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ABSTRACT

The effects of two sowing methods (rows and broadcast) and six treatments of nitrogen fertilizer (30, 50 and 70 kg N alone and 1kg Nitrobein / fad .added for each dose on yield and its components of three flax genotypes Sakha 1, Strain 22 and Sakha 3 were studied. Two experiments were conducted at Gemmeiza Agric. Res. Station, El-Gharbia Governorate during 2010/2011 and 2011/2012 seasons.

The obtained results can be summarized as follows:

1- Sakha1 produced the highest values of upper branching zone length, main stem diameter, straw yield/plant and per fad., no. of capsules/plant, no. of seeds/capsule, 1000 seed weight and seed yield/ plant and per fad. in both seasons.

2- Strain 22 achieved the highest mean values of oil percentage and oil yield/fad. in both seasons.

3- Sakha 3 gave the highest mean values of total plant height , technical stem length, fiber length, fiber fineness, fiber percentage and fiber yield/ fad. in both seasons.

4- The sowing of flax in rows significantly increased straw, fiber and seed attributes except with fiber fineness character where the differences between the two sowing methods did not reach the level of significance, in both seasons in comparison with the broadcast method.

5- Applying nitrogen at the rate of 30 kg nitrogen + 1kg Nitrobein / fad. gave the highest estimates in all studied attributes except upper branching zone length character which was insignificant among the six nitrogen fertilizer treatments. All the previous results were significant in both seasons.

6- All the interaction combinations had significant effects on total plant height, technical stem length, main stem diameter, straw yield/ fad., no. of capsules/plant, no. of seeds/capsule, seed yield/ fad., fiber length and oil percentage in both seasons.

ACKNOWLEDGMENT

At the first, special thanks are due to ALLAH.

The writer wishes to express his deep sincere appreciation and gratitude to ***Prof. Dr. Mohamed Hany Fayed,*** Prof. of Agron., Agronomy Department, Faculty of Agric .Cairo, Al-Azhar Univ., for his valuable advice, supervision, continuous help and constructive criticism during preparation of this manuscript.

Sincere thanks are due to ***Prof. Dr. El-Ghareib Abd Allah El-Ghareib,*** Prof. of Agron., Agronomy Department, Faculty of Agric .Cairo, Al-Azhar Univ., for valuable advice, supervision, continuous help throughout the course of this study.

Thanks are due to ***Prof. Dr. Gamal H. El-Shimy,*** Chief research, Fiber Crops Research Section, Agric. Res. Center, Giza for his supervision, valuable advice and continuous help during this investigation.

Thanks are also due to ***Prof. Dr. Mohamed E. A. Kineber,*** Director of Fiber Crops Res. Section, Agric. Res. Center, for his continuous help during this study.

I am also grateful to ***Prof. Dr. Hussein Abo-Kaied, Dr. Ramadan Abd El-Haleem*** and the staff members of Fiber Crops Res. Section, Agric. Res. Center, for their help during my study.

INTRODUCTION

Flax *(Linum usitatissimum,* L.) is considered as a very important crop in several regions of the world for its fiber and seed products. Flax is winter annual crop. In Egypt, flax cultivation increases the national income . It is considered as very important fibers exportation crop.

Flax seeds contain 32 to 44 percent oil, based on dry weight. Flax seed oil may be help to lower cholesterol level in the blood , so it protects the heart disease, control high blood pressure, counter inflammation associated with gout, control constipation, promote healthy hair and nails, reduce cancer risk and guard against the effects of ageing, treat menopausal symptoms, female infertility fight prostate problems, male infertility and impotence . Linseed oil, used in paints and varnishes. Linseed cake or meal is used as feed for livestock.

Flax fiber is spun into linen yarns which are used in threads and twines of various kinds. The yarn is also moved into toweling, clothing fabrics, table linen and the textiles. The short tangled fibers called tow, usually used for paper manufacture and packing.

