

**EFFECT OF PLANTING METHODS AND SOWING
DATES ON SEED AND FIBER QUALITY OF
SOME NEW FLAX VARIETIES**

By

DOAA ISMAIL MAHMOUD ISMAIL
B.Sc. Agric. Sci. (Agronomy), Fac. Agric., Cairo Univ., 2004

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ABSTRACT

This study was carried out at Etay El-Baroud Agricultural Research Station during 2005/2006 and 2006/2007 seasons to study the effect of three planting methods; *i.e.* broadcast seeds after irrigation in a tillage land, broadcast seeds before irrigation in a tillage land and broadcast seeds before irrigation in non-tillage land and three sowing dates; *i.e.* 5th November, 20th November and 5th December on yield and yield attributes of Sakha 3 and Sakha 4 flax varieties.

The data indicated that planting methods significantly affected seed and fiber yields and all their attributes except number of seed/capsule, oil percentage in both seasons and seed index in the second season. In general, mean values of flax characters grown under seed broadcasting after irrigation in a tillage land were superior compared with the other two methods in both seasons.

Sowing date significantly affected all characters under study, where the first sowing date gave the highest averages for all characters under study *i.e.*, plant height, technical length, stem diameter, straw yield / plant as well as per fed., seed yield / plant as well as per fed., number of capsules / plant, number of seeds / capsule, seed index, oil yield / fed., fiber yield / fed., fiber length, total fiber percentage and oil percentage.

In both seasons, Sakha 4 variety was superior to Sakha 3 in straw yield/fed. as well as per plant, technical length, stem diameter and hence fiber length. However, there were no-significant differences between the two flax varieties in seed yield/fed. as well as per plant, plant height, fiber yield/fed., number of capsules/plant, number of seeds/capsule, seed index, oil yield/fed. in both seasons and oil percentage only in the second season. Sakha 3 variety was superior to Sakha 4 in total fiber percentage in both seasons and oil percentage in the first season.

The interaction between the three factors under study significantly affected all characters except the interaction between planting methods and varieties on number of seeds/capsule in both seasons.

Key words: Flax, Planting method, Sowing date, Varieties, Oil, Fiber.

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INTRODUCTION

Flax (*Linum usitatissimum* L.) is one of the oldest crops cultivated for its seed and fibers. Flax has been used in the Middle East since the fifth millennium BCE. In Egypt its role was probably more important than in many other cultures, as Egyptians rarely used wool and cotton was unknown during much of their ancient history. It was seen as a gift of the Nile, as the Hymn to Hapi has it: People are clothed with the flax of his fields.

Flax is the source of two important commodities. Linen is a historic, economically important cloth made from the fiber of flax. Linseed oil is obtained from the pressed seeds of the plant. There are about 200 species of *Linum*. The species that is cultivated most extensively is *L. usitatissimum*, an annual plant grown for its fiber and seed. Varieties of *L. usitatissimum* grown as a fiber crop have been selected to have stems that are tall, which ensures long fibers. Varieties grown for seed are shorter, with extensive branching, and thus bearing more flowers and yielding more seed.

Flax plants have gray-green, lanceolate (long and tapered), alternate leaves. Their height ranges from 0.3-1.2 m. Many cultivated varieties of flax have blue flowers, although some have white, yellow, pink, or red flowers. The flowers are self-pollinating and symmetrical, with five sepals, five petals, five stamens, and a pistil with five styles. The fruit is a capsule with five carpels, each containing two brown, yellow, or mottled, shiny seeds. Flax crops are grown in rotation with other crops to avoid fungal pathogens that cause diseases in flax plants.

Linum angustifolium is wild, perennial flax, is thought to be a "parent" of cultivated flax. There is evidence that this species was used by prehistoric peoples in Switzerland about 10,000 years ago.

Flax plants grown for fiber require well-weeded well-drained soil, and a cool, humid environment. The plant is harvested when the stems begin to turn brown. Any delay in harvesting results in deterioration of the fiber, causing it to lose its luster and softness. The plants are often harvested by hand, uprooting the plant to preserve the length of the fiber. Flax is also harvested mechanically, but fiber length is sacrificed to some degree. Good fiber is 12-20 in (20-30 cm) long. The seed pods (bolls) are separated from the uprooted plants, either mechanically or by hand, a process called rippling. The uprooted plants, now called straw, are then retted. This is a process by which bacteria and fungi are allowed to rot the semi-woody stalk tissues, and break down the gummy substance (pectin) that binds the fibers together. If the straw is not retted enough, removal of the semi-woody stalk is difficult, but if the straw is over-retted, the fiber is weakened. In pool or dam retting, the straw is placed in a tank of warm water, while in dew retting it is spread out in a field, allowing the straw to become dampened by dew or rain. Stream retting is a method where the flax bundles are put into flowing streams, and this produces the best linen fiber. Straw can also be retted chemically. The various retting processes are used to create various shades and strengths of fiber. After retting, the straw is dried and put through a machine called a flax brake, which crushes the stems into small, broken pieces called shives. The shives are removed from the fiber by a process called scutching, done either

