Agricultural Economics Research Review
Vol. 17 (Conference No.) 2004 pp 51-57

Impact of *Boro* Rice Technology on Income and Employment in Flood-prone Madhubani District of Bihar

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Abstract

The study assesses the impact of *Boro* rice on farmers' income and employment using the farm level data. The yields of *Boro* rice are higher than the *kharif* rice. Though its cost of cultivation is higher, the net returns over cost A are positive. Cultivation of *Boro* rice has been found more profitable compared to other crops grown during this season in this area. Small farmers put a larger area to *Boro* rice cultivation and they are likely to be benefited the most from its expansion in the flood-prone areas. The impact of *Boro* rice cultivation on employment has also been found significant because a majority of the farm labour remains unemployed or under-employed due to lack of employment opportunities on and off the farm. However, the farmers have been noted to be risk averse due to high cost of production and terminal drought. Introduction of short-duration and drought-resistant varieties along with provision of short-term credit can help the expansion of *Boro* rice cultivation in the flood-prone district of Madhubani in Bihar.

Introduction

Rice has a wide range of adaptability and is cultivated in the diverse agroclimatic situations. In Bihar, of the total cultivated area, nearly 50 per cent is under lowland wherein productivity of rice in the main *kharif* season is below one tonne/ha. A marginal increase in productivity of rice in lowlands may lead to considerable increase in rice production in the state, and thereby bring an improvement in the living standards of thousands of smallholders. Improving yield in unfavorable ecosystem is receiving considerable attention in the agricultural research system. Although,

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evolving suitable cultivars may take time, in recent years '*Boro*[1] ' rice has been introduced in the season following the main crop in some of those pockets of Bihar that are chronically flood-affected.

The productivity of *Boro* rice is much higher than that of *kharif* rice (Singh and Singh, 2000). It is mainly due to receiving of solar radiation for a larger period and prevalence of lower night temperature throughout the crop growth and favorable temperature during the ripening stage. 'Gautam' one of the recently released varieties of *Boro* rice has recorded yield of 8-10 tonnes/ha under farmers' conditions (Thakur *et al.*, 1994). The high yield more than compensates the high costs of its cultivation which are due to its increased irrigation requirements (Chatterjee *et al.*, 1996). In Bihar, the importance of *Boro* rice cultivation lies in the fact that this practice utilizes the land otherwise left fallow due to prolonged accumulation of rainwater, therefore practically a wasteland. Besides this, *Boro* rice technology provides employment to the farmers during the slack season from January to May. In the present study, the impact of *Boro* rice cultivation on income and employment has been evaluated.

Methodology

The study was conducted in the Jhanjharpur block of Madhubani district in Bihar where farmers experience flood threats every year. Three villages having the highest area under *Boro* rice were selected randomly. From these selected villages, 30 farmers growing *Boro* rice and 30 non-growers of *Boro* rice were selected by random sampling procedure. The survey was conducted for the crop year 2001-2002 to generate information for the impact assessment.

Impact of *Boro* Rice

Operated Area

Of the selected *Boro* farmers, 53 per cent of the operated area was low-lying (Table 1). It was much higher compared to that of non-growers (7%) of *Boro* rice. This was true in the case of size group-wise analysis also. Small, medium and large *Boro* farmers had 80, 55 and 44 per cent of the area as lowland.

The proportion of area under *Boro* rice by farm-size is depicted in Table 2. Small famers had a greater proportion of area under *Boro*

[1] *Boro* is a Bengali word originated from the Sanskrit word '*Borob*', which means special rice cultivation in lowland areas during November to May taking advantage of residual water in the field after harvesting of the *kharif* crop.

Table 1. Incidence of lowland on the selected farms

(in hectares)

Sl No.	Type of farms	*Boro* rice growers			Non- growers		
		Total operated area	Upland and medium land	Low land area	Total operated medium land	Upland and	Low land
1.	Small farms	0.83	0.20	0.63	1.04	1.01	0.03
		(100)	(20)	(80)	(100)	(97)	(3)
2.	Medium farms	2.67	1.20	1.47	2.92	2.61	0.31
		(100)	(45)	(55)	(100)	(88)	(12)
3.	Large farms	5.34	2.96	2.38	5.70	5.36	0.34
		(100)	(56)	(44)	(100)	(94)	(6)
4.	All farms	2.50	1.18	1.32	2.40	2.23	0.17
		(100)	(47)	(53)	(100)	(93)	(7)

Note: Figures within the parentheses show the percentage of total

Table 2. Area cultivated with *Boro* rice on selected farms (%)

Type of farms	Total operated area (ha)	*Boro* rice area (ha)	Percentage of *Boro* rice area
Small farms	0.83	0.66	80
Medium farms	2.67	1.54	58
Large farms	5.34	2.42	45
All farms	2.50	1.37	55

rice (80%), compared to medium (58%) and large (45%) farmers. This suggested that small farmers would be benefited the most from *Boro* rice cultivation.

Cost of Production and Income

Boro rice technology provides additional income to the farmers from the land which would have remained untilized due to water stagnation. Although, the cost of *Boro* rice production is higher due to its increased irrigation requirements, its yield is much higher compared to that of *kharif* rice and its other competitive crops.

