Selection indices for economic characters in segregation populations of lentil

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The present study was carried out at Giza research station, Agricultural Research Center, Egypt during the three winter seasons of 2002/03, 2003/04, and 2004/05. The materials included five F3-lentil populations, where about 6000 seeds from each F3 population wee sown on 18 December 2002. The wide spread local variety Giza 9 and the early maturing variety Sinai 1 were used as checks. At maturity, 100 plants from each F3 population were selected on the basis of number of pods/plant. A total of 20 plants were selected separately and randomly from each F3 population, as well as, from check varieties, Giza 9 and sina 1, and the following characters were measured in each plant:1-Plant height (cm).2-Total number of branches/plant.3-Number of pods/plant.4-Number of seeds/plant.5-Number of seeds/pod (estimated from 20 pods/F3 population).6-Biological yield /plant (g).7-Seed yield/plant (g).8-Harvest index (seed yield/plant biological yield / plant) x 100).9-Plant growth vigor (1-high, 2-mediam, 3-low vigor).10-Days to 50% flowering.11-Days to 90% maturity .The characters numbers 9, 10 and 11 were measured on the plot-basis.The 100 selected plants from each F3 Population were rankedaccording to their seed yield.' The plants, which significantly exceeded the yield of Giza 9, were selected to be growing as F4 families in next season. The total number of selected plants from F3 to be planted as F4 families were 6, 6, 5, 17, and 21 for cross 1, 2, 3, 4 and 5,respectively. The seeds of these plants were saved for planting in F4 generation.In 2003/04-winter season, the seeds of the selected F3 plants were planted as F4 families on 13 December 2003. A randomized complete block design with two replicates was used. Each replicate contained 57 plots (55 plots for all the five crosses and two plots for Giza 9 and Sinai 1). Field practices were applied as used in F3 generation and all the characters measured in F3 generation were also measured. The highest three seed yield plants in every F4 family were selected and saved to be grows in F5 generation.In 2004/05, the seeds of the three selected F4 plants were planted as F5 families on 27 October 2004. A randomized complete block design with three replicates was used, and each replicate contained 167 plots (165 plots for all the five crosses and two plots for Giza 9 and Sinai 1). Field practices were applied as used in F4 generation and all the characters measured in F4 generation were also measured.The analysis of variance was performed, for each F4 and F5 families of every cross separately (including Giza 9 and Sinai 1) with randomized complete black design. The least significant differences (L.S.D) was estimated and used to compare among means of the families, Giza 9 and Sinai 1. The analysis of variance was made for each F4 and F5 families in each cross again, but excluding Giza 9 and Sinai 1. In addition the variance of F4 and FS families in every cross was estimated separately using MSTAT computer program. The various genetic parameters; phenotypic, genotypic and error variances, broad sense heritability, expected genetic advance from selection, phenotypic (P.C.V), genotypic (G.C.V) and environmental (E.G.V) coefficient of variation were estimated. Simple correlation coefficients among all studied characters were calculated for F4-families and F5 families.The obtained results could be summarized in the following points:1-The average seed yield/plant in F3 was very low in all crosses, except cross 3, and ranged from 0.16 g for cross 2 to 0.97 g for cross 5. Cross 3 gave a reasonable average seed yield of 1.47 g/plant. Low seed yield was mainly due to broomrape's (Orobanche) infection, which qrread over the field. However, many plants were not infected and gave reasonable seed yield. Thus, useful selection was practiced in ali the five crosses. Many selected plants gave

seed yield above 1.4 g/plant with ovarall average seed yields of the five crosses ranging from 1.0to 1.8 g/plant.2-The response to selection was measured as the percentage increase of F4 values over F3 values for all studied characters. The data indicate the superiority of F4 values over F3 values for of the most studied characters. For example, seed yield/plant in F4, cross 1, increased by 583.64% (about six times) over the corresponding value of F3, and the percentage increase of other crosses ranged from 48.23% for cross 3 to 1856.25% for cross 2. Similarly, the percentage increases of number of pods/plant of F4 over F5 were high and ranged from 49.02% to 548.85%. All other characters showed similar superiority in F4 over FS but with various values of increases, except the characters: plant vigor in crosses 2,3, 4 and 5, harvest index in cross 3, and number of seeds/pod in cross 3, which had negative response. Days to flowering and maturity showed positive response in all crosses, which means that F4 families were late in flowering and maturity compared to F3 families.3-The results of F4 crosses indicate that there are highly significant differences among families for several characters, which make it clear that there are opportunities for improving those characters by selection within the population. Estimates of broad sense heritability showed that seed yield/plant, days toflowering, biological yield/plan, and number of branches/plant had high values of >80%.4-The genetic advance from selection depends on the heritability