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Boro Rice In Eastern India- A Case Study of North Eastern Alluvial Plains of Bihar[1]

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Introduction:

Boro rice cultivation is relatively a new phenomenon in Bihar agriculture, where rice is being grown since time immemorial, during both kharif and rabi seasons. The cultivation of rice during rabi crop season (Nov.-May) was unknown probably till the new rice strains through Bangladesh refugees were introduced in these parts of India. “Boro” a Bengali term derives its name from the Sanskrit word 'Borob' and refers to a special type of rice cultivation in lowlands during November-May months. Boro rice has traditionally been cultivated in the river basins, deltas, chaurs or saucer shaped depressions, where water accumulates during the monsoons but cannot be drained, thus providing ideal settings for boro rice cultivation during winter season. Although, boro rice cultivation has been an old practice in deep water areas, it is only recently that it has emerged as a major break through in enhancing rice productivity, not only in traditional, but also in non-traditional boro rice areas with assured irrigation and modern inputs. The credit primarily goes to the farmers’ own initiatives in adopting its cultivation in a big way. But proper research inputs have not been fully exploited by the farmers. It is therefore worthwhile to examine the current scenario and analyze the future concerns. With the increased availability of irrigation facilities, boro rice technology has also moved to non-traditional flood-free irrigated areas.

Northeastern region of Bihar also known, as 'Kosi' region comprises of Saharsa, Madhepura, Supaul, Purnea, Katihar, Darbhanga, Madhubani, and Khagaria districts. This region is characterized by high water level and during good monsoon years, large tracts of land become unsuitable for traditional rabi crop due to water logging and flooding from Kosi and its many tributaries. Wheat cultivation in this region is a remote possibility due to water stagnation, thus rice is the only option left with the farmers.

Boro rice has come as a boon to the farmers of this region, but it has become popular only recently with the introduction of cold tolerant rice varieties. Boro rice produces more yields than the kharif rice in the same ecology. In fact, the yields recorded from experiments, both at research station and at farmers fields show that yields from boro rice are manifolds compared to kharif rice. 'Gautam' one of the recently released varieties, from Rajendra Agricultural University, Pusa (Samastipur) have recorded yields between 8-10 t/ha. Even on farmer's fields. (Thakur et. al. 1994). Despite the higher cost of cultivating boro rice the returns per ha. are significantly higher than kharif rice (Singh et.al. 1998).

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Higher productivity of boro rice has been attributed to factors like higher solar radiation, low night temperatures throughout the crop growth period in winters and favorable temperatures during ripening. Any variation in these factors can affect the yield significantly. The economic advantages provided by boro rice have caused revolutionary changes in north-eastern parts of Bihar, not only in terms of socio-economic changes among the farmers of this region, but to the economy of the state as a whole.

Little information is available about the impact of boro rice cultivation in Bihar, its role in improving rural economy in general and the farmers' economic condition in particular. Available literature suggests about the tremendous potential of boro rice cultivation in enhancing the production and productivity of food crops. Adoption of this new technology has been difficult for resource poor farmers of these regions. In view of these factors, the present study has been conducted in twin villages namely Sisai-Agwanpur in Saharsa (Bihar), an area which has taken boro rice cultivation in a big way, owing to its proximity to Regional Research Station, Agwanpur, Saharsa and also due to typical topography of the village which is ideally suited for boro rice cultivation.

Study Area:

The study was conducted in Sisai -Agwanpur village of Saharsa district; Bihar which besides being a in major boro rice growing area also had the advantage of having a Krishi Vigyan Kendra, and a Regional Research Station, located within the village. The close interaction of farmers with the scientists has proved to be a boon for the farmers of the village as many of them or their family members work at the research farm as daily wage earners, which has helped them understand the technology better than their counterparts elsewhere. But this aspect has not been studied in this paper, the study is confined to find out the cost and returns from boro rice, the pattern of input use along with consumption and marketing behavior of the farmers.

