.67 | 1.79 |
| | 1996 / 97 | 66.17 | 68.83 | 72.08 | 75.92 | 0.51 |
| Fiber ( % ) | 1995 / 96 | 12.69 | 15.03 | 17.01 | 16.02 | 0.21 |
| | 1996 / 97 | 13.25 | 14.42 | 16.17 | 15.33 | 0.38 |
| Fiber fineness ( N.M ) | 1995 / 96 | 151.17 | 157.33 | 163.25 | 169.42 | 2.84 |
| | 1996 / 97 | 153.83 | 159.25 | 165.00 | 171.58 | 1.94 |

**Ns indicate insignificant differences at 0.05 level.**

Regarding harvest index % for fiber (Tables 3 and 4), This trait varied significantly among cultivars in both seasons .where Riena and Giza 7 cvs were significantly superior than other cultivars.

As for flax fiber quality, results presented in Table 4 showed that the four tested cvs. significantly varied in their fiber quality i.e. fiber length, fiber percentage and fiber fineness. Regarding fiber length, Giza 7. Was significantly superior; while Riena cv had the lowest value in this respect. Thus, it could be concluded that Giza 7 gave the longest fibers, Whereas, Riena had the shortest fibers. Concerning fiber percentage, Riena ranked first followed with significant differences by Giza 7. Meanwhile, Giza 6 and Giza 8 recorded the lowest values. Concerning fiber fineness, Giza 8 and Giza 7 gave higher values than those obtained for Giza 6 and Riena. The above mentioned results are in accordanced with those obtained by Momtaz et al., (1990), Eid (1996), Aly and Awaad (1997) and Eid (2001).

**2-B- Seeding rates: -**

The response of straw yield and its components and fiber quality of flax to seeding rates is presented in Tables 3 and 4. The obtained data revealed that seeding rates exhibited significant effects on plant height, technical length, straw yield / plant and per fed., fiber yield/ plant and fed.,

fiber length, fiber percentage, fiber fineness during both seasons and harvest index % for fiber in second season only

Plant height and technical length were substantially influenced by tested seeding rates in both seasons. Whereas, plant height and technical length increased significantly by increasing seeding rate from 40 to 70 Kg seed / fed (Table 3). These trends are in harmony with those obtained by EL-Shimy *et al.* (1993), Esmail and Morsy (1994) and Abdel-Wahed (1996).

Straw and fiber yield/plant paradoxically significantly decreased by increasing seeding rate of flax up to 70-Kg seed/fed. during both seasons (Tables 3 and 4). This trend may be due to the low competition for edaphic factors between plants due to low number of plants per unit area in case of low seeding rate, which led to higher straw and fiber yield/plant. Shafshak *et al.* (1992), EL-Sweify (1993), Abdel Fatah (1994), Esmail and Morsy (1994) and Abdel-Wahed (1996) found that higher seeding rate decreased significantly straw and fiber yield/plant.

Seeding rates caused significant differences in straw and fiber yield/fed. in both seasons (Tables 3 and 4). Results showed that straw and fiber yield/fed significantly increased by higher seeding rate up to 60-Kg seed/fed then declined.

The highest straw and fiber yield / fed were obtained from seeding rate at 60 kg / fed. While, 40-kg seed / fed produced the lowest straw and fiber yields. Thus, increasing seeding rate above 60 kg seed / fed, may be led to higher competition among flax plants. These conclusion are in harmony with those obtained by Abdalla *et al.* (1989), Shafshak *et al.* (1992), Sorour *et al.* (1992) and Abd el Wahed (1996).

Regarding harvest–index % for fiber (Tables 3 and 4), significant variations between seeding rates were detected in the second season harvest index % for fiber decreased by increasing seeding rate up to 70 kg seed / fed.

As for flax fiber quality, results presented in Table (4) showed that, seeding rate significantly affected fiber quality i.e fiber length, percentage and fineness. However, increasing seeding rate increased significantly the three traits in both seasons. Hence dense flax population certainly improved flax fiber quality. In this respect, Abdel - Fatah (1994) and Abdel – Wahed (1996) came to the same findings.

