HERITABILITY OF SOME ECONOMIC CHARACTERS IN AN EGYPTIAN COTTON CROSS

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THESIS

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I N T R O D U C T I O N

Among our native field crops, cotton occupies the first place. This is due to its undisputed indispencibility to the national economy. Its high reputation in the world markets has long been established. It is the duty, therefore, of the Agriculturists of the U.A.R. to do whatever they can to help maintain that reputation. This would call for the combined efforts of the breeders, physiologists, entomologists and soils men. Varieties of cotton come and go on the agricultural scene. The disappearance of a variety is not always due to its deterioration but more after than not, specially in the U.A.R. due to the constant striving of the specialists to produce better varieties than those under cultivation. This is largely the plant breeder's work who is never satisfied with the levels reached with respect to yield and quality characters.

In this thesis one Egyptian cotton cross was studied with the sole object of determining heritabilities of certain characters which were thought to be specially important both to yield and quality of lint. The method used in estimating heritability is the six-population method, a method which has never been used, to the authors knowledge, in studying heritabilities of characters in Egyptian cotton, inspite of its

acknowledged accuracy. It is hoped therefore that this study would add something of value that would help the cotton breeder in his selection work.

REVIEW OF LITERATURE

Lint Percentage :

Lint percentage or ginning out-turn is the ratio of lint to seed cotton, and is directly related to lint yield.

According to Leak (1914) lint percentage is determined by seed weight and lint weight, the latter being in turn determined by the number of fibres carried by the individual seed and weight of individual fibres.

In the crosses four high lint percentage strains (Lonestar, Texas Rust, Red leaf and Acala) and a strain called No Lint, Thadani in 1925 (c.f. Knight 1954) obtained the ratio 3 : 1 of high : low lint amount in F_2, indicative of one gene pair difference between the parents. Ware (1929) studied the inheritance of lint percentage in four crosses; (a) Pima (30.9 % x Winesap, 31.9 %; (b) Pima, 28.6 % x Upright, 36 %; (c) Winesap, 30.7 % x Sea Island, 20.8 % and (d) Scant Lint, 5.6 % x Normal, 34.3 %. (The percentages indicate lint percentages of the plants). In cross (d) high ginning out-turn was incompletely dominant, also the F_2 and the back crosses to the low parent indicated monogenic control

of that character. In cross (c) F_1 was intermediate while in crosses (a) and (b) it was lower than the low parent. According to Knight (1954), Okelly and Hull in 1930 came to a conclusion that where segregation was sufficiently clear cut to give definite indications, it appeared that lint percentage was controlled by a single factor pair. They found that it was not possible to determine definitely the nature of the segregation in crosses between species and crosses between Upland strains where the percentage differences were narrow. On the other hand, where segregation was definitely evident, high lint percentage was partially or entirely dominant.

In Egyptian varietal crosses, Aboul-Ela (1930) found to F_1 to be closer to the low parent in ginning outturn, with one exception those crosses where Enan's Brown lint cotton was a parent.

According to Knight (1954), Kokuev in 1936 observed transgressive segregation in F_2's of crosses between varieties with differing ginning outturns. In a cross between Giza 35 B (high ginning outturn) and G. 26 A (low ginning outturn), Kilany and Aboul-Naga (1943) found that ginning outturn of F_1 generation was intermediate. According to

Kime and Tilley (1947) high lint percentage in crosses between Upland varieties was partially dominant. Issac (1950) observed that the parental difference in lint percentage was governed by no more than 3 to 4 pairs of genes in Upland cotton. Paliatseas (1951) found a minimum gene difference of 8 major pairs between the parents, which differed by 6.5 per cent in lint percentage. Heritabilities were 0.77 and 0.35 using the analysis of variance method and the regression of F_3 line means on F_2 plants respectively. In the cross Wilds x Half and Half, Mason (1951) observed partial dominance of low lint percentage. The F_2 mean was not significantly lower than the average of the two parents. He obtained a heritability value of 0.60 from F_2 data, indicating that selection for lint percentage in that generation on an individual plant basis might be effective. Deshotels (1952) in a cross between Tuxtula and Half and Half, observed partial dominance of low lint percentage over high. His estimated heritability value was 0.63 from F_2 data. Heritability values of 0.71 and 0.43 from F_2 and F_3 respectively in the cross between Delta Smooth Leaf and Hurley Long Boll were obtained by Young (1953). Breaux (1954), studied lint percentage as a one of the major components of yield in American Upland

cotton. He obtained a heritability value of 0.506 on the basis of the regression of F_3 line means on their respective F_2 plants. Manning (1955) observed that parental varieties which ranked high in lint percentage tended to produce hybrids which also ranked high in this character. Heritability of lint percentage ranged from 0.63 to 0.76 in his work suggesting that single plant selection for this character would be effective. In a cross of two Upland cotton varieties, Stith (1956) found that lint percentage behaved as a quantitative character with partial dominance for high lint percentage. The heritability value was 0.43 and 0.79 from F_2 and F_3 data respectively. Kamel and Gomaa (1962) in two crosses, Karnak x Giza 58 and Giza 60 x Giza 58, found that lint percentage was quantitatively inherited with partial dominance of low lint percentage in both crosses. They added that the number of gene pairs responsible for the parental difference ranged between 2 and 5 pairs in the first cross, and 3 pairs in the second cross. Heritability value based on F_2 data was 0.59 and 0.39 for the first and second crosses respectively. Abdo (1964), in the cross Ashmouni x Giza 63, found that lint percentage was quantitatively inherited with complete dominance of high percentage and that two to four pairs of genes controlled the parental

difference. The heritability value was 0.61 calculated from F_2 data. In two Egyptian cotton crosses : (Giza 66 x Giza 45) and (Giza 66 x Giza 59), El-Fawal (1966) found that lint percentage behaved as a quantitative character in the two crosses. The two F_1 means were nearer to the low parent, indicating partial dominance of low lint percentage. About two pairs of genes were responsible for the parental difference in the first cross, 2 to 3 pairs in the second cross. Heritability varied from 0.487 to 0.509 in the first cross, and from 0.399 to 0.453 in the second cross calculated from F_2 data. Calculating F_3 data heritabilities were 0.568 and 0.466 for the first and second cross respectively. Working on six Egyptian cotton crosses. Abo-El-Zahab (1969) observed a partial dominance of high lint percentage. He estimated heritabilities in the broad sense to be at 0.755, 0.571, 0.474, 0.456, 0.393, 0.079, while in narrow sense were 0.716 for one of the crosses and 0.254 for other

Lint Strength :

Fibre strength was found to be a quantitative character by Ware and Harrell (1944). In an Upland varietal cross they found F_1 plants to be intermediate though with a slight tendency towards the weak parent.