

**PERFORMANCE AND GENE ACTION FOR SEED  
AND FIBER YIELDS IN DIALLEL CROSSES OF  
FLAX UNDER DIFFERENT ENVIRONMENTS**

By

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B.Sc. Agric. Sc. (Agronomy), Ain Shams University, 2008

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## ABSTRACT

**Amany Nabil Sayed Mohammed, "Performance and Gene Action for Seed and Fiber Yields in Diallel Crosses of Flax under Different Environments". Unpublished Doctor of Philosophy Thesis, Ain Shams University, Faculty of Agriculture, Agronomy Department, 2019.**

Thirty six entries of flax (*Linum usitatissimum*, L.) involving eight parental genotypes and their twenty eight hybrids produced using diallel fashion in 2014/2015 to study combining ability, heterosis and heritability for straw and seed yields/plant and their related traits in the F<sub>1</sub> and F<sub>2</sub> populations under early (D1) and late (D2) sowing dates (two environments) in the Agricultural Research Station, Faculty of Agriculture, Ain Shams University, Shalakan, Kalubia Governorate.

Mean squares due to the 36 genotypes as well as mean squares due to parents and crosses were highly significant for straw yield/plant, plant height, technical stem length, fiber yield/plant, fiber percentage, fiber length, fiber fineness, seed yield/plant, no. of fruiting branches/plant, no. of capsules/plant, no. of seeds/capsule, oil percentage, harvest index and days to maturity in the F<sub>1</sub> and F<sub>2</sub> generations. Highly significant differences were showed between parents as well as crosses in their responses under different environments for straw and seed yields/plant and their related characters, indicating presence of wide genetic variability among studied genotypes. Delaying sowing date caused reduction for all studied traits of parents and crosses in F<sub>2</sub>, indicating that the delay in the planting date has a detrimental effect on these traits.

General and specific combining ability mean squares were found to be highly significant for straw and seed yields/plant and their related characters in the F<sub>1</sub>, F<sub>2</sub>D1 and F<sub>2</sub>D2 with the exception of a few cases, indicating the importance of both additive and non-additive gene effects in the expression of all studied traits. The additive effects were more important than non-additive effects under all studied environments for fiber percentage, fiber fineness, no. of fruiting branches/plant, no. of

capsules/plant, 1000-seed weight, oil percentage and days to maturity. On the other hand, non-additive effects were more effective than additive for technical stem length, fiber yield/plant, fiber length, no. of seeds/capsule and harvest index. The parents appeared to be the best general combiner under all respective environments for studied traits were; Giza 11 and Giza 12 for straw yield/plant in addition to Giza 11 for 1000-seed weight, Sakha 5 for plant height and fiber length, Sakha 6 for fiber yield/plant and No. of capsules/plant and days to maturity, Jowhar for fiber percentage and No. of capsules/plant, S. 402/1, Sakha 2, Giza 12 and Sakha 5 for fiber fineness in addition to Sakha 2 for No. of fruiting branches/plant and harvest index and S. 2465/1/3 and Sakha 5 for oil percentage. Some of the crosses exhibited highly significant and positive SCA effects under all studied environments included high x high and high x low general combiner parents as (P5xP7), (P2xP5), (P1xP3) and (P1xP8) for straw and seed yields/plant and other related characters, suggesting that the breeding procedure which utilize both additive and non-additive genetic variances would be more useful for improvement of straw and seed yields/plant and their components of flax.

Highly significant positive heterosis as percentage relative to mid and better parents was found in straw and seed yields /plant and their related characters in the F<sub>1</sub> and early and late sowing dates in the F<sub>2</sub> hybrids. This result suggests the presence of high degree of genetic differentiation between the studied parents. Positive and highly significant heterotic effects relative to mid and better parents for straw yield/plant and its related characters were found in the crosses; P2xP5 and P2xP7 for straw yield/plant, technical stem length and fiber fineness, in addition to the cross P2xP5 for fiber length as well as the cross P5xP7 for straw yield/plant and plant height under all studied environments. With respect to seed yield/plant and its related characters, positive and highly significant heterotic effects relative to mid and better parents were showed in the crosses; P1xP2 and P1xP3 for seed yield/plant in addition to 1000-seed weight for only the cross P1xP2, the cross P1xP3 for harvest

index, the cross P4xP7 for no. of fruiting branches/plant and no. of capsules/plant, the crosses; P1xP8 and P2xP5 for no. of seeds/capsule and eight crosses for oil % under all studied environments. On the contrary, highly significant negative heterotic effects relative to mid and better parents were found in the two crosses; P1xP6 and P2xP3 for days to maturity in F<sub>1</sub> and F<sub>2</sub> at early and late sowing dates except at better parent in the F<sub>1</sub> hybrid. Crosses showing desirable heterosis over better parent can be exploited for isolating transgressive segregants in later generations for straw and seed yields and their related characters, oil percentage and days to maturity.

High estimates of broad sense heritability were recorded for all studied traits ranged from 63.17% for days to maturity in F<sub>1</sub>, 64.44% for no. of fruiting branches in F<sub>2</sub> at early sowing date and 77.65% for fiber length in F<sub>2</sub> at late sowing date to 99.59, 99.88 and 99.70% for fiber fineness in F<sub>1</sub> and F<sub>2</sub> at early and late sowing dates, respectively, indicating that dominance effects had prominent role in the inheritance of studied traits. High values of narrow sense heritability were found for oil percentage followed by fiber fineness which gave values of 55.57, 63.14 and 63.16% and 54.46, 60.13 and 60.21% for the tow traits in F<sub>1</sub> and F<sub>2</sub> at early and late sowing dates, respectively, indicating the importance of additive gene effects in the inheritance of these traits and consequently the effectiveness of selection for improving such traits under similar environments. However, heritability in narrow sense were moderate to low values for the rest traits, indicating that, in the case of moderate and low heritability values in the narrow sense, response to selection for these traits in later segregating generations would be expected.

**Key words:** Flax, Straw yield, Seed yield, Sowing dates, Performance, Combining ability, Heterosis, Additive, Non-additive, Heritability.



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