Chickpea sown in November with a seed rate of 60 kg ha^{-1}, fertilizer rate of 43 kg N ha^{-1}, and frequent irrigation gave high yield under research station and farmers' field conditions. On heavy soils, sowing on ridges was the best, while on lighter soils broadcasting on flat or sowing on ridges were found to be equally good (Nourai 1987; Taha 1989).

Production constraints. Chickpea ranks third after faba beans and hericot beans in area and importance in Sudan. This competition leads to the growing of the crop on marginal lands. Some problems of root rot and wilt disease are still to be solved and intensive screening of varieties for the disease is going on at Hudeiba. Chickpea is very sensitive to storage insects such as *Trogoderma granarium*. Therefore the improvement of chickpea storage and processing could ensure supply to the market throughout the year.

At present, the Nile Valley Regional Program on cool-season legumes, in collaboration with the Extension Department, Regional Ministry of Agriculture, Northern Region, is transferring the technology to the farmers.

The expansion in chickpea production in future could be through effective transfer of technology to farmers and by solving the pests and disease problems.

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Growing Chickpea at ICRISAT Center as a Rainy-season Crop

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As chickpea is usually grown on residual moisture and often without irrigation, drought is commonly regarded the crop's foremost abiotic stress factor. Assuming irrigation water is not available, there seem to be three ways to tackle the drought problem for chickpea.

One way is by growing drought-resistant varieties. Two such varieties have been identified by ICRISAT's physiologists. They are ICC 4958 and ICC 10448. Saxena (1987) says that at a yield level of about 0.5 t ha^{-1} for the released cv Annigeri in peninsular India, the yield of ICC 4958 is about 0.86 t ha^{-1}, an increase of 0.36 t ha^{-1} or 72%. At 1.7 t ha^{-1} the varieties are at par in yield, and beyond this level, Annigeri starts to exceed ICC 4958 in productivity.

Another way of alleviating the drought problem is by using extra-short duration varieties such as ICCV 2, a kabuli variety released in Andhra Pradesh, India, under the name of Swetha; and ICCV 88201 and ICCV 88202, two new desi lines of extra-short-duration group.

The third way of avoiding drought problem could possibly be to grow chickpea as a rainy-season crop. In the following paragraphs, we wish to share our experience of growing chickpea as a rainy-season crop.

Off-season cropping of chickpea during the rainy season in rainout shelters for generation advancement of breeding material has been a well established practice at ICRISAT Center for over 10 years, but this is different from growing chickpea as a real rainy-season crop.

Postrainy season chickpeas are usually sown during October. In the past 8 years there has been a sustained effort at ICRISAT Center to grow chickpea as a semi-postrainy season crop by sowing around the middle of September, that is about a month earlier than usual. A mean yield advantage of about 25% was recorded for September sowing over October sowing (C.L.L. Gowda, ICRISAT Center, personal communication 1990). Again, this practice is different from growing chickpea as a real rainy-season crop, as the plants are still small, when the rains are tailing off, and the crop growth is basically dependent on residual moisture. A rainy season crop of chickpea can face problems as described below:

- In June 1974, an Alfisol area of about 2 ha was sown to chickpea. The crop was severely attacked by *Colletotrichum* blight and white root rot which discouraged us for some time to attempt growing chickpea as a

rainy-season crop, but the idea of "rain sowing" of chickpea was not totally abandoned.

- During the 1985 rainy season, we observed several chickpea volunteer plants in a sorghum crop and in fallow land. They survived the rains and produced flowers and pods. We harvested 12 of these and recorded yields of 4 to 55 seeds plant^{-1}, with a mean of 18.5±15.7 (CV=84.7%). We did a germination test on the seeds of the 12 plants and found a germination percentage ranging from 75 to 100 with a mean of 94.6±7.8% (CV=8.2%).
- In June 1986, we sowed chickpeas at ICRISAT Center in four different places in replicated trials. The yields obtained are tabulated below:

Place of experiment	Yield (t ha^{-1})
Vertisol, field	0.48
Alfisol, field	0.29
Transition soil, movable rainout shelter	1.41
Transition soil, nonmovable rainout shelter	0.77