Flax cultivated area in Arab Republic of Egypt in 2011/2012 season was about 9861[(*)] faddan, which did not enough to cover the great demands especially from linseed oil. In the same time, it is very difficult to increase the flax area in the valley lands due to the great competition with the other winter crops as wheat, clover and faba been ……etc, for this reason, it is necessary to increase flax productivity from the present limited area, this could be achieved by growing more productive varieties and by improvement of agricultural treatments i.e., sowing methods and

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N fertilization recently, much interest is focused on using nitrogen as bio fertilizers to minimize or decreasing chemical nitrogen fertilization, to decrease production cost and reduce environmental pollution.

The main objective of the present investigation was the evaluation of three flax genotypes i.e., Sakha 1 (dual purpose), Strain 22 (oil type) and Sakha 3 (fiber type) under two sowing methods (rows and broadcast) and some nitrogen fertilizer treatments (30 ,50 and 70 kg N alone and 1kg Nitrobein/ fad. added for each dose .

REVIEW OF LITERATURE

The available literature will be reviewed under the following headings:

1- Varietals differences.

2- Effect of sowing methods.

3- Effect of nitrogen fertilizer treatments:-

a- Effect of mineral nitrogen fertilizer .

b- Effect of mineral and bio-nitrogen fertilizer.

1- Varietal differences .

El-Shimy *et al.* (2001) found that the newly flax variety Sakha l surpassed Giza 8 in total length, straw yield/plant and/ fad. , fiber yield/plant and/fad ., no. of capsules/plant, seed index, seed yield/plant and / fad., fiber length, fiber percentage and oil percentage.

El-Gazzar and Abou-Zaied (2001) found that Sakha1 V. significantly surpassed Sakha 2 V. and Strain 3 in technical length, stem diameter, straw yield/fad., fiber yield per plant, and fad .,fiber percentage and fiber length in the second season, fiber fineness in both seasons. They reported also that Sakha 2 significantly surpassed Sakha 1 and Strain 3 in fruiting zone length, fiber length in the first season, number of seeds / plant, seed index, seed yield / fad., and oil percentage in both seasons .No significant differences between Sakha 1 and Strain 3 in technical length, fiber length and no. of seeds/capsule in the second season. .

El-Azzouni and El-Banna (2002) revealed that flax genotype Sakha 1gave the highest values for plant height , technical length ,

straw, seed and fiber yields/ fad., no. of capsules / plant and no, of seeds / capsule ,when compared with Strains 402/12 and 399/1/3.

El-Azzouni *et al.* (2003) showed that Sakha l V. had the superiority on Strain 2465/3 in straw yield/fad. and all of its related characters as well as seed yield/fad., followed by Strains 2465/3 and 402/12 in the two seasons.

Zahana *et al.* (2003) found that Sakha 1 flax variety significantly produced the highest values of straw yield and its components , fiber length, number of capsules / plant, seed index, seed yield/plant, and /fad., oil percentage, and oil yield / fad. when compared with Belinka and Bombay.

Zahana *et al.* (2004) evaluated flax varieties i.e. Sakha1, Sakha 2, Strain 329/2/18/7, Strain 402/3/5/10, Strain 402/21/20/3, Ariane and Strain 288/37/14/8 and showed that Strain 402/3/5/10 gave the highest plant height, technical length, Sakha 1 variety gave the highest straw yield/ plant and fad., while Sakha 2 variety gave the highest number of capsules per plant, seed yield/plant, seed index, oil percentage and oil yield per fad. On the other hand, Ariane ranked the first for fiber yield/fad., fiber percentage and fiber fineness. However, it gave the lowest seed index, oil percentage and oil yield per fad.

El-Shimy *et al.* (2006) showed that the flax variety Sakha 1 surpassed either Sakha 2 or the lowest one Giza 8 in total length, technical length, straw yield/ plant and/ fad., fiber yield/ plant and per fad., fiber percentage and fiber length in both seasons. The variety Sakha 2 ranked first and superior the other two varieties Sakha 1 and Giza 8 in no. of capsules/ plant, no. of seeds/ capsule, 1000-seed weight, seed yield/ plant and / fad., oil percentage and oil yield/ fad. in both seasons .

