only when it is having short internodal distance and early fruiting. This will ultimately result in an increased fruiting zone.

- To attain a sustained improvement, the required information on range of variability for different morphological traits and suitable donors for different quantitative and qualitative traits is available amply in the published literature. The genetic behavior for different characters in segregating populations and their mode of inheritance is well established.
- To realize the maximum yield potential in chickpea, an effective and realistic selection procedure through which a desirable genotype can be isolated should be developed. Many reports have come out for different selection procedures but there is no report available that informs as to which procedure developed which genotype
- The lack of information on karyomorphology and gene mapping in chickpea does pose an obstacle to adopt the sophisticated biotechnological approaches.

On Paper 2 of S.K. Tripathi (ICN 22, June 1990, Pages 8-9):

Poor response to high management and an efficient plant type, have been described as impediments in realizing high yields in chickpea. These aspects are probably because of the strong gene linkages established as a result of centuries old interactions in agroclimatological niches through which pulses have been domesticated.

Use of herbicides, popularization of different cropping systems are the other areas through which a substantial increase in chickpea production is underlined. For this, suitable extension methodology for mass awareness has been appropriately suggested. The other aspect which has been appropriately addressed is irrigation management. Information on quantum and schedule of irrigation in chickpea needs refinement and can be taken as a valuable suggestion.

On Paper 3 of G.S. Giri (ICN 22, June 1990, pages 9-10):

The declining trend in area and cultivation has been described as the cause for reduced chickpea production. This ultimately supports the fact that chickpea genotypes are nonresponsive to high management. Unlike chickpea, area under wheat has gone up primarily because of the response of high-yielding wheat varieties to better management.

The inadequate attention towards research and biased extension efforts neglecting chickpea has also been the area of concern that has hampered chickpea development.

Consequently, the following aspects can be considered on priority basis.

I. Research:

(a) Crop improvement:

- identification of stable and suitable donors and their utilization in development of diseases and pests tolerant/resistant varieties.
- development of genotypes with more effective pods branch^{-1}.
- efficient plant type coupled with responsiveness to high management.
- suitable, effective, and realistic breeding methodology and selection strategy to isolate desirable genotypes.

(b) Crop management:

- irrigation management in terms of quantum and schedule for different agroecological niches must be established.
- insecticidal schedule (preferably integrated pest management) be developed.
- different cropping systems in view of the farmers' socioeconomic situations should be worked out.

II. Extension:

- popularization of improved chickpea production technology among farmers.
- identification of suitable chickpea cultivation areas through the National Wasteland Development Board.
- availability of *Rhizobium* culture, fertilizers, herbicides, and pesticides in rural areas.

Sowing Date and Pod-borer Damage in Chickpea at ICRISAT Center

H.A. van Rheenen and **S.S. Lateef** (ICRISAT Center)

In a recent article in ICN 23, 1990, van Rheenen and Virmani (1990) asked the question: Why should we continue growing chickpea on residual moisture? Are there alternatives? And the alternative they suggested was to change the date of sowing.

Changing the sowing date would lead to changes in the incidence of pests and diseases. In this short note, we report the effect of sowing date on pod-borer [*Heli-*

coverpa armigera (Hüb.)] damage to chickpea (*Cicer arietinum* L.) at ICRISAT Center.

A field in a nonsprayed area of the farm was divided into three blocks, and the sowing dates for these were 25 Aug, 14 Sep, and 13 Oct 1989. The cultivar Annigeri was sown at various places in the three blocks, and we collected two random plants at harvest from 10 plots in each block to assess the pod damage caused by *Helicoverpa*. We counted the pods damaged by the borer. The percentage-pod damage together with the weather records of the growing season are shown in Table 1.

Table 1. Pod-borer damage in chickpea cv Annigeri, sown on 25 Aug, 14 Sep, and 13 Oct 1989 at ICRISAT Center; single plant seed yields; and the rainfall and temperatures recorded during the growing season.

	Sowing date 1989		
Observation	25 Aug	14 Sep	13 Oct
Pod-borer damage (%)	31.1 ± 3.1	16.8 ± 2.0	27.1 ± 2.4
Single plant seed yield (g)	11.9 ± 1.2	9.5 ± 0.6	10.8 ± 0.7
Rainfall (mm)	352.3	147.1	6.7
Temperature range (°C)			
daily maximum		34.6-20.0	
daily minimum		23.5- 9.0	

We note that the August-sown crop received more than double the amount of rainfall than the September sowing, while the October-sown chickpea had a negligible amount of rainfall during its growing season. The temperatures went up to 34.6°C in February, and reached a minimum of 9°C in November and December. The seed yields plant^{-1} in different blocks showed marginal differences.

The pod-borer damage of the 1st and 3rd (= normal) sowing dates showed no significant difference, but the damage in case of the 2nd sowing date was significantly lower. The crops sown in August and October would have needed therefore more protection against *Helicoverpa* attack than the September-sown chickpea.

Reference

van Rheenen, H.A., and **Virmani, S.M.** 1990. Why should we continue growing chickpea on residual moisture? Are there alternatives? International Chickpea Newsletter 23:4-5.

Chickpea Improvement in Mexico

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Chickpea was introduced in Mexico by the Spaniards in the 16th century. Breeding efforts began in 1958 with the collection of local landraces and exotic germplasm and their agronomic evaluation (Campos et al. 1961). Hybridization and selection for resistance to fusarium wilt began in 1964 with the introgression of the resistance genes from desi into kabuli types (Lopez-Garcia and Andrade-Arias 1977). Since the beginning of the breeding program 19 cultivars have been released, the latest being "Mocorito 88" and "Tubutama 88".

In Mexico, chickpea is cultivated in two distinct regions: a) El Bajio region, where desi-type cultivars are grown under residual moisture for local consumption as animal feed; and b) the Northwest (NW) region, where kabuli-type cultivars are grown, both under irrigation and residual-moisture situations, and around 80% of the production is exported. During 1984-88, harvested area with kabuli chickpea was around 65000 ha with an average yield of 1.3 t ha^{-1}.

The breeding program. The program has been divided into two subprograms located at the two main production regions mentioned above. A common problem in both regions is fusarium wilt. Two wilt-sick plots were developed in the Northwest (NW) region and one is being developed at El Bajio region. The wilt-resistant materials from the NW region are susceptible at El Bajio region (Andrade, INIFAP, personal communication 1989).

Desi-type varietal improvement program. The main objectives are: breeding for high yield potential and protein content; and drought and wilt resistance. Each of these objectives is being pursued separately. Biparental crosses are made within the desi gene pool, always including a locally adapted parent. Segregating populations are handled by the pedigree method.

The major abiotic stress factor in the region is drought and the program is tackling this constraint through empirical approaches by growing advanced breeding material in a stress environment, where they are compared to the