benefits of early harvest, high yields, and a good market price. The new varieties are being considered by the National Seed Committee for release. Their release will enable farmers to choose appropriate varieties for their specific needs, e.g., desi or kabuli, short- or medium-duration, for rainfed or irrigated environments.

As collaboration between Myanmar and ICRISAT is strengthened, the evaluation of new promising breeding lines will be intensified on both research stations and farmers' fields. In a significant development, CARI has initiated a chickpea breeding program that involves crossing and screening of segregating populations in wilt and root rot nurseries.

Potential for Expansion of Chickpea in the Barind Region of Bangladesh

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Pulses are important both as components of human diet and as part of the rainfed agriculture cropping system of Bangladesh. The present diet availability of only 12 g per capita per day is rather low. The area under pulses is declining with the expansion of irrigated facilities that encourage the cultivation of such crops as rice and wheat. Chickpea is presently the third most important pulse crop in Bangladesh. Currently most of the chickpea areas are confined to five districts; Faridpur, Jessore, Kustia, Pabna, and Rajshahi (Khaleque et al. 1991). The crop is usually cultivated on the clay-loam or clay soils of the Gangetic calcarious flood plain areas.

The main constraints to chickpea production in these areas are such diseases as collar rot (*Sclerotium rolfsii*), wilt (*Fusarium oxysporum* f.sp. *ciceri*), botrytis gray mold (*Botrytis cinerea*), and dry root rot (*Rhizoctonia bataticola*). Uncertain rainfall during the flowering (Jan/Feb), podding, and maturity stages (Mar/Apr) make chickpea an unstable and uncertain crop. Farmers in these regions are gradually moving out of chickpea cultivation to grow other crops. The recently released varieties Barichhola 2 and Barichhola 3 are only resistant to wilt. Sources resistant to collar rot, root rot, or botrytis gray mold have not been found in the world germplasm collection at ICRISAT Asia Center. Chickpea cultivation will remain under perennial threat in these areas until disease-resistant varieties are developed.

Most of the 0.8 million ha of land in the Barind area of northwestern Bangladesh, remains fallow in the winter months after the harvest of the transplanted local aman (rainy-season) rice (Raisuddin and Nur-E-Elahi 1984). The major cropping pattern is fallow— aman rice— fallow (90%) where aman rice is sown in June/July and harvested in December. The Barind region receives a relatively low rainfall (1200-1500 mm), almost all of it during the rice-growing season. The low organic matter content (0.5%) of the soil, its plow pan, and its low pH (5.5-6) limit the uptake of nutrients and N-fixation by legume crops.

Chickpea trials in the Barind area by the Pulses Research Centre (PRC) and the On-Farm Research Division (OFRD) of BARI, indicate that yields of about 2.5 t ha^{-1} could be harvested with few additional inputs (Tables 1 and 2). In the Barind area chickpea must be sown by early November to ensure high yields. In order to sow early the local long-duration cultivars of rice need to be replaced by such short- duration varieties as BR 1, BR 14, TR 50, Ratna (Bangladesh-ICRISAT Barind Initiative 1991). The OFRD, Barind, has already developed the following alternative cropping pattern:

Green manure (GM) — aman rice - chickpea + linseed
(May–Jun) (Jul–Oct) (Nov–Mar)

In this pattern 60 kg P_2O_5 and 20 kg S ha^{-1} are applied in the GM which is comprised of daincha, or *Sesbania* sp), 40 kg N, 40 kg K, and 20 kg S ha^{-1} are applied to the rice, and no fertilizer is applied to the chickpea. Following this pattern, the organic matter content of the soil is increased and an additional 1.5 t ha^{-1} chickpea are obtained. This results in a marginal benefit cost ratio of 5.48 (Table 1).

As mentioned earlier, the Barind is a dry area, the lack of humidity does not encourage botrytis gray mold infestation. In the 1989/90 season most of the chickpeas growing in the traditional area were damaged by the rains which encouraged botrytis development during February to April. Experiments could not be harvested at Ishurdi, Jessore, or Faridpur but in the Barind 1.5-2.5 t ha^{-1} were harvested from breeding trials. Variety trials have been conducted at Barind locations to select suitable varieties for the area. The data from a 3-year varietal trial

Table 1. The performance of green manure–aman rice–chickpea+ linseed cropping pattern at Saroil, Barind in 1991/92 under different fertilizer regimes.

