

and BR-77 were consistent across generations and therefore have potential for use as parents in the simultaneous improvement of shelling percentage and seed density. However, narrow sense heritability estimates and predicted genetic advance were low suggesting that the breeding methods conventionally used for self-pollinated crops may be ineffective in improving these characters.

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<sup>1</sup>Gupta, V.P., Kaul, A.K., and Ramanujam, S.  
1972. SABRAO Newsletter 4(2):133-137.

<sup>2</sup>Kempthorne, D. and Curnow, R.N. 1961.  
Biometrics 17:229-250.

### Natural Outcrossing in Chickpea

Chickpea is a self-pollinated crop and estimates of the levels of natural outcrossing are low, ranging from 'self-pollination is the rule'<sup>1</sup> to 1.58%<sup>2</sup>. However, the level of natural outcrossing in self-pollinated crops is known to vary with environments and this study was undertaken to determine the extent of natural outcrossing at ICRISAT Center during the 1978/79 and 1979/80 rabi seasons.

The marker used was the simple leaf character which is recessive to the normal compound leaf. Four F<sub>2</sub> populations of crosses of simple x compound leaf were sown in 1978/79 at a spacing of 30 x 10 cm. Seventy five simple leaf segregants were tagged in the four populations and harvested separately at maturity.

The progenies were sown in one row each during 1979/80 and the number of compound leaf types appearing in each row was counted. The percentage of compound leaf types varied from 0 to 2.11, with an average of 0.96 (Table 1). Since, in F<sub>2</sub> populations, plants homozygous for simple leaf, heterozygous and homozygous for compound leaf can be expected to occur in a 1:2:1 ratio there is an equal chance of pollination with gametes carrying the simple or compound leaf alleles, the actual levels of outcrossing will be twice the observed rate. The estimate (1.92%) confirms the low level of outcrossing in chickpea and is very close to the value of

Table 1. Number of plants of simple and compound leaf types in the outcrossing study.

Population	No. of plants		% plants with compound leaves
	Simple leaf	Compound leaf	
P-2974 x PRR-1	193	2	1.03
PRR-1 x P-1100	69	0	0.00
JG-71 x PRR-1	232	5	2.11
PRR-1 x CPI-36071	432	2	0.46
<b>Total</b>	<b>926</b>	<b>9</b>	<b>0.96</b>

1.58% reported by Niknejad and Khosh-khui (1972)<sup>2</sup>.

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<sup>1</sup> Eshel, Y. 1968. Israel J. agric. Res. 18 (1):31-33.

<sup>2</sup> Niknejad, M. and Khosh-khui, M. 1972. Indian J. agric. Sci. 42(4):273-274.

## Physiology/Agronomy

### A Strategy for Increasing Chickpea Production in North India

In north India, chickpea is grown extensively in rainfed areas on conserved moisture, in which situations the recommended sowing period is from 25 September to 15 October. This recommendation is appropriate for areas and years where late rains occur in September but when the rains stop early, extension of the sowing period beyond these dates will be beneficial.

Moreover, sowing outside this period would contribute to increased chickpea production by allowing the extension of the crop to situations where it would not normally be grown. For example, in years when September rainfall is low, improved moisture may be assured by earlier sowing. In contrast, later sowing may be advantageous in drier areas, to exploit the rains which normally occur in December and where there is no suitable alternative, and in irrigated tracts to enable chickpea to compete with wheat in the existing rice:wheat rotation.