Selection of Farmers:

Using stratified purposive sampling technique, all the farmers growing boro rice were categorized into four groups based on there size of holding namely marginal (>1 ha.), small (1-2 ha.), medium (2-4 ha.), and large (< 4 ha.). It was observed that a total of 60 farmers were growing boro rice and all of them were selected for detailed study (Table –1).

Data:

Data from the selected farmers were collected on various aspects related to boro rice cultivation viz. Costs incurred, agronomic practices followed, marketing and consumption activities etc. by making routine visits to farms from time to time. The study is based on data collected for three consecutive crop years 1996-97 to 1999-2000.

The study is basically exploratory in nature as it also attempts to find out the farmers own innovative practices in boro rice cultivation along with relevant economic details. Simple tabular analysis has been done to arrive at conclusions and is based on a small sample. The study area is also limited to one village only. The findings are only suggestive in nature and this must be kept in mind while using the study in drawing larger policy implications.

Findings:

Agronomic Practices Followed By Farmer's:

Farmers irrespective of their size of holding followed identical agronomic practices in the study area. They used seeds of Sujata, Pusa 2-21, and Saket-4 along with the newly released variety Gautam for boro rice crop. (Table-II). The seed rate varied between 70-75 Kg./ha. and the farmers were not treating it with any chemicals. The farmers were found to be using banana sheath and gunny bags to facilitate seed germination in cold weather of winters, and the seeds were then broadcasted in the seedbeds, some ash was also spread on the seeds to protect them from low temperatures. Urea was also broadcasted in the beds at this time.The transplanting was done when the seedlings were 40-45 day old in a very well prepared field trough ploughing and puddling. Lot of family labor is used in the process. Transplanting was using mostly family labor and exchange labor. A basal dose of 40 Kg N_2, 40 Kg P_2O_5 and 20 Kg K_2O per ha. at the time of puddling. 20 Kg N_2 is applied about 30-40 days after transplanting and again at the time of panicle initiation.

Water Management:

Water management in boro rice is a very important aspect and farmers were found to be using canal water, stagnated water and bamboo bore wells for irrigation .It is noteworthy that bamboo bore well is a local innovation in the areas where ground water level is high. It is easy to install, cheap and uses a pipe made of bamboo stripes, iron rings and coconut rope, which is quite cheap and easily available. An interesting feature observed during the course of the study was the cultivation of wheat and boro rice side by side in the study area. While wheat was grown on the uplands of the chaurs from where water had receded and boro rice in the lower reaches of the chaur, which had water. It seems that farmers on their own have devised a game to minimize the risk and uncertainty. In favorable monsoon years they successfully grew boro rice but during unfavorable years they cultivated wheat, linseed, lentil, and rape-mustard to maximize their gains. Water level being high in the area made irrigation relatively easier and bamboo bore wells brought it within reach of small and marginal farmers. Relationship between fast expansion of area under boro rice and bamboo bore wells also needs to be investigated.

Another interesting thing noticed in the study area was that most of the farmers (particularly marginal and small) took a summer mungbean in the upland plots, which were otherwise left fallow due to high moisture content and where wheat or boro rice could not be taken. Summer mungbean being a short duration crop is harvested by the end of May, it thus escapes the monsoon.

Farmers Profile:

In the study area , data was also collected about the occupation pattern, literacy etc. the details have been presented in Table-III. A perusal of thus table revealed that of the total adults, number of adults engaged in agriculture was highest on small farms (65.31%) followed by marginal (57.53%), medium (54.55%) and large (39.13%) respectively. The total adults per family were highest on medium farms (6.6), which was higher than the average number of adults per family (5.93) taking all the farms together. The literacy among the adults was highest on large farms (63.04%) and lowest on marginal farms (19.86%), which might be related to the economic condition of the respondents.

