Exploring Novel Cropping Options for Pigeonpea in Chittagong District, Bangladesh. I. Adaptation to Rice Fallows

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Pigeonpea is a minor pulse crop in Bangladesh, mainly grown in the northwestern part of the country (Virmani et al. 1991). Traditional medium- to long-duration landraces of indeterminate habit are grown; they are sown on raised land, above flood level, in Apr–Jul and harvested during Feb–Apr. The recent advent of short-duration pigeonpea genotypes, less sensitive to photoperiod than traditional short-day-sensitive genotypes (Lawn and Troedson 1990), has opened possibilities for including pigeonpea in various cropping systems in the country for which it was not previously considered. One such possibility is use of pigeonpea as a fallow crop, to follow transplanted aman (t. aman) rice in the southern parts of the country where winter temperatures remain warm enough to support pigeonpea growth.

In Chittagong district, rice fields often remain fallow or are planted to low-yielding cowpea after harvest of the t. aman crop in Nov or Dec. Sufficient soil moisture remains to support growth of a crop following rice because of good soil moisture holding characteristics, and the high annual rainfall of around 3200 mm, even though less than 100 mm per month are received from Nov–Mar. A range of genotypes, from extra-short- to long-duration genotypes were tested in this study, for their suitability as a crop to follow t.aman rice in Chittagong district.

Table 1. Nodulation status and time to 50% flowering and maturity of several pigeonpea genotypes on two sowing dates in 1987/88 and 1988/89 in rice fallows at Hathazari, Chittagong district, Bangladesh.

	Number of nodules plant^{-1}		Time (days) to			
	Effective	Ineffective	Flower		Mature	
Treatment	1988/89	1988/89	1987/88	1988/89	1987/88	1988/89
Sowing date[1]						
D_1	2.9	2.7	68	67	124	125
D_2	2.7	3.1	67	67	120	123
Significance[2]	NS	NS	NS	NS	*	*
Genotype						
ICPL 4	4.3	4.6	57	59	113	114
ICPL 87	1.4	2.2	69	71	122	123
ICPL 95	3.3	2.0	70	74	132	134
ICPL 151	1.8	2.3	67	62	119	120
ICPL 161	2.2	3.4	66	66	119	122
ICPL 186	4.0	3.3	70	70	124	128
ICPL 83006	2.3	1.8	63	61	119	120
ICPL 83024	3.4	3.3	67	66	123	122
ICPL 84052	2.2	2.3	69	69	122	126
ICPL 87114	3.2	2.3	73	71	126	128
UPAS 120	2.8	2.7	66	65	118	120
LSD (P=0.05)	0.64	0.82	0.9	6.6	0.9	8.1
CV (%)	19.6	24.8	1.2	8.4	0.6	5.7
Interaction[2]	*	**	**	*	**	*

1. D_1 = 23 Dec 1987 and 4 Dec 1988 and D_2 = 15 Jan 1988 and 24 Dec 1988.
2. NS = not significant; * = significant difference at P<0.05; ** = significant difference at P < 0.01.

Experiments were conducted at the Regional Agricultural Research Station, Hathazari (22° 3'N, 91° 5'E), Chittagong district Bangladesh, over two seasons, 1987/88 and 1988/89. The experiments were sown in silt loam soils of pH 5.6 following harvest of t. aman rice. A split plot design with three replications was used. Two sowing dates (23 Dec and 15 Jan in 1987/88, and 4 and 24 Dec in 1988/89) were assigned to main plots and 23 genotypes differing in growth duration to subplots.

Subplot size was 0.9 × 4.0 m and a plant population target of 14 plants m^{-2}. The land was thoroughly tilled prior to sowing and 25 kg P ha^{-1} as triple superphosphate, 10 kg ha^{-1} S as gypsum, and 20 kg N ha^{-1} as urea applied as a basal dose. Seeds, not inoculated with *Rhizobium*, were hand dibbled at 45 × 15 cm spacing with 2–3 seeds $hill^{-1}$, and thinning to 1 plant $hill^{-1}$ after emergence. Weeding was done at 30 days after sowing (DAS). After a postsowing irrigation, the crop was grown on residual soil moisture or subsequent rainfall; the only substantial rainfall being 34 mm in Feb of 1987/88, and 50 mm in late-Feb 1988/89. Following observations of apparent podfly (*Melanagromyza obtusa*) attack, two sprays of Dimecron 100® were applied to each sowing in both seasons. For the shortest-duration lines, two harvests of pods were taken, but only one harvest was taken from the other lines that reached maturity before rainfall intensity increased in Apr/May.

Most medium- and late-duration genotypes did not set pods before the onset of regular rainfall in Apr/May, and they succumbed to root rot damage resulting from waterlogging. Thus, detailed analysis was restricted to the short-duration lines able to form pods before this damage occurred. Emerging seedlings were attacked by *Sclerotium rolfsii*, more severely in 1988/89 (about 50 mm rainfall in Dec). ICPLs 95 and 83024 were most susceptible to this root disease, with final plant populations reduced to 68% of the desired level in 1988/89, but ICPL 4, ICPL 87, and UPAS 120 were affected least. Nodulation with native rhizobia, as observed at 45 DAS in 1988/89, was moderate, but about half of the nodules remained ineffective (Table 1).