El-Azzouni *et al.* (2006) indicated that the dual purpose cultivars Sakha 1 and Sakha 2 significantly surpassed the oil types (2419/1 and 2465/1) in straw and fiber yields as well as their components. Meantime, 2419/1 and 2465/1 Strains gave the highest estimates for seed yield/fad., when compared with Sakha 1 and Sakha 2. However, number of seeds/capsule, 1000 seed weight and oil percentage were not affected by varying genotypes.

El-Gazzar (2006) showed that Sakha 2 variety had higher values than Strain 22 in all characters under study except oil percentage and oil yield / fad ., in both the growing seasons.

Mohamed *and Moawed* (2006) indicated that there were highly significant differences between flax genotypes for the studied parameters in both seasons. Sakha 1 variety surpassed Sakha 2 and the Strains of 2419/1 and 413/1/3/2 for plant height, technical length, straw yield/plant and /fad. and fiber yield/fad., in both seasons. Sakha 2 surpassed Sakha 1, 2419/1 and 413/1/3/2 Strains for seed index and seed yield/fad., while Strain 2419/1 surpassed other Strains and Species for no. of capsules/plant and seed yield/plant in both seasons.

Atta *et al.* (2007) indicated that Sakha 1 cultivar ranked first and out yielded Sakha 2 cultivar in straw yield/fad. and its related characters. Meanwhile, Sakha 2 cultivar significantly surpassed Sakha 1 cultivar in seed yield/fad., and its related characters.

Hussien (2007) showed that the flax variety Sakha 1 significantly surpassed the two other genotypes i.e., Sakha 2 and Strain 2419/1 in total and technical length/plant, straw yield/plant, fiber yield/plant, fiber yield/fad., fiber length and fiber fineness. The oil Strain 2419/1 ranked first and significantly surpassed Sakha 2 and Sakha 1 varieties in number

of capsules/plant, 1000 seed weight, seed yield/plant, and/fad., seed oil percentage and oil yield/fad.

Moawed *et al.* (2008) showed that Sakha 3 surpassed Sakha 4 in all studied straw characters, while Sakha 4 achieved maximum estimates in all seed traits in both seasons.

El-Deeb (2011) showed that Giza 9 surpassed Sakha 3 in total plant length, technical plant length, straw yield/plant and/ fad., no. of capsules/plant, seed yield/plant, seed index, fiber length, fiber percentage and fiber fineness.

2- Effect of sowing methods.

El- Sahookie (1979) studied the response of three oil seed flax cultivars at six rows spacing i.e. 10, 15, 20, 25, 30 and 35 cm and found that fiber and seed yields significantly increased with decreasing row space.

El-Farouk *et al.* (1982) studied the effect of row spacing i.e. 10, 20 and 30 cm as well as broadcast on Giza 5 and Giza 6 Egyptian flax varieties. They found that narrowing the distance between rows significantly decreased stem diameter, straw, seed and, fiber yields/fad., and fiber percentage. Also, broadcasting method was inferior to drilling one in fiber percentage but was superior in fiber fineness.

El-Ganayni *et al.* (1985) studied the effect of row spacing 10, 15 and 20 cm as well as broadcasting on the local flax var. Giza 4 and stated that row spacing had significant effect on number of capsules per plant, number of seeds/capsule, oil percentage and straw yield/ plant. But it did not significantly affect seed yield/plant. Also, they found that yield components increased as row spacing became wider. In addition, the highest seed yield/plant was obtained at 20 cm row spacing maximum

straw yield was obtained by10 cm between rows in the first season and broadcasting in the third season**,** respectively. In addition, the highest fiber yield and oil percentage were obtained from broadcasting treatment.

Guleria and Singh (1985) illustrated that sown flax in rows 15, 20 and 25 cm had no effect on oil content in seeds, the economic yields of seed and fiber were obtained with 20 cm between rows.

Tomar *et al.* (1993) revealed that yield of flax was higher with 25 than 20 and 30 cm row spacing.

El-Azzouni *et al.* (2006) showed that the drilling method significantly exceeded broadcasting method in all of straw and fiber yields and their components.

