EVALUATION OF SESAME LINES IN ADVANCED BREEDING GENERATIONS

BY

AYMAN ANTER SABER ABDALLAH
B. Sc. Agric. Sci. (Recla. Techn. and Desert Soil Cultiv.) Fac. Agric., Cairo Univ., 2003
M.Sci. Agric.Sci. (Agronomy) Fac. Agric., Cairo Univ., 2010

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APPROVAL SHEET

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Data**: 1 / 10 / 2015**

SUPERVISION SHEET

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ABSTRACT

Selection index was constructed to help selection for several important traits simultaneously. Judicious use of conventional and restricted selection indices is of a great importance to the breeder because selection focuses on breeding value, the portion of genetic superiority transmitted to progeny. Selection of F_6 line (s) that combine high seed yield with one or more desired agronomic or seed yield component trait in a new cultivar was practiced via 12 conventional and two restricted selection indices. These lines were evaluated in the next generation (F_7) in an evaluation experiment. The two experiments were grown in the Agricultural Production and Research Station of National Research Center, El Nubaria district, Egypt, in 2011 and 2012 seasons, respectively. The results showed significant genetic variances among lines for all studied traits expect days to maturity in F_6 and fruiting zone length in F_7. Mean performance of F_6 and F_7 lines were higher than the check cultivar for number of branches plant^{-1}, number of capsules plant^{-1}, seed yield plant^{-1}, oil % and seed yield plot^{-1}. Height to 1st capsule, branches plant^{-1} and seed yield plot^{-1} showed higher values of PCV and GCV, also reported from high to moderate heritability. There are no discrepancies between expected and actual genetic advances reported for four traits viz., fruiting zone length, number of branches plant^{-1}, number of capsules plant^{-1} and seed yield plot^{-1} while other traits showed discrepancies. The lines C1.5 and C3.8 showed 1.14 and 1.16 fold the genetic advance in favor of actual as compared to the expected genetic advance. Seed yield plot^{-1} showed positive significant correlation with plant height, stem height to 1st capsule, number of branches plant^{-1}, number of capsules plant^{-1} and seed yield plant^{-1} in F_6 and F_7, but it was negative and significant correlated with seed index and oil%. Conventional selection index N0.11 which contains four traits viz., plant height, number of branches plant^{-1}, number of capsule plant^{-1} and seed yield plot^{-1} reported the highest genetic advance and relative efficiency of direct selection for seed yield plot^{-1} itself. Holding seed index and/or oil % of selected sesame plants to the means of unselected plants in a restricted selection indices increased the seed yield plot^{-1} by 8.0 and 4.0% of lines mean while conventional selection index decreased seed yield plot^{-1} by 32 and 41%. Certain lines appeared in the selected sample of lines regardless of the procedure used and selected percentage (top 10 and/or 20%) ;their names were, C1.5, C1.6, C1.8, C3.8, C6.3 and C6.5. Estimations of rank correlation indicated that direct selection for seed yield plot^{-1} was nearly as effective as conventional selection indices which included more than two traits. The line C3.8 recorded the highest seed yield plot^{-1} amongst the 27 elite lines in F_6 and F_7 as well as check cultivar and reported higher resistance for *Charcoal*-rot and *Fusarium* wilt diseases and their combined inoculation.

Key words: Sesame (*Sesamum indicum* L.), genotypic variance, heritability, correlation, direct selection, expected and actual genetic advance, conventional and restricted selection indices, rank correlation**.**

Dedication

I dedicate my dissertation work to my family for all their support to me during the implementation of the study.

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GENERAL INTRODUCTION

Sesame (*Sesamum indicum* L.), is probably the most ancient oil seed crop. It is known under different names in different countries viz: simsim, benniseed, til, gingelly and a jonjoli (Khidir, 1997 and Singh *et al*., 2014). It is a self pollinated crop, under the family *Pedaliacea*. It is grown in an area of 6.99 million hectares with a production of 3.8 million tons in the world. Acreage in Egypt is about 30 thousand hectares with a total production of 30,000 t seeds and productivity of 1333.3 t/ha (FAO 2013). Sesame seeds are rich in oil and protein with high dietary energy value of 6,355 kcal kg^{-1}. Chemical composition of seed shows that it contains 57–63% oil, 23–25% protein, 13.5% carbohydrate and 5% ash (Elleuch *et al*., 2007). It is rich source of various nutritional elements including iron, magnesium, manganese, copper and calcium, and the important vitamins B_1 (thiamine) and E (tocopherol). Due to its flavor and stability as well as high-quality cooking value, sesame fat is of great significance in the food industry. The presence of sesamin and sesaminol lignans in its nonglycerol fraction contributed to oxidative stability and antioxidative activity of sesame oil (Wu, 2007). Sesame oil contains several fatty acids such as oleic acid (43 %), linoleic acid (35%), palmitic acid (11%) and stearic acid (7%) (Bharathi *et al*., 2014). Because of its high oil quality and wide use in raw foods, confectioneries and bakery industries, the demand of sesame seed is increasing in the global market (Ashri, 1989). The importance of sesame lies in its high quality oil which is often referred to as the “queen” of vegetable oil. The outstanding characteristic of sesame oil is its stability and keeping quality as well as resistance to rancidity.

The mathematical genetic theory, in the form of selection index, developed by Smith (1936) is the basis for simultaneous selection of several traits. A selection index most often aims at giving appropriate weight to the components maximizing gains from selection (Falconer, 1983). It is therefore important to improve seed yield using both hybridization and selection as breeding strategies.

Proper understanding of genetic variability, heritability and correlation studies of plant traits is vital for effective use in any breeding program (Ganesh and Thangavelu, 1995).

Heritability in the broad sense is defined as the proportion of phenotypic variance that is attributable to an effect for the whole genotype, comprising the sum of additive, dominance, and epistatic effects (Nyquist, 1991and Falconer and Mackay, 1996). Also, it helps for construction of selection index.

On the other hand, sesame yields are highly variable depending upon the growing environment (Ram *et al.*, 1990) therefore sesame breeder must know the relationship between yield and its components (Ganesh and Sakila, 1999).

A rank correlation was constructed to determine the ranking of each line within the population based on direct and indices selection (Mwimali, 2014).

However, sesame is the crop of small holders with limited resources to breeding activities including disease resistance against prevailing diseases. The productivity in Egypt remained virtually stagnant