**2- C- The interaction:**

The significance level for mean square for straw yield and its components and fiber quality in response to interaction cultivars x seeding rates interaction are presented in Table (6). This interaction revealed significant effect on straw yield / plant in both seasons and fiber yield / plant in first season only. However, other interactions gave insignificant effect in both season. Data presented in Table (7) clearly indicated that Giza 8 with seeding rate at 40 kg seed / fed produced highest straw yield / plant in both seasons. Also, Giza 7 with seeding rate 40 at kg seed / fed produced the highest fiber yield / plant.

**3 – Seed yield and its components: -**

**3 - A – The cultivars:**

The response of seed yield and its contributing variables of flax to cultivars are presented in Table 5. Cultivars had a significant effect on number of capsules/plant, 1000 seed weight (seed index), seed yield/plant and fed., harvest index % for seed and seed oil % in both seasons.

Number of capsules/plant of Giza 8 followed by Giza 7 were significantly superior to; Giza 6 and Riena. Riena recorded the lowest mean values with insignificant difference from Giza 6. These results are in line with those obtained by Kineber (1994), Eid (1996) and Kineber and EL-Kady (1998).

**Table (5): Seed yield and its contributing Variables of flax as influenced by cultivars and seeding rates in 1995 / 96 and 1996 / 97 seasons .**

| Variables | Season | Cultivars (A) | | | | L.S.D |
|---|---|---|---|---|---|---|
| | | G. 6 | G. 7 | G. 8 | Riena | 0.05 |
| Number of capsules/ plant | 1995 / 96 | 12.00 | 17.83 | 20.75 | 8.17 | 4.12 |
| | 1996 / 97 | 12.92 | 19.75 | 20.76 | 8.91 | 5.85 |
| 1000 seed weight ( g ) | 1995 / 96 | 7.96 | 9.68 | 9.88 | 5.23 | 0.56 |
| | 1996 / 97 | 8.08 | 9.78 | 9.93 | 5.38 | 0.85 |
| Seed yield / plant ( g ) | 1995 / 96 | 0.40 | 0.57 | 0.72 | 0.22 | 0.07 |
| | 1996 / 97 | 0.45 | 0.62 | 0.76 | 0.27 | 0.11 |
| Seed yield / fed. ( ton ) | 1995 / 96 | 0.657 | 0.926 | 1.232 | 0.420 | 0.045 |
| | 1996 / 97 | 0.623 | 0.889 | 1.209 | 0.405 | 0.106 |
| Harvest index % ( seed ) | 1995 / 96 | 24.28 | 22.13 | 28.34 | 24.22 | 2.21 |
| | 1996 / 97 | 20.50 | 20.53 | 26.87 | 21.46 | 1.63 |
| Seed oil ( % ) | 1995 / 96 | 38.13 | 39.43 | 40.47 | 33.28 | 0.71 |
| | 1996 / 97 | 38.33 | 39.23 | 40.19 | 33.30 | 0.77 |
| | | Seeding rates Kg / Fed (B) | | | | L.S.D 0.05 |
| Variables | Season | 40 | 50 | 60 | 70 | |
| Number of capsules/ plant | 1995 / 96 | 18.25 | 16.33 | 13.32 | 10.84 | 1.81 |
| | 1996 / 97 | 19.58 | 17.42 | 14.25 | 11.08 | 0.77 |
| 1000 seed weight ( g ) | 1995 / 96 | 8.58 | 8.33 | 8.07 | 7.78 | 0.13 |
| | 1996 / 97 | 8.66 | 8.43 | 8.17 | 7.90 | 0.09 |
| Seed yield / plant ( g ) | 1995 / 96 | 0.55 | 0.53 | 0.46 | 0.38 | 0.03 |
| | 1996 / 97 | 0.60 | 0.56 | 0.51 | 0.44 | 0.02 |
| Seed yield / fed. ( ton ) | 1995 / 96 | 0.768 | 0.803 | 0.842 | 0.822 | 0.017 |
| | 1996 / 97 | 0.739 | 0.777 | 0.814 | 0.796 | 0.011 |
| Harvest index % ( seed ) | 1995 / 96 | 27.48 | 25.06 | 23.69 | 22.75 | 1.12 |
| | 1996/ 97 | 23.97 | 22.54 | 21.92 | 20.93 | 0.75 |
| Seed oil ( % ) | 1995 / 96 | 38.23 | 38.11 | 37.68 | 37.28 | 0.10 |
| | 1996 / 97 | 38.21 | 37.95 | 37.63 | 37.25 | 0.09 |

Regarding seed index, the highest significant seed index detected for Giza 8 and Giza 7, while Riena gave the lowest seed index values. Kineber and EL-Kady (1998) found significant differences in seed index between flax genotypes.