Alternate Formats (2007) showed that yields were similar for 20cm rows as compared to broadcast seeding for all seed rates in all years. Plant emergence was reduced for broadcast sown flax, but this had no effect on final seed yield. There was no benefit in using narrow row spacing. The three years average yield in 18cm (3 inch) rows was 2037kg/ha as compared to 2027kg/ha in 36cm (6 inch).

Ayad *et al*. (2012) showed that the wt., of 1000 seeds, seed and oil yields were highly increased when flax plants sown at row spacing of 15cm, but no. of capsules/plant and no. of seeds/capsule were increased at row spacing of 35cm. seed and oil yields significantly increased when the plant growing at 15 and 25cm row spacing with 60kg $N.ha^{-1}$.

3- Effect of nitrogen fertilizer treatments

a-Effect of mineral nitrogen fertilizer:-

Hamed (1998) pronounced that increasing nitrogen level from 15 to 35 kg N/fad. caused markedly increase in number of capsules per plant

and seed yield per fad., other estimated characters i.e plant height, technical length, seed, straw yields per plant and seed index were increased without significant differences between nitrogen levels.

El-Gazzar (2000) cleared that 72 kg N/ha occurred significantly increased fiber yield, fiber percentage and fiber fineness, at the same trend 95 kg N / ha significantly increased technical stem length, straw yield per hectar, number of seeds per capsule, oil percentage and oil yield per hectar in both seasons. Straw and seed yields per hectar increased by increasing nitrogen level from 72 to 142 kg N / ha. Also, number of seeds /capsule take the same trend.

El-Gazzar and El-Kady (2000) showed that nitrogen levels insignificantly affected plant height, technical length, stem diameter, top capsule zone length, straw, fiber and seed yields/plant and seed index in both seasons. Adding 30 kg N /fad., significantly increased fiber fineness, fiber percentage and fiber yield/fad. Adding 40 kg N/ fad. significantly increased oil %. Adding 50 kg N/fad significantly increased no. of seeds/capsule, seed yield/fad. and oil yield/fad. Increasing N level up to 60kg N/fad. significantly increased straw yield/fad. and no. of capsules/plant.

Mostafa and Ahmed (2000) showed that increasing N level from 20 up to 50kg N/fad significantly increased technical stem length, main stem diameter, straw yield/plant, fiber percentage as well as straw and fiber yields/fad. The application of 50 kg N/fad., significantly increased upper branching zone length, number of capsules and seeds/plant, 1000 seed weight, seed yield/plant as well as seed and oil yields/fad.. Each increment of applied nitrogen resulted in a significant reduction in seed oil content in both seasons. Increasing N-level from 40

up to 50kg N/fad., gave significant increase in all these characters, except straw yield/fad.

Abou-Zaied (2001) found that increasing nitrogen level from 40 to 60kg N/fad., caused a significant increase in all studied characters except fiber fineness which significantly decreased by in increasing nitrogen level. Meanwhile, increasing nitrogen level from 60 to 80kg N/fad., caused insignificant increase in all studied characters except fiber fineness, while nitrogen sources used in this investigation show a similar effect on the studied characters.

El-Gazzar and Abou-Zaied (2001) stated that using 40kg N/fad., significantly increased fiber yield per plant in the first season, fiber percentage, fiber fineness and oil percentage in both seasons. Also application of 55kg N/ fad. significantly increased technical stem length in the first season. Increasing N rate from 40 to 70kg N/fad., significantly increased straw yield per plant and no. of seeds/capsule as well as seed yield/fad., in both seasons.

El-Gazzar and Kineber (2002) reported that the addition of 30 kg N/fad., significantly increased fiber fineness and oil percentage in both seasons. Also adding of 45 kg N / fad. significantly increased technical stem length, straw yield per plant and fad., in both seasons, as well as increasing N levels from 30 to 60 kg/fad. ameliorated number of capsules per plant, seed yield per plant and /fad. They cleared that increasing nitrogen level up to 75 kg N/ fad. significantly increased straw yield / fad. and fiber length in both seasons.

Zahana *et al.* (2004) found that the highest straw yield/fad., was obtained by applying 80kg N/fad to Sakha 1. In addition, the highest seed yield per fad. and oil yield/fad .were obtained by applying 80kg N/fad., to