The overall cost of cultivation of *Boro* rice (Costs A, B and C) was Rs 16490, 23998 and 25384, respectively . All these costs varied directly with the farm-size. The per hectare production of *Boro* rice was quite high (55 q/ha). The yield had a direct relationship with farm-size. The unit cost of production was also higher on small farms than on medium and large farms (Table 4).

Table 3. Cost of *Boro* rice cultivation

(Rs/ha)

Farm-size groups	Cost A	Cost B	Cost C
Small farms	13860	20580	23562
Medium farms	16661	24217	25342
Large farms	17650	25508	26332
Total farms	16490	23998	25384

Table 4. Yield and unit cost of production of *Boro* rice by farm-size

Particulars	Small	Medium	Large	Total
Yield (q/ha)	49.5	55.6	57.8	55.2
Value of main product (Rs/ha)	19305	21668	22495	21543
Byproduct (q/ha)	59.4	66.72	69.21	66.23
Value of byproduct (Rs/ha)	2917	3336	3460	3311
Cost of production (Rs/q)	416	396	396	400

Table 5. Gross and net returns from *Boro* rice by farm size

(Rs/ha)

Particulars	Small	Medium	Large	Average
Gross income	22275	25004	25956	24855
Net income over Cost A	8415	8343	8304	8364
Net income over Cost B	1694	787	447	857
Net income over Cost C	-1287	-337	-376	-528

Table 6. Net returns over cost A from alternative crops grown on flood-prone farms

(in Rs)

Crops	Cost of cultivation	Gross income	Income over Cost A
Late-shown wheat	14,700	17,500	2,800
Grama-maize	12,500	14,000	1450
Grama-moong	6590	11,200	4610

The estimates of the net income are depicted in Table 5. The income over cost C was negative and marginally positive over cost B. Such a low net income is due to high labour costs. It may be noted that labour remains idle during the *Boro* season in this area. However, when the imputed cost of family labour was not considered, the returns from *Boro* cultivation (over Cost A) were quite high (Rs 8364/ha). These returns can be increased further by reducing the number of irrigations and having an efficient management. Under different size-groups of farms, income over Costs A, B and C varied inversely to the farm-size.

The *Boro* rice production has been found profitable than some alternative crops like late-sown wheat, Grama-maize or Grama-moong. The income per hectare over Cost A was Rs 2800, Rs 1450 and Rs 4610 from the respective crops (Table 6) which were quite low as compared to income from *Boro* rice . It showed that *Boro* rice cultivation was more beneficial than other crops grown during this season in the area.

Employment

Utilizing the *rabi* fallow land for *Boro* cultivation engages farmers at a time (January-May) when they often remain idle due to lack of on-farm as well as off-farm employment opportunities. The per hectare labour-use in *Boro* rice cultivation is shown in Table 7. On an average, one hectare area under *Boro* rice generates employment for 123 mandays. Labour-use is higher on small farms than on medium and large farms. Table 7 also

Table 7. Per hectare utilization of human labour in *Boro* rice cultivation

(mandays)

Sl No.	Cost of items	Small farms	Medium farms	Large farms	All farms
1.	Land operation	18.47	14.41	13.52	14.88
		(13.52)	(11.72)	(11.60)	(12.09)
2.	Manures/ Fertilizers	7.41	5.51	4.05	5.29
		(5.42)	(4.48)	(3.47)	(4.30)
3.	Seedling preparation	9.88	7.53	5.76	7.28
		(7.23)	(12.28)	(4.94)	(5.91)
4.	Transplantation	28.47	30.58	35.70	32.26
		(20.84)	(24.88)	(30.63)	(26.22)
5.	Irrigation	19.76	16.16	14.60	16.25
		(14.46)	(13.15)	(12.52)	(13.20)
6.	Weeding	21.17	21.94	20.09	21.01
		(15.50)	(17.85)	(17.24)	(17.07)
7.	Plant protection	1.76	0.9	0.94	1.09
		(1.28)	(0.73)	(0.80)	(0.88)
8.	Harvesting/ Transportation	19.17	14.67	11.52	14.29
		(14.03)	(11.93)	(9.88)	(11.61)
9.	Threshing/ Winnowing	10.47	11.16	10.35	10.67
		(7.66)	(9.08)	(8.88)	(8.67)
10.	Total	136.56	122.87	116.53	123.02

Data within the parentheses show percentage to the total

shows higher labour utilization during transplantation, followed by weeding, irrigation, land preparation and post-harvest operations.

Conclusions

The study has concluded that *Boro* rice is a boon for farmers in flood-prone areas. Although its cultivation is costly, the net returns are higher due to higher yields. *Boro* rice cultivation is also profitable compared to other competing crops. Its cultivation provides gainful employment to the farmers who otherwise remain idle during this season due to lack of on-farm as well as off-farm employment opportunities. There is considerable migration of labour from Bihar to other states and expansion of *Boro* rice would help check migration. The following recommendations have been made to popularise *Boro* rice cultivation:

- *Boro* rice occupies hardly one lakh hectares of land at present in Bihar. Farmers hesitate to undertake cultivation of *Boro* rice because of its high cost of production. Efforts should be made to reduce the cost of

cultivation through better management practices. Further, this also implies that government should provide short-term credit facilities to ease out capital constraints of smallholders.

- The terminal drought is an important obstacle to *Boro* rice cultivation. Agricultural research can contribute to help overcome this problem by developing short-duration drought-resistant varieties.

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