Effect of some selection procedures on lint yield and seed characters improvement in cotton

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The purpose of this study was to obtain information regarding; (1) type of gene action, (2) both broad and narrow sense heritabilities, (3) phenotypic, genotypic and environmental variances, (4) magnitudes of the phenotypic and genotypic correlations, (5) relative effectiveness of within and between different selection procedures in improving lint yield, (6) correlated response between selected and unselected traits, (7) effect of selection procedure on genetic variation, and (8) effect of phenotypic selection for seed index on oil percentage in F4 and Sogenerations.The present investigation was carried out at Sakha Experimental Farm, Sakha Agricultural Research Station, during 2000, 2001 and 2002 growing seasons. Six populations experimentsIn 2000, the two crosses (G. 45 x G. 75) and (G. 88 x G. 89) with their six populations; P1, P2, F1, BC1, BC2 and F2 were evaluated in two separate experiments.The following characters were assessed:1Lint yield/plant (g.).2Bolls/plant.3Seeds/boll.4Lint/seed (g).5Lint percentage.6Seed index (g).7100-seed volume (cm3).8Seed density (g/cm3).9Heavy seed (%).10Micronaire reading.11Pressley index.cgiyit.ma/ifyThe obtained results were:1.The scaling tests, F2-deviation and BC-deviation showed significant values for most studied characters in the two crosses indicating that there were non-allelic gene interactions.2.All types of gene effects were significant and govern the inheritance of the most studied characters with some exceptions indicating that selection procedures based on the accumulation of additive effects should be successful in improving most of the characters under investigation.3.The potence ratio values indicated that there was an existence of overdominance for bolls/plant, seed index and seed density in the two crosses as well as 100-seed volume (cross I), lint yield/plant, lint/seed, lint percentage and heavy seed percentage (cross II), however, other characters expressed partial dominance.4.High heritability values in broad sense were observed for lint yield/plant and lint percentage in both crosses, in addition to bolls/plant and micronaire reading (cross I), seeds/boll, lint/seed and seed index (cross II).5.High to moderate narrow sense heritability estimates were found for all characters except seed density in the two crosses, 100-seed volume, heavy seed percentage and pressley index (cross I) and seeds/boll (cross II).6.The difference between broad and narrow sense heritabilities may be due to the presence of non-additive gene action in the inheritance of most characters.7.The highest predicted genetic advances as a percent of F2 mean (Ag%) were achieved for lint yield/plant and bolls/plant in the(1-12(;),./(441t1110%07two crosses, lint/seed, 100-seed volume and heavy seed percentage in the cross II. Low predicted genetic advances were detected for seed density in the two crosses, 100-seed volume and pressley index in cross I. Selection procedures:The materials of this part consisted of three populations; G. 45 x G. 75, G. 87 x G. 89 and G. 86 open-pollinated. The selection procedures were as follows: I. Selection index and phenotypic trait selectionThe 5% superior plants for lint yield/plant (x,), bolls/plant (xi), seeds/boll (x2) and lint/seed (x3) were chosen from each population. Selected elite plants were 50, 49, 48 plants of four characters in the three populations, respectively.In 2001, part of selfed seeds of the 50, 49, 48 selected progenies in the three populations were evaluated with the two parents and a random sample of F3 and SI seeds (bulked seeds). Three replications per progeny in RCB design was used. All F3 and SI progenies in the three nursery fields were selfed to produce F4 and S2 seeds.The 50, 49 and 48 progenies were ranked using twelve selection procedures involving the four characters. The three superior progenies of each selection index were

determined using 6.00, 6.12 and 6.25% selection intensity for the three populations, respectively. A total of 10, 13 and 11 progenies covering these selection indices, and their selfed seeds were evaluated with the twoparents and a random sample of F4 and S2 (bulked seeds) in a randomized complete block design with three replications in 2002. 2.Recurrent selectionIn 2001, selfed seeds of the eight parents (four superior plants in lint percentage and four elite plants in seed index) of recurrent selection were sown and a half diallel hybridization was made and 28 hybrids were obtained.In 2002 season, the 28 hybrids with their eight selected parents were compared with the two original parents and bulked seeds were planted in a randomized complete block design with three replications for each population. 3.Seed charactersThe (5%) 15 superior plants in seed index were selected in each population. In 2001 season, selfed seeds of the 15 progenies of each population were evaluated. In 2002 season, selfed seeds of the 3 elite progenies in oil percentage were evaluated with the two parents and a random sample of F4 and S2 seeds of the three populations in a randomized complete block design with three replications.The characters used in this part were:1Lint yield/plant (g.).2. Bolls/plant.3Seeds/boll.4.Lint/seed (g).5Lint percentage.6.Seed index (g).7100-seed volume (cm3).8.Seed density (g/cm3).9Heavy seed (%).10.Oil percentage.CY(e/m-ma/ieyThe data justify the following conclusions Selection index and phenotypic trait selection1.The phenotypic variance components in F4 and S2 generations were higher than F3 and Si for all studied characters with the exception of lint percentage in populations I and II. The increase in phenotypic and most genotypic variances in F4 and S2 generations is due to the efficiency of selection procedures application which create substantial genetic variation.2.Comparing the means of F3 and Si generations with those of F4 and S2 ones showed that the means of F4 and S2 generations surpassed those of F3 and S1 for all studied characters except seeds/boll in the three population.3.Both lint yield and