estimate and the magnitude of phenotypic variance. In order to determine the validity of selection, expected genetic advance should be obtained. In addition, heritability estimates together with genetic gains are more useful than the heritability values alone in predicting the resultant effect of selecting the best individuals. For example, in cross 1 in F4, number of branches/plant, which had high broad sense heritability (82.94%) had low genetic advance (23.07%) because its coefficient of phenotypic variation was low (6.80). In comparison plant growth vigor, which had a low heritability (50.0%), had a high genetic advance percentage of 30.71% due to its high coefficient of phenotypic variation (29.81%).5-The results of F4 generation show that seed yield/plant correlated positively and significantly with number of pods/plant and number of seeds/plant in all crosses. The results suggested that selection for high number of pods/plant would be an efficient method for improving seed yield. The relationships among the two main yield components, number of pods/plant and number of seeds/plant, showed strong association between them; indicating selection for one of them is enough to improve yield. Moreover, in most cases there was no significant correlation between number of pods/plant and number of seeds/plant with number of seeds/pod. These results indicate that it would be difficult to achieve a response to selection for high levels of pods/plant and /or seeds/plant and number of seeds/pod.6-In F5 generation, the response to selection was also high. For example, seed yield/plant in cross 2 increased by 841.25% (about eight times) over the corresponding value of F3, and thepercentages increases of other crosses ranged from 43.81% for cross 3 to 208.36% for cross 1. Similarly, the percentages increases of number of pods/plant of F5 over F3 were high and ranged from 14.01% to 131.23%. Most other characters showed similar superiority in F5 over F3 but with various values of increase, except several characters. Days to flowering and maturity showed positive effects in all crosses, which mean that the F5 families were late in Flowering and maturity compared to F3 families.7-The results of F5 show -the existence of highly significant differences among families for several characters, which make! it clear that there are opportunities for improving those characters by selection within the population. Estimates of broad sense heritability showed that several characters had high values of broad sense heritability above 80%.. Genetic advance is also of considerable importance because it indicates the magnitude of the expected genetic gain from one cycle of selection. The genetic advance from selection depends on the heritability estimate, the magnitude of phenotypic variance.8-The associations between plant characters of F5 generation show that seed yield/plant correlated positively and significantly with number of pods/plant and number of seeds/plant in all crosses. The results suggested that selection for high pods/plant would be an efficient method for improving seed yield. The relationships among the two main yield components, number of pods/plant and number of seeds/pod, showed strong association, indicating selection for one of them is enough to improve yield. Moreover, in most cases there was no significant correlation between number of pods/plant and number of seeds/plant with number of seeds/pod. These results indicate that it would be difficult to achieve a response toselection for high levels of pods/plant and /or seeds/plant and number of seeds/pod.9- Number of branches/plant (primary and secondarybranches) correlated negatively or not correlated, in most cases, with harvest index. The results indicate that it is possible select for high seed yield/plant with a reduced number of branches/plant.10- Wide variation in average seed yield/plant among F3,F4, and F5 was dected. The Average seed yield of these generations was 0.74, 3.36, and 1.72 g/plant, respectively. This wide variation was due to genetic variation among various generations and environmental effects. As mentioned before, Orobanche affected F3, which dramatically influenced seed yield. F5 was planted very early on 27 October 2004, while F4 planted in proper optimum date on 13 December 2003 (the recommended date of planting for lentil is between 15 November to 15 December in North Egypt). It seems that date of planting played an important role on the performance of the families. This was clear for time from planting to maturity, which was 127.37 days in F4, while it increased to 170.99 days in F5. These results suggest that, the possibility of rising yield levels through improved crop management practices, especially date of planting.11- The families in this study showed wide genetic diversity,allowing selection for high-yielding lentil families. There was a significant and positive correlation among seed yields of both F4 and F5 families (r = 0.583**), indicating that most selected high yield families in F4 gave high seed yield in F5. There are about 20 selected families in F5 that gave seed yield higher than the local checks Giza 9 and Sinai 1. These families are no’s 3, 10, and 12 in cross 1; no. 2 in cross 2; nos. 2 and 5 in cross3; nos. 3, 6, 14, 23, and 30 in cross 4, and nos. 1, 2, 5, 6, 7, 17,18, 30 and 31 in cross 5. These families exceeded the seed yield of Giza 9 by a range of 69.8% - 159.7%. All these families are considered promising and should be exploited inlentil improvement programs.