Cultivars had a significant effect on seed yields/plant and fed in both seasons. Data showed that Giza 8 gave the highest seed yield followed by Giza 7 with significant differences between their productivity. Riena gave the lowest seed yield/plant and per fed. These results reflected the fact that Giza 8 gave the highest number of capsules and seed index leading to the highest seed yield/plant and per fed; While Riena provided the lowest values for the above traits, a result which reconverted on the productivity of unit area.

Harvest index % for seed of Giza 8 was significantly superior as compared with Giza7, Giza 6 and Riena, which gave insignificant differences in both seasons. Data showed statistical differences among cultivars in seed oil percentage. Giza 8 cv gave the highest mean value (as average 40.33 %) for oil %; while Giza 7 cv gave the next to the above mentioned cv. However, Riena cv gave the lowest mean value accounted to 3329 % (as average); whereas Giza 6 was in between.

**3- B- Seeding rate:**

Seeding rate had a significant effect on number of capsules/plant, seed index, seed yield/plant and per fed, harvest index % for seed and seed oil % in both seasons (Table 5). Number of capsules/plant and seed yield/plant paradoxically significantly decreased by increasing seeding rate of flax up to 70 Kg/fed. in both seasons. The greatest values in these traits were obtained by using 40 Kg seed/fed; while the lowest values were obtained by using 70 Kg seed/fed in both seasons. This may be attributed to the fact that high seeding rate created a high competition between plants for nutrients, moisture and light. These results are in harmony with those obtained by Sorour et al (1992), EL-Sweify (1993), Esmail and Morsy (1994) and Agegnehu and Honermeier (1997)

Likewise, seed index and harvest index % for seed followed exactly the same trend recorded for the above-mentioned; where these traits were significantly affected by seeding rate. There was a gradual decrease in seed index and harvest index % for seed with increasing seeding rate. In this respect, Gubbles and Kenaschuk (1989) and Esmail and Morsy (1994) found that seed index was decreased by increasing seeding rate.

Seed yield/fed was significantly affected by seeding rate in both seasons. In general, increasing seeding rate up to 60 Kg/fed was accompanied by improvement of seed yield /fed. On the other hand, 40 Kg/fed produced the lowest seed yield/fed with significant differences to all other seeding rate. Generally, the rise in seed yield with higher rates could be reached up to a certain level of seeding rate (40 Kg/fed.); Higher rates above this level gave was no further response. It could be concluded that the increase in number of plants/fed by planting at higher population density was great enough to compensate for the detected reduction in seed yield /plant, indicating that the population density of flax had definite positive effect on

seed yield/fed. Similar results were obtained by Shafshak et al (1992), EL-Shimy et al (1993), Abdel-Fatah (1994), Esmail and Morsy (1994), Stevenson and Wright (1996) and Gyanendra – Tiwari et al (2001).

Seed oil percentage was significantly affected by seeding rate in both seasons. There was a gradual decrease in seed oil percentage with increasing seeding rate (Table 5). These results are in agreement with those obtained by Hassan and EL-Farouk (1987), Gubbels and Kenaschuk (1989), Esmail and Morsy (1994) and Abdel-Wahed (1996).

**3- C- The interaction :**

Cultivars x seeding rates interaction produced significant effect on number of capsules/plant, seed yield/plant and fed in both seasons (Table 6). Data presented in Table 7 clearly indicated that, Giza 8 with seeding rate at 40 Kg/fed gave the highest number of capsules (24.67 and 26.01) and seed yield/plant (0.80 and 0.84 g/plant); while Giza 8 with seeding rate at 60 Kg/fed gave the highest seed yield/fed. in both seasons (1.273 and 1.254 ton/fed, respectively).

