Singh, H., Sandhu, T.S., and **Jolly, R.S.** 1987. Effect of growth regulators in relation to time of sowing on growth and yield of soybean cultivars. Annals of Biology 3:36–43.

Singh, K. 1989. Hormonal regulation of reproductive phenomena and yield of chickpeas. Annals of Plant Physiology 3:108–115.

Pod Volume and Pod Filling as Useful Traits of Chickpeas

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The seed yield of chickpea is determined by the number of plants unit area^{-1}, the number of pods plant^{-1}, seeds pod^{-1} and the seed mass. With the increase in number of pods plant^{-1} or unit area, a corresponding increase in seed yield is expected (Joshi 1972, Rang et al. 1980, and Pundir et al. 1991). Breeders have invariably used these traits as important selection criterion for breeding improved chickpea cultivars. They have also been used in characterization and preliminary evaluation of chickpea germplasm accessions. However, no attention has been paid so far to individual characteristics of the pod, such as size (volume) and seed filling percent. Data were recorded on pod volume, pod filling percent, and seed mass in a set of 83 diverse accessions, and the relevance of these traits in genetic resource characterization, and as selection criteria in chickpea breeding are discussed here.

Eighty-three accessions were selected from the ICRISAT gene bank to provide geographical diversity and the greatest variation for pod and seed sizes. These accessions were sown in a Vertisol field at ICRISAT Center on 4 Nov 1990. The experiment was laid out in an augmented design in 4-m long single row plots, with interplant spacing of 60 × 10 cm.

The chickpea pod is generally rhomboidal in shape and inflated, therefore, measuring the pod size is not easy. Pod and seed sizes in the present study were measured in terms of their volume and were recorded on the principle of equivalent volume of water replacement. The equipment used was fabricated locally and is shown in Figure 1. To the best of our knowledge, this is the first

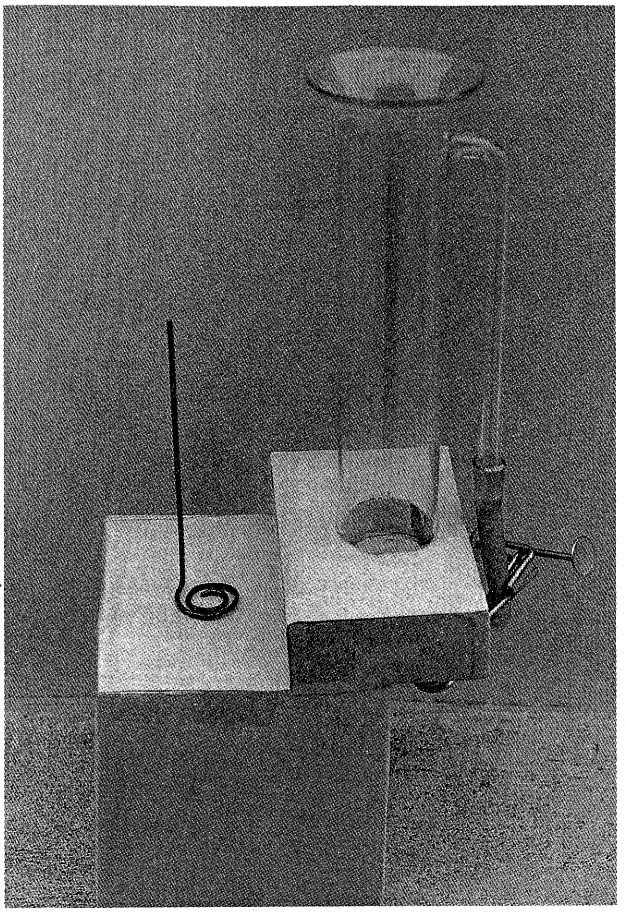

Figure 1. Locally fabricated glassware used to measure volume of chickpea pods and seeds.

numeric observation of the two traits. The procedure followed is given below:

- Five representative and undamaged pods were picked from the basal nodes of fully developed branches at crop maturity.
- The measuring jar was filled with water and excess water (water above the hole) was released.
- Five pods were put in the jar and submerged using a metal coil.
- The water, equivalent to the volume of pods, which was displaced was collected in the graduated tube and measured.

To measure pod filling percent, the seeds from the same five pods were removed and their volume was measured in a similar manner. Pod filling percent was calculated using the following formula:

$$\text{Pod filling \%} = \frac{\text{Volume of seeds from 'n' number of pods}}{\text{Volume of 'n' number of pods}} \times 100$$

n = 5 in the present study

The pod volume varied from 0.30 to 2.77 mL pod^{-1} (9-fold variation). Pod filling ranged from 8.97 to 56.53% (6-fold variation). The correlation estimates among the traits revealed a strong positive relationship between pod volume and seed size (Table 1). The seed size is already known to be a highly heritable trait (Niknejad et al. 1971, and Pundir et al. 1991). Therefore, pod volume is also expected to be a heritable trait. Generally, larger pods mean larger seed, therefore the trait is worth considering in chickpea breeding research. The pod filling percent has shown a negative trend with pod volume and seed mass. However, we identified some accessions that are high seed yielders, have large seeds, and high pod-filling percent, e.g., cvs Annigeri and K 850 (pod filling 39 and 32%, respectively). Some lines are good yielders but show a low pod filling percent; e.g., cv ICCV 2 has 25% pod filling. By increasing pod filling percent, a further increase in seed yield potential of ICCV 2 can possibly be achieved. This indicates the relevance of the pod-filling trait to chickpea breeding programs.

We plan to conduct a systematic study of the genetic nature of these traits to further assess their usefulness in chickpea improvement.

Table 1. Simple correlations between some seed yield traits of chickpea, ICRISAT Center, 1990/1991.

Trait	Pod volume	Pod filling (%)
Pod filling (%)	-0.130	
Seed mass	0.756	-0.344

Significance level: >0.283 at 0.01 probability.

References

Joshi, S.N. 1972. Variability and association of some yield components in gram (*Cicer arietinum* L.). Indian Journal of Agricultural Sciences 42:397–399.

Niknejad, M., Khosh-Khui, M., and **Ghorashy, S.R.** 1971. Inheritance of seed size in chickpea (*Cicer arietinum* L.). Crop Science 11:768–769.

Pundir, R.P.S., Reddy, K.N., and **Mengesha, M.H.** 1991. Genetics of some physiomorphic and yield traits of chickpea (*Cicer arietinum* L.). Legume Research 14:157–161.

Rang, A., Sandhu, T.S., and **Bhullar, B.S.** 1980. Protein and amino acid association with yield and its components in gram. Indian Journal of Genetics and Plant Breeding 40:423–426.