mechanically or by hand. The fibers are then straightened out by hackling or combings, sorted according to length, and baled. The long fibers, called line fiber, are used to make fine fabrics, threads used for bookbinding and shoe making, and twine. The short, damaged or tangled fibers, called tow, are used for products such as rope, and rougher linen yarns.

Seed flax grows best in a warm climate, but hot temperatures and drought can reduce the crop yield and oil content. The soil should be fertile and well weeded. To obtain the seed, the flax plants are allowed to over-ripen, which destroys the plant's value for its fiber as linen. Flax seed contains about 40% oil. Linseed oil, which hardens by oxidation, is used to manufacture paints, varnishes, patent leather, linoleum, and oilcloth. The remaining seed and hull wastes after pressing are used for livestock feed. Fiber can also be obtained from seed flax plants. This fiber is made into special papers.

Flaxseed oil is derived from the seeds of the flax plant (*Linum usitatissimum*, L.). Flaxseed oil and flaxseed contain substances that promote good health. One of these substances is alpha-linolenic acid (ALA), an essential fatty acid that appears to be beneficial for heart disease, inflammatory bowel disease, arthritis, and other health conditions. Flaxseed, in addition to ALA, contains a group of chemicals called lignans that may play a role in the prevention of cancer.

Flax plays an important role in Egypt economy. The total cultivated area of flax in Egypt was 12833 fed. in 2009 (Annual economic bulletin - Ministry of Agriculture and Land Reclamation.

from 2004-2008). The cultivated flax area in Egypt had been decreased during the last two decades. Therefore attempts have been devoted to maximize flax productivity per unit area by growing high yielding varieties and improving agricultural treatments i.e., planting methods and sowing dates. The new reclaimed lands could be considered as the solution for increasing flax area.

Planting methods affected significantly the productivity of straw, fiber and seed yields. Flax growers broadcast seeds before or after irrigation in a well levelled seedbed to insure good germination and seedling emergence. These beds are prepared after one or two plows followed by compaction and in some cases, land levelling. Tillage operation one of the important factors affecting the flax yield production and in most field crops.

Flax varieties may differ considerably in their growth habitat, i.e. stem diameter and technical stem length. Their response to cultural practices is expected to give higher production for fiber and oil.

Therefore, the aim of this investigation was to study the response of two flax varieties to three planting methods and three sowing dates in relation to straw, fiber and seed yields.

REVIEW OF LITERATURE

Mathur *et al.* (1984) in India, evaluated flax yield under three sowing dates *i.e.*, 3rd November, 18th November and 3rd December and found that seed yield (number of capsules / plant, number of seeds / capsules, seed yield / plant, seed index, oil yield / fed. and oil percentage) were higher when flax was sown on 18 November, which is considered as early sowing.

Balazs *et al.* (1986) in Romania, found that sowing between 1st to 10th April and 1st to 10th June gave straw yield in the range from 2.55 tons for the first sowing date to 7.46 tons for the latest one.

Thosar (1986) in India, studied the effect of four sowing dates on yield of flax (30th September, 15th October, 30th October and 15th November). He reported that sowing flax at the late of September or early October gave the highest fiber and seed yields.

Hassan and El-Farouk (1987) studied the effect of three sowing dates (30th October, 20th November and 10th December). They found that delaying sowing date of flax from 30th October to 10th December reduced all characters under study *i.e.* plant height, technical length, stem diameter, straw yield / plant as well as per fed., fiber yield / fed., fiber length, number of capsules / plant, number of seeds / capsules, seed yield / plant, seed index, oil yield / fed. and oil percentage .

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

El-Shimy *et al.* (1990) reported that Giza 5 variety was superior to Giza 6 in straw yield per plant as well as per fed., while Giza 6 variety was superior in seed yield per plant and seed yield per fed., concerning fiber length, H.63 was the highest followed by Giza 5.

Gaafer *et al.* (1990) found that S.81/4 was superior in total plant height, technical length, straw yield per plant as well as per fed. and fiber yield per fed. They also found that Giza 6 variety was superior in seed yield and its associated characters followed by I.191. Meanwhile, Fam. 3248/1 was the lowest in this trait.