bolls/plant exhibited the highest phenotypic and genotypic coefficients of variation estimates in the three populations; however, seeds/boll, lint/seed, lint percentage and seed index showed moderate to low variabilities.4.High heritability values in broad sense were observed for lint yield and bolls/plant in the three populations, while the remaining characters, estimates widely fluctuated over the successive generations of selection probably due to the varied environmental factors.5.The phenotypic and genotypic correlations between lint yield/plant and bolls/plant in the three populations were positive and highly significant. Insignificant positive or negative correlations between lint yield/plant and seeds/boll were shown in almost all generations for the three populations. rp and rg of lint yield with lint/seed had been increased from F2 to F4 and from So to S2 generations for the three populationsoYetweimaieyexcept population II which showed increase from F2 to F3 only. rp and rg between lint yield and lint percentage were high and positive relationship and increased from F2 to F4 and from So to S2 generations in most studied generations. Lint yield/plant showed significant and positive with seed index in F2 and So generations of the three populations.6.Deletion of lint yield (x„) resulted in major adjustments of phenotypic weights of the other yield components to compensate for the loss of this variable. While the deletions of bolls/plant (xi) and/or seeds/boll (x2) and/or lint/seed (x3) had little effects on the magnitude of weights of lint yield.7.The highest predicted genetic advances of lint yield from F3 and S1 means occurred when using the indices 123 (populations I and II) and 112 (population III). The highest predicted genetic advances of lint yield from F4 and S2 means occurred when using the indices Ix, (populations I and III) and Ixi (population H).8.The highest realized genetic advances for lint yield were when applying the indices Ix3 (population I), 1123 (population II) and Ix2 (population III).9.The deviations of realized advance from predicted advance for lint yield/plant were positive and high in all indices in population III.10.The highest predicted responses to selection for lint percentage and seed index in F4 generation were by using the indices Ix3 and Ix2 for population I, and 123 and 1x3 for population II, respectively.(---9r2etwe/ritaieyRecurrent selectionI. Both phenotypic and genotypic variances were significant and large in magnitude for all studied characters in the three populations, except seeds/boll in population III. The increase in 172 and 172 is due to new recombinations which createPsubstantial genetic variation.2.The 28-hybrids had the highest means of lint yield/plant, bolls/plant and seeds/boll compared with the better parent for populations I and II. The same-hybrids mean performance was higher than Giza 86 pure line mean for lint/seed, lint percentage and seed index in population III.3.The estimates of phenotypic and genotypic coefficients of variation were large in magnitude for all the studied characters in the three populations except for seeds/boll and lint percentage in population III.4.Phenotypic and genotypic correlations between lint yield/plant and bolls/plant were positive and highly significant; the relationship of lint yield/plant with seeds/boll and seeds/boll with seed index showed insignificant positive or negative rp and rg in the three populations. Lint yield/plant and each of lint/seed or seed index exhibited weak negative phenotypic and genotypic associations in populations I and II; rg was significant and positive in population III.5.The highest predicted genetic advances were achieved for lint yield/plant, bolls/plant, lint/seed and seed index in the three populations. High to low values of GCV were found to be associated with high to low genetic advances in most studied characters in the three populations.&win/ma/leyComparative efficiency of the different selection procedures in improving lint yield1.In population I, the direct phenotypic selection procedure for lint yield only (NO was superior to the other selection procedures in in F4 generation. The ranks of actual relative efficiencies relative to selection for lint yield alone (Ix,) were 274.60% for recurrent selection, 221.69% for Ix3 and 158.20% for 1w123, Ivv, and 1w2.2.Concerning population 11, the recurrent selection and index 1x1 were more efficient than the other selection procedures in F4 generation. The ranks of actual relative efficiencies relative to selection for lint yield alone (1)0 were 550.00% for recurrent selection, 532.14% for 1123 and 113, 405.36% for 1x3 and 296.43% for 123.3.Regarding population III, both recurrent selection and index Ixw were superior to the other selection procedures in S2 generation. Phenotypic selection of seeds/boll (1x2), index 123 and recurrent selection showed the highest percent of actual advance compared with phenotypic selection for lint yield alone (Ix,). Effect of phenotypic selection for seed index on seed characters’1.Generally, residual genetic variability as expressed by 62g and GCV, indicates that the large magnitude of variability still left in oil percentage and 100-seed volume in populations II and III, and heavy seed percentage in population III.2.Phenotypic selection for seed index in F2 and So generations and for oil percentage in F3 and S1 generations afterwards wasrgalitzlit,4747effective for improving oil percentage due to the presence of transgressive segregation for oil percentage in population III.3.High heritability values in broad sense were observed for oil percentage in the three populations, seed index, 100-seed volume and heavy seed percentage in population III, and seed density in populations II and III. Low heritability values in broad sense were found for seed density in population I and seed index in populationII.4.Oil percentage showed positive and high correlation with seed index and 100-seed volume in populations I and II, and with seed density in population III.5.Both population I and III showed high values of actual advance for oil percentage, seed index and 100-seed volume.