Table 2. Plant height at maturity, number of pods $plant^{-1}$, and grain yield of several pigeonpea genotypes at two sowing dates in 1987/88 and 1988/89 in rice fallows at Hathazari, Chittagong district, Bangladesh.

	Plant height (cm)		Pods $plant^{-1}$		Grain yield (g m^{-2})	
Treatment	1987/88	1988/89	1987/88	1988/89	1987/88	1988/89
Sowing date[1]						
D_1	80	78	29	26	49	28
D_2	88	85	30	27	23	22
Significance[2]	*	*	NS	NS	*	*
Genotype						
ICPL 4	50	55	24	27	36	24
ICPL 87	48	49	24	21	37	23
ICPL 95	135	122	35	27	38	25
ICPL 151	45	45	24	22	27	22
ICPL 161	114	119	35	27	30	30
ICPL 186	115	114	35	33	36	24
ICPL 83006	53	53	29	27	45	31
ICPL 83024	66	64	25	20	25	18
ICPL 84052	116	110	30	35	43	27
ICPL 87114	99	96	29	24	40	29
UPAS 120	83	83	35	29	39	22
LSD (P=0.05)	3.9	3.1	1.9	5.5	6.0	4.0
CV (%)	4.0	41.6	4.1	18.2	9.8	12.6
Interaction[2]	*	**	**	*	*	*

1. D_1 = 23 Dec 1987 and 4 Dec 1988, and D_2 = 15 Jan 1988 and 24 Dec 1988.
2. NS = not significant; * = significant difference at $P < 0.05$; ** = significant difference at $P < 0.01$.

Date of sowing had no effect on time to flower but late-sowing shortened slightly days to maturity (Table 1). Genotypes that produced seed matured within 130 days, with ICPL 4 maturing earliest. Late sowing resulted in taller plants, with seed-producing genotypes reaching heights of between 0.5 and 1.4 m (Table 2). Pods $plant^{-1}$ increased with later sowing and for the different genotypes ranged between 20 and 35 pods $plant^{-1}$ (Table 2). ICPL 84052 had the highest number of pods $plant^{-1}$. All pods formed were severely infested by podfly, for all genotypes at each sowing time in both seasons. Grain yields were highest for the early sowing but were generally at low levels (divided by 100 to estimate t ha^{-1}, which did not exceed 0.5 t ha^{-1} for any genotype) (Table 2).

Thus, it is possible to identify short-duration pigeonpea genotypes that can grow reasonably well, produce an acceptable number of pods $plant^{-1}$ and mature in a relatively dry period in rice fallows of Chittagong district. However, grain yields were very low for all genotypes at each sowing in each season, which can be attributed to the severe infestation of podfly. Little control of this pest could be obtained by insecticide spraying. There would be little prospect of farmers of this region adopting insecticide spraying for pulses, even if an effective spraying regime could be identified, because of the low input status assigned to pulses generally. Thus, any prospect for growing short-duration pigeonpea as a rice fallow crop in Chittagong district would depend on development of genotypes truly resistant to podfly damage.

References

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Exploring Novel Cropping Options for Pigeonpea in Chittagong District, Bangladesh. II. Adaptation to Hilly Areas

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Chittagong district mainly comprises hilly regions subject to ever-increasing devegetation, with the consequence of soil erosion and nutrient loss. This is exacerbated by an annual rainfall of 3000 mm or more. Agricultural productivity in such regions is low, particularly during the rainy season. Thus, increased use of a grain legume crop that can stabilize the soil, increase organic matter and add fixed nitrogen to the soil should be advantageous. Pigeonpea is a strong candidate in this regard. However, this crop is particularly susceptible to excess soil moisture conditions, likely in such a high rainfall region. But the soil type in these hilly areas is mainly of sandy-loam texture, and thus infiltration and drainage of excess moisture should be facilitated.

It was therefore decided to examine adaptation of pigeonpea to such hilly areas. It was hypothesized that medium-duration genotypes (150–200 days) are best suited, to be sown near the beginning of the rainy period (i.e., May) and the grain to reach maturity after cessation of the main rains (i.e., Nov). At Hathazari, 95% of total annual rainfall (3200 mm) is received during the monsoon season of Apr to Oct, with a peak of 842 mm in Jul. Thus, in the first instance, a range of genotypes, mainly of medium-duration but also including some short- and long-duration genotypes, were evaluated at two sowing dates.

Experiments were conducted in the hilly orchard area of the Regional Agricultural Research Station, Hathazari, Chittagong district, Bangladesh. The soil was sandy loam with pH 5.5 and the site well-drained. In 1989/90, a split-plot experiment with three replications was conducted. Sowing dates of 16 May and 20 Jun 1989 were assigned to main plots and a set of 30 genotypes, comprising 8 short-, 20 medium-, and 2 long-duration genotypes, were assigned to subplots. Subplots consisted of 2 rows each, 3-m long. Interrow