- The yields obtained in our trials were not high, but the crop growth was good. Admittedly, some varieties matured at the wrong time when the soil was still wet at harvesting in September.
- In 1987, we had about 0.25 ha of the medium-duration variety ICCV 6, sown on an Alfisol on 19 June. The seedling emergence was poor because of drought and crusting of the soil after sowing, but from 10 good row sections of 10-m length a yield of 697±235 kg ha^{-1} was obtained. Again, yields were not high, but also the field was not fertile.
- In 1988, we grew several large plots with segregating populations in a Vertisol field during the rainy season and we also tested more than 1000 lines in a low-lying part of the field. The rainfall was heavy, the field drained poorly, and most lines were killed by *Colletotrichum* blight. However, a few survived. We selected the relatively good lines; and also made an important observation: drainage seemed to be a key factor for plant survival and crop growth. The message seemed to be that growing chickpea as a rainy-season crop requires good water management; and resistance to *Colletotrichum* blight will help stabilize the production.
- In 1989, we tested the selections of 1988, together with other materials, in a Vertisol field, where no pesticides were sprayed and where fertilizer applications were low. Sowing was on 60 cm ridges; they were lower than desired, but in general the drainage of the field was good. The sowing date was 25 August and the rainfall from that date till the end of the rainy season, i.e., on 30 September was high (340.6 mm). The growth of chickpeas was good in spite of the heavy rains. Around 5 October, we noticed the first symptoms of *Colletotrichum* blight and on 17 and 18 October we scored for disease damage, using the common 1-9 scale (1=no symptoms; 9=succumbed to the disease). The damage was moderate in severity for the more susceptible lines, and light for the more resistant selections. Crop growth otherwise continued to be satisfactory,

Table 1. *Colletotrichum* blight and *Helicoverpa* pod-borer damage in progenies and progeny bulks of various crosses, scattered in a pesticide-free field, ICRISAT Center, rainy season 1989.

Cross number	Parents	Progenies/ bulks	Damage ratings[1]		Yield[2] plant^{-1} (g)
			Colletotrichum blight	*Helicoverpa*	
ICCX 850005/18	ICCV 2; COG 2	18	3.6±0.24	4.7±0.37	8.1±0.66
ICCX 850006/23	COG 2; ICC 12237	12	3.8±0.25	5.5±0.50	10.5±1.81
ICCX 850021	ICCV 2; ICC 12237	33	3.0±0.13	5.1±0.24	8.4±0.72
ICCX 860001	ICC 12237, Shoba	10	3.9±0.23	5.2±0.29	8.4±0.74
ICCX 860006	L 132-1; ICCL 85216	9	3.2±0.36	4.4±0.38	7.3±1.38
ICCX 860010	ICC 1069; K 850	8	3.3±0.37	4.6±0.53	12.2±2.06
ICCX 860047	ICCX 790106; R17	21	3.4±0.18	5.1±0.22	7.8±0.52
-	Annigeri (control)	50	4.7±0.08	6.4±0.12	9.6±0.69

1. 1 = no symptoms; 9 = succumbed to pest.
2. 10 g plant^{-1} = 1 t ha^{-1}.

but damage by *Helicoverpa* pod borer was rather severe. We scored for the borer damage on a 1-9 scale again, and calculated the yields plant^{-1}. Part of the data set obtained is presented in Table 1. It shows several important observations:

- The disease damage was not a major problem.
- Genotypic differences in resistance to *Colletotrichum* blight were confirmed. This is a valuable bit of information for breeders.
- The yields showed considerable variation, partly because of small plot sizes, but they were satisfactory, taking into account the damage caused by pod borers against which no insecticidal spray was undertaken. The highest yield was approximately 1.5 t ha^{-1}.

A similar observation as made by the authors during 1988 was also recorded during 1989 in respect of drainage and disease damage: In some fields, where chickpea had been sown during the middle of September, and in a plot where June sown chickpea had grown in a rainout shelter, but where the shelter had been destroyed by heavy storms, a slightly higher, and better drained position seemed to have made the difference between life and death of the plants.

The following preliminary conclusions are drawn if chickpea is grown under conditions similar to those at ICRISAT Center.

- Rains per se cause no problems to chickpea growth.
- Good water management can reduce *Colletotrichum* blight severity in a rainy-season chickpea crop.
- Host-plant resistance will reduce the *Colletotrichum* blight damage.
- Good agronomic practices and pest control can possibly boost the yield of selected varieties to over 2 t ha^{-1}.
- Good germination and emergence of seedlings, ample water supply and good management will result in stable yields of 2-3 t ha^{-1}.

A study of climatic conditions of other chickpea-producing areas of latitudes comparable to that of ICRISAT Center will be of interest to see how widely chickpea can be grown as a rainy-season crop.

Also a broader survey of alternative cropping and a study of economic aspects will be needed to ascertain the prospects of rainy-season chickpea.

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Errata

In ICN 23 - page 14: SE values in Table 1 were omitted. Please note the values as given in the following table.

Table 1. Incidence of *H. armigera* on different dates of sowings and yield of two chickpea cultivars VL 86 and T 2 at Hawalbagh, Almora, India, 1988/89.

	Pod damage by *H. armigera* (%)		Yield (t ha^{-1})	
Sowing date	VL 86	T2	VL 86	T2
5 October	8.03 (16.45)[1]	7.60 (15.92)	1.737	1.762
15 October	8.13 (16.54)	7.18 (15.42)	1.758	1.808
25 October	9.10 (17.43)	8.34 (16.77)	1.729	1.721
5 November	11.87 (20.14)	12.64 (20.67)	1.583	1.512
15 November	17.76 (24.81)	16.57 (23.75)	1.112	1.083
SE	(±0.055)	(±0.269)	±0.1187	±0.1356

1. Figures in parentheses are angular transformed values.