	Green manure daincha (*Sesbania* sp)	Aman rice	Chickpea + linseed	
Variety	Local	IR 20	Nabin	local
Fertilizer	60 kg P_2O_5 and 20 kg S ha^{-1}	40 kg N, 40 kg K_2O, 20 kg S ha^{-1}	-	-
Date of sowing/ transplanting in 1991	27 May	30 Jul	14 Nov	
Yield (t ha^{-1})	17.61 MBCR[1] = 5.48	3.24	1.25	0.667

1. Marginal benefit cost ratio.
Source: BARI 1993a.

(1991–93) indicated that seed yields between 1.9 t ha^{-1} (local) and 2.18 t ha^{-1} (ICCL 85222) could be obtained (Table 2). Further reports available from OFRD indicate the good performance of chickpea in the Barind area.

Future Prospects

After observing the performance of chickpea in the Barind, BARI-PRC and OFRD-Barind conducted pilot demonstrations in farmers' fields, arranged field days, and distributed seeds of daincha, short-duration rices (BR 1, BR 14), and chickpea among farmers to encourage them to include chickpea in their cropping systems. As a result, the area under chickpea has progressively increased over the past 4 years. Starting from about 200 ha in 1990 it rose to an estimated 3000 ha in 1993. At the present retail price this 3000 t of produce is worth about Taka 90 million (US$ 2.25 million).

Expansion of the chickpea area in the Barind could be expedited if a special project/initiative were to be launched. It is suggested that the main components of such an initiative could include:

- Large-scale demonstrations covering all the Barind,
- Fixed extension target for every year,
- The timely supply of such inputs as daincha seed, short-duration rice variety, and fungicide-treated chickpea seed,
- Encouraging farmers to follow rotations,
- Avoidance of highly acidic soils, or those with hard pans, as suggested by the Bangladesh-ICRISAT Barind Initiative 1991,
- The application of one or two irrigations and fertilizer (@20:40:20 kg NPK ha^{-1}) for higher yield where irrigation facilities are available,
- Research support to develop suitable varieties for the Barind.

BARI and ICRISAT are already collaborating in the development of short-duration disease-resistant chickpea varieties, management options, pest control, and amendments of soil conditions to improve the productivity per unit area. If only 10% of the Barind could be brought under chickpea cultivation, it could double chickpea production in Bangladesh and reduce the large imports of pulses that are made every year to meet the increasing demand.

Table 2. Yield performance of different chickpea advanced lines under yield trial in the Barind area, 1990–93.

Advanced lines	Mean seed yield (t ha^{-1})			
	1990/91 (1)[1]	1991/92 (3)	1992/93 (3)	Overall mean
ICCL 85222	2.72	1.37	2.46	2.18
ICCL 83149	2.56	1.56	2.40	2.17
ICCL 85104	2.51	1.40	2.31	2.08
ICC 11320	2.35	1.27	1.96	1.86
RPSP 333-1	2.68	1.36	2.20	2.08
Control				
Nabin	2.65	1.42	2.28	2.12
Local	2.56	1.16	2.00	1.90

1. Figures in parentheses indicate the number of trial locations.
Source : BARI 1993b.

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Pigeonpea

Vamban 1: A Short-duration Pigeonpea Variety for Tamil Nadu, India

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A short-duration pigeonpea variety, Vamban 1, was released in 1992 by the Tamil Nadu Agricultural University for cultivation (rainfed/irrigated) in Pudukkottai district, Tamil Nadu. This variety was developed from a non-selected bulk population of a double cross (Prabhat × HY 3C) × (T 21 × ICP 102) made at ICRISAT Asia Center. Further selections were made at the National Pulses Research Centre (NPRC), Vamban, Pudukkottai. Vamban 1 is a determinate type with plant height of 80-90 cm. It matured in 95-100 days at Vamban. The seeds are brown in color, with a 100-seed mass of 6.7 g. The performance of Vamban 1 in 30 trials conducted during 1986–89, are presented in Table 1. The on-station trials at NPRC, Vamban were sown in seven replications in a randomized-block design (RBD). Each plot consisted of 6 rows, 4.5 m long; spacing was 45 × 15 cm. Multilocational trials were also conducted using a RBD with seven replications. It was also observed that pod borer incidence was lower (14.4%) in Vamban 1 than in ICPL 87 (40.8%) and UPAS 120 (15.6%). There was no difference among three varieties in the incidence of podfly.

Vamban 1 yields were distinctly superior to those of ICPL 87 and UPAS 120 (Table 1). Average yields were 0.86 t ha^{-1} on station (47.5% higher than ICPL 87, 31.8% higher than UPAS 120), and 0.81 t ha^{-1} in multilocational trials (36.6% higher than ICPL 87, 37.3% higher than UPAS 120).

This variety is recommended for Pudukkottai, Trichy, Salem, Periyar, and Coimbatore districts for sole cropping and intercropping with groundnut under rainfed and irrigated conditions. It is likely to replace such other short-duration varieties as ICPL 87 and UPAS 120, which are now cultivated on about 12 000 ha.