**Table (6): Significance level for interactions among cultivars x seeding rates in 1995 / 96 and 1996 / 97 seasons.**

| Variables | A × B | | Variables | A × B | |
|---|---|---|---|---|---|
| | 1995 / 96 | 1996 / 97 | | 1995 / 96 | 1996 / 97 |
| Straw yield components : | | | Fiber length ( cm ) | N S | N S |
| Plant height ( cm ) | N S | N S | Fiber % | N S | N S |
| Technical length ( cm) | N S | N S | Fiber fineness ( N.M ) | N S | N S |
| Straw yield / plant ( g ) | * | * | Seed yield | | |
| Straw yield/ fed ( ton ) | N S | NS | components: | * | * |
| | | | No.of capsules / plant | N S | N S |
| Fiber yield components : | | | 1000 seed weight (g.) | * | * |
| Fiber yield / plant ( g ) | * | NS | Seed yield / plant (g.) | * | * |
| Fiber yield / fed ( ton ) | NS | NS | Seed yield /fed. (ton) | N S | N S |
| Harvest index %( fiber ) | NS | NS | Harvest index %(seed) | N S | NS |
| | | | Seed oil % | | |

**A and B indicate cultivars and seeding rates, respectively.**
*** and NS indicate significant and insignificant differences at 0.05 level.**

**Table ( 7 ): Effect of cultivars x seeding rates interaction on yield and its contributing variables in 1995 / 96 and 1996 / 97 seasons.**

| Cult.s | 1995 / 96 | | | | L.S.D 0.05 | Cult.s | 1996/97 | | | | L.S.D 0.05 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seeding rates | | | | | | Seeding rates | | | | |
| | 40 | 50 | 60 | 70 | | | 40 | 50 | 60 | 70 | 70 |
| | Straw yield / pl. | | | | | | Straw yield / pl. | | | | |
| G.6 | 2.20 | 2.13 | 2.05 | 1.87 | 0.09 | G.6 | 2.24 | 2.16 | 2.07 | 1.97 | 0.03 |
| G.7 | 3.04 | 2.99 | 2.92 | 2.78 | | G.7 | 3.09 | 3.03 | 2.97 | 2.88 | |
| G.8 | 3.38 | 3.19 | 3.20 | 3.16 | | G.8 | 3.43 | 3.36 | 3.29 | 3.20 | |
| Riena | 1.82 | 1.75 | 1.66 | 1.65 | | Riena | 1.85 | 1.81 | 1.75 | 1.66 | |
| | Fiber yield / pl. | | | | | | No. of capsules / pl. | | | | |
| G.6 | 0.30 | 0.27 | 0.25 | 0.22 | 0.02 | G.6 | 16.67 | 14.66 | 11.68 | 8.66 | 1.53 |
| G.7 | 0.53 | 0.49 | 0.47 | 0.43 | | G.7 | 23.66 | 21.68 | 18.67 | 15.00 | |
| G.8 | 0.40 | 0.36 | 0.33 | 0.29 | | G.8 | 26.01 | 23.00 | 18.99 | 15.01 | |
| Riena | 0.29 | 0.26 | 0.24 | 0.21 | | Riena | 11.99 | 10.33 | 7.68 | 5.68 | |
| | No. of capsules / pl. | | | | | | Seed yield / pl. | | | | |
| G.6 | 15.33 | 13.33 | 10.67 | 8.67 | 1.61 | G.6 | 0.51 | 0.47 | 0.43 | 0.37 | 0.03 |
| G.7 | 22.32 | 19.34 | 16.33 | 13.32 | | G.7 | 0.71 | 0.66 | 0.59 | 0.53 | |
| G.8 | 24.67 | 23.66 | 19.00 | 15.68 | | G.8 | 0.84 | 0.80 | 0.75 | 0.66 | |
| Riena | 10.68 | 9.00 | 7.32 | 5.67 | | Riena | 0.34 | 0.30 | 0.25 | 0.20 | |
| | Seed yield / pl. | | | | | | Seed yield / fed. | | | | |
| G.6 | 0.45 | 0.44 | 0.39 | 0.31 | 0.05 | G.6 | 0.581 | 0.617 | 0.661 | 0.635 | 0.038 |
| G.7 | 0.65 | 0.60 | 0.56 | 0.48 | | G.7 | 0.851 | 0.881 | 0.925 | 0.897 | |
| G.8 | 0.80 | 0.79 | 0.71 | 0.58 | | G.8 | 1.150 | 1.203 | 1.254 | 1.228 | |
| Riena | 0.29 | 0.26 | 0.19 | 0.15 | | Riena | 0.374 | 0.407 | 0.418 | 0.423 | |
| | Seed yield / fed. | | | | | | | | | | |
| G.6 | 0.606 | 0.650 | 0.695 | 0.677 | 0.047 | | | | | | |
| G.7 | 0.891 | 0.919 | 0.959 | 0.936 | | | | | | | |
| G.8 | 1.184 | 1.224 | 1.273 | 1.246 | | | | | | | |
| Riena | 0.392 | 0.417 | 0.443 | 0.428 | | | | | | | |