Labour Use Pattern:

Operation-wise labor use on sample farms has been presented in Table-IV. A close look at the figures revealed that taking all size-groups together maximum labor was used on sowing and transplanting (27.80%) followed by land preparation (18.68%), irrigation (17.33%), harvesting and threshing (17.96%), intercultural operations (15.43%) and manuring and fertilizer application (2.80%) respectively. On various categories of farms the total human labor used was found to be highest on medium and large farms (286 man days/ha.) followed by small (275 man days/ha.) and marginal (261 man days/ha.).

Factor-Wise Cost in Boro Rice Cultivation:

Cost incurred on various factors of production on sample farms has been presented in Table-V. A perusal of this table revealed that the imputed value of land took the highest share of the factor cost which ranged from 25.96 per cent on large farms to 29.50 per cent on small farms. The cost incurred on human labor got second highest share ranging from 22.01 per cent on small farms to 25.39 per cent on large farms. Cost of irrigating the crop got the third highest share of factor cost that varied between 17.35 per cent on large farms and 18.80 per cent on medium sized farms. So far as the total factor cost was concerned it was found to be highest on small farms (Rs.10984 per ha.) while it was lowest on large farms (Rs.10402 per ha.). The average factor cost for all the farms was Rs.10675.25 per hectare. The same trend was observed so far as the contribution of various factors of production towards the factor cost was concerned. The contribution of imputed value of land was again highest (27.96%) followed by cost of human labor (24.29%), cost of irrigation (17.83%), cost of manure and fertilizers (9.87%), cost of bullock (6.79%), misc. cost (6.00%) , cost of seed (5.82%) and cost of plant protection (2.15%) respectively.

Returns From Boro Rice:

Returns from boro rice have been presented in Table-6. A close look at the shows that the grain yield was highest on small farms (61 qtls../ha.) followed by marginal (57 qtls./ha.) ,medium (53 qtls./ha.) and large farms (51 qtls./ha.) .The net returns as a result were highest on small farms (Rs.16466.00 per ha.) despite the high factor cost and lowest on large farms (Rs.12548.00 per ha.). Overall boro rice was a profitable venture on all size groups of farms. The cost of producing boro rice was lowest on small farms (Rs.180.07per quintal) and highest on large farms (Rs.203.96 per quintal), the average cost of production for all the farms being Rs.192.33 per quintal resulted in a positive B-C ratio of 1:1.34 there by giving a decent return to the farmers this showed that there was no positive correlation between the size of farm and cost of production.

Utilization of Main Produce and Its Marketing:

This aspect of boro rice cultivation was studied to find out the post-harvest behavior of the farmers, in light of the observations of this researcher that due to poor cooking quality it did not fetch a better market price. It was however found that a large number of farmers kept little for their own consumption and sold more than 50 percent of their produce. On- farm consumption was highest on small farms (57.81%) followed by medium (56.75%), marginal (54.32%), and large (41.19%) respectively. Overall the boro farmers sold about 42 percent of their produce and consumed about 50 percent besides keeping 6 percent for seed purposes. (Table-7). So far as the quantity of produce sold in the market was concerned it was highest on large farms (53.69%) as these farmers had large surplus and better storage facility at their disposal. The remaining farms

on an average could sell only 36-40 percent of their produce owing to higher on farm consumption leading to lower surplus and their overall poor economic condition.

Conclusions:

Boro rice cultivation despite being a new phenomenon in Bihar plains has been able to make a significant impact in the economy of North Bihar areas, which could be achieved through their own innovative approach and a little help from the scientists of Rajendra Agricultural University, Bihar in form of some new varieties of boro rice. Agronomic practices followed by the farmers varied from farm to farm but it was observed that in general the farmers followed most of the recommended practices. The high water requirement of the crop was met with a local innovation called "bamboo boring" which served as the chief source of irrigation during the months of April-May when there was a scarcity of surface water in the region and farmers had to use round water sources , this led to the higher cost to be spend on fuel etc. by the farmers. The study strengthened the belief that farmers are better innovators and a little