

Research Reports

Breeding

Assessment of F_2 -derived lines as a breeding procedure in chickpea

In self-pollinated crops, traditional breeding methods promote rapid progress to homozygosity leading to the development of pure line varieties. The uniformity exhibited by such varieties is essential in situations relying exclusively on mechanization and where quality of produce is an overriding factor. However, such varieties may lack the stability of performance over environments, which would be conferred by more-heterogeneous populations.

F_2 -derived lines may have considerable advantages in this respect as well as from a logistical point of view. Since no selection is practiced within the progeny/family after single plant selection in the F_2 , the lines thus produced are heterogeneous and thereby probably more stable and could offer opportunities for further selection if desired. The present study was therefore undertaken at ICRISAT subcenter, Gwalior, to assess the suitability of F_2 -derived lines as a breeding procedure in chickpea.

In 1980/81, 232 single plants were selected in F_2 populations of 46 single crosses among F_2 desi parents of long-, medium-, and short-duration. The F_3 progenies of these plants were tested in an augmented design in 1981/82. Each plot had two rows of 4-m length with a spacing of 60 cm between and 20 cm within rows. Forty-seven lines with at least 10% more seed yield than checks, Annigeri and K 850, and uniform for the most-important characters, e.g., duration, seed type, seed size, color etc., were selected.

In 1982/83, 47 F_2 -derived F_4 families along with two checks, Annigeri and K 850, were evaluated for seed yield in a 7 x 7 simple lattice design with two replicates in plots of four rows with spacings of 30 cm x 10 cm. The check cultivar K 850 ranked 37th in seed yield, and 23 top-yielding lines were selected for further testing.

In 1983/84, 23 F_5 lines and 2 checks, K 850 and Gwalior 2, were tested in a 5 x 5 balanced lattice square with three replicates, and same plot size and spacing as in previous year. Several lines produced heavier seed yields than checks and five top-yielding lines (Table 1) were selected for testing in the International Chickpea Screening Nursery in the next season.

These five F_2 -derived F_6 lines formed part of the International Chickpea Screening Nursery--Desi Medium Duration in 1984/85, which included a total of 60 test entries and 3 checks. The nursery was grown in an augmented design over eight locations in India. The F_2 -derived lines ranked 1, 4, 7, 17, and 54 in seed yield on the basis of overall mean across locations (Table 1) confirming their wider adaptability over a range of environments. The cause of low yield of the line ICCL 84326, that ranked 54th, was fusarium wilt, which considerably reduced its plant stands at several locations. The other four lines were not highly susceptible to wilt.

Although with limited data and material, the results of this study over several years suggest that F_2 -derived lines as a breeding procedure could prove useful in breeding self-pollinated crops such as chickpea. It not only provides heterogeneous--and thus more stable--lines with opportunities for further selection, but also enables the breeders in obtaining sufficient seed by F_4 family stage for multilocal tests to assess stability of performance and in avoiding too much selection for specific adaptation. Instead of expansion to large numbers as in normal pedigree procedure, the greatest volume of

Table 1. Seed yields of some selected F₂-derived lines over years and locations.

Entry	F ₂ -derived line		Seed yield (kg ha ⁻¹)		Rank in seed yield ^c
	Pedigree	ICCL No.	1982/83 ^a	1983/84 ^a 1984/85 ^b	
73167-5-3-B-BP x K 850 (JG 62 x F 496)	ICCX-780083-8G-BG	84323	2481	1860 1619	17
P 324 x NEC 177	ICCX-780578-2G-BG	84325	2592	1800 1814	4
7389-20-3-B-BP x P 436 (K 850 x F 378)	ICCX-780077-20G-BG	84326	2480	1770 1011	54
7389-20-3-B-BP x P 180-1 (K 850 x F 378)	ICCX-780073-7G-BG	84327	2596	1700 1989	1
73167-5-3-B-BP x P 1081-1 (JG 62 x F 496)	ICCX-780095-8G-BG	84328	2628	1720 1742	7
Control K 850			2047	1410 1366	39
Trial mean			2206	1510	
SE ±			185.6	138.7	
CV (%)			12.9	15.9	

a. One location at Gwalior.

b. Mean over eight locations.

c. Among 63 entries.

material is at F_2 and F_3 stages and from then on it rapidly reduces.

This system will be well adapted to supplying useful material from ICRISAT to other Centers. For example, after identification of best F_3 progenies, F_4 families could go into the International Chickpea Screening Nursery, which would also provide segregating material for further selection.

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Variation in the proportion of double-podded nodes among advanced-generation progenies in chickpea--some preliminary observations

Physiological studies conducted at ICRISAT Center (Sheldrake et al. 1978) have shown that grain yield in chickpea are up to 11% higher in double-podded (two pods/pedicle at least at one fruiting node) than in conventional single-podded genotypes, particularly under stress of environmental conditions. Further studies at ICRISAT Center and elsewhere have shown that the double-podded characteristic is under the control of a single recessive gene; so the characteristic can easily be incorporated into the breeding material. But its expressivity is low. All fruiting nodes in double-podded genotypes are not double-podded and this proportion varies from genotype to genotype. A higher proportion of double-podded nodes may be more desirable in a genotype since it may add to the increase and stability in seed yield. The present study investigates the extent of proportion of

double-podded nodes among advanced-generation, double-podded progenies of chickpea.

Forty-three F_7 , 184 F_6 , and 247 F_5 progenies, derived from crosses between double-podded and multiseeded (single-podded) lines, were grown in field at ICRISAT Center in 1984/85 in unreplicated plots of two rows, spaced 60-cm apart, with plants at 20 cm. These were evaluated for the expressivity of the double-podded characteristic at the time of maturity. For this, 10 random plants were chosen in each plot and the numbers of total fruiting nodes and of those bearing two pods per pedicle on the main stem of each plant were counted. The proportion of double-podded nodes in each plant was then estimated as percent of the total fruiting nodes (this simple procedure was adopted after it was found that the estimates thus obtained were well correlated with those obtained by counting all the fruiting nodes and double-podded nodes on a plant). The means and their standard errors for each progeny were calculated using the data from all 10 plants in a progeny. No transformation of data was carried out since there were no extreme values in the data set.

The estimates of the percentage of double-podded nodes of five progenies with the highest and one progeny with the lowest proportion each in the F_5 , F_6 , and F_7 generation are presented in Table 1. The percentage of double-podded nodes varied from 28.5% to 80.2% in F_5 ; 29% to 83.2% in F_6 ; and 33.6% to 77.6% in F_7 generation. In a separate experiment at ICRISAT Center the same year, the double-podded variety JG 62 produced about 50% double-podded nodes. Several lines, such as ICCX-790173-BH-BP-28P-1P (F_6 generation), produced significantly higher proportions of double-podded nodes than others and may be used as better sources of the double-podded characteristic in breeding programs.

These are only preliminary observations and the selected progenies/lines with highest and lowest proportions of double-podded nodes will be further evaluated in a replicated test in 1985/86.