L.S.D at 0.05 value for differences inter combinations between cultivars and seeding rates.

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## تأثير معدل التقاوي علي محصول بعض أصناف الكتان

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أقيمت تجربتان حقليتان بمحطة التجارب والبحوث الزراعية بكلية الزراعة جامعة القاهرة خلال عامي ١٩٩٥/٩٦ ، ١٩٩٦/٩٧ لدراسة إنتاجية بعض أصناف الكتان ( جيزة ٦ وجيزة ٧ وجيزة ٨ بالمقارنة بالصنف رينا) باستخدام معدلات تقاوي مختلفة ( ٤٠ ، ٥٠ ، ٦٠ ، ٧٠ كجم بذور / الفدان ) وكانت أهم النتائج ما يلي :- اختلفت المادة الجافة الكلية باختلاف الأصناف في مختلف الأعمار حيث تفوق الصنفان جيزة ٨ و جيزة ٧ عن بقية الأصناف في معظم الحالات . وأعطي الصنف رينا أقل مادة جافة كلية . قلت المادة الجافة الكلية بزيادة معدل التقاوي. وتم الحصول علي أكبر مادة جافة مع زراعة الصنف جيزة ٨ بمعدل تقاوي ٤٠ كجم / فدان . وأثرت الأصناف معنويا علي الطول الفعال ومحصول القش والألياف / النبات والفدان والألياف وطول ونعومة الألياف في الموسمين وطول النبات في الموسم الأول .و في معظم الحالات كان الصنف جيزة ٧ أحسن الأصناف في الصفات السابقة عدا نعومة الألياف ونسبة الألياف حيث كان الصنف رينا متوفقا فى نسبة الألياف بينما جيزة ٨ تفوق فى نعومة الألياف. أثرت الأصناف معنويا علي عدد الكبسولات / النبات ودليل البذرة ومحصول البذرة / النبات والفدان ودليل الحصاد للبذرة ونسبة وطول ونعومة الألياف ونسبة الزيت في الموسمين . حيث تفوق معنويا الصنف جيزة ٨ عن بقية الأصناف في الصفات المذكورة .كانت هناك زيادة معنوية تدريجيا في طول النبات والطول الفعال وطول ونعومة الألياف بزيادة معدل التقاوي من ٤٠ إلي ٧٠ كجم بينما نسبة الألياف ومحصول القش والألياف والبذرة / الفدان حتى ٦٠ كجم . وعلي عكس ذلك كان هناك نقص معنوي لعدد الكبسولات / النبات ومحصول القش والألياف والبذرة / النبات ودليل البذرة ودليل الحصاد للألياف والبذرة ونسبة الزيت بزيادة معدل التقاوي حتى ٧٠ كجم/ فدان نتيجة زيادة التنافس بين النباتات في وحدة المساحة . وتوضح النتائج أيضا الصنفان جيزة ٨ وجيزة ٧ مع معدل تقاوي ٤٠ كجم / فدان أعطيا أعلا محصول قش وألياف / النبات . وأعطي