Zedan (1990) compared among two flax varieties (Giza 6 and Belinka), he found that Giza 6 flax variety had highest values of main stem diameter, number of capsules per plant, seed yield per plant, straw yield per plant, straw yield per fed., seed yield per fed., seed index and oil percentage. While Belinka variety surpassed Giza 6 in total plant height, technical length, fiber yield per fed. and fiber length.

Abou-Zaied (1991) in Egypt, studied the effect of three sowing dates (25th October or 15th November or 5th December) on the yield of flax and showed that sowing flax plants on 25th October significantly increased technical length, main stem diameter, fiber yield / fed. and seed index.

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

and its components, *i.e.* number of capsules per plant, seed yield per plant as well as per fed., seed index, oil percentage and oil yield per fed.

Abo-Kaied (1992) evaluated twenty flax genotypes including 4 commercial varieties (Giza 5, 6, 7 and 8). He found significant differences among genotypes for straw yield/plant, seed yield/plant, plant height, stem diameter, seed yield/plant, seed yield/fed., number of capsules/plant, number of seeds per plant and seed index and also Giza 7 flax variety gave the higher values for straw yield/plant, plant height and stem diameter than Giza 8.

Samui and Bandopadhyay (1992) in India, found that seed yield decreased from 1.21 to 0.82 t/ha. with delay sowing date.

El-Shimy *et al.* (1993) evaluated four flax genotypes *i.e.*, Giza 5, S.162/12, S.2465/1 and S.2419/1. They found significant differences among them 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 fed., while Giza 5 variety was superior in number of capsules per plant and seed yield per fed. 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 and straw yield per plant as well as per fed., fiber length. On other hand, S.2419/1 was superior in main stem diameter, number of capsules per plant, seed yield per plant as well as per fed., seed index, oil percentage and oil yield per fed.

Werma and pothak (1993) in India, observed that sowing date of flax on 18th October gave the highest seed yield (2.38 tons/ha). Delaying sowing to 27th November decreased seed yield to 1.11 tons/ha for the latter sowing date.

Dixit *et al.* (1994) compared between three sowing dates (25th October, 20th November and 15th December), they indicated that delaying sowing date after 25 Oct. decreased seed yield. Whereas seed yield was decreased by 75% when flax was sown on 15 December.

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

Mostafa (1994) compared 12 flax genotypes namely, Giza 5, Giza 6, Giza 7, Giza 8, S.119/2, S.23/4, S.282/37/14/8, S.402/3/15, S.2465/1, S.2651/2, S.281/209/211 and S.329/5/3. He found that there were significant differences among these genotypes where Giza 7 ranked first and was superior over the remaining genotypes in total plant height, technical stem length.

El-Kady *et al.* (1995) evaluated six promising flax genotypes (S.355, S.342, Giza 7, Giza 8, S.2419/1 and S.297). They reported that S.342 was the best genotype in straw yield and its related characters, followed by Giza 7.

They also found that Giza 8 was the best genotype in the first season, while S.355 was the best in the second season.

El-Sweify *et al.* (1996) compared the two cultivars Giza 7 and Giza 8. The results indicated that Giza 8 cv. gave the highest value

concerning the straw yield per plant as well as per fed. with regard to chemical composition of seeds, Giza 8 cv. record higher oil % than Giza 7 cv.

El-Sweify and Mostafa (1996) evaluated three flax genotypes *i.e.*, S.2419/1, Giza 8 and Belinka varieties and reported that S.2419/1 genotype surpassed Giza 8 and Belinka in all growth characters as well as straw and seed yields/fed., while cv. Belinka gave the highest mean values of technical stem length.

Moawed (1996) showed that the commercial variety Giza 7 recorded the highest values of stem diameter, straw yield per plant, as well as per fed., while Giza 8 was the best one in relation to number of capsules/plant, number of seeds/capsule, seed yield per plant as well as per fed. and seed index. On the other hand, the imported variety Viking recorded the highest estimates of plant height, technical length, fiber yield per plant as well as per fed., fiber length and fiber percentage.

Salama (1996) in Egypt, showed the effect of planting date *i.e.*, 15th November and 1st December on some new local cultivars (Giza 7 and Giza 8) and the introduced cultivar Ariana. She indicated that the early planting date (middle of November) significantly increased plant height, technical length, number of capsules, seed index, seed and straw yields as well as oil percentage than the late planting date (first of December).

Giza 8 cultivar markedly surpassed the rest of cultivars in the number of capsules, 1000 – seed weight, seed and straw yields and oil percentage. However, Giza 7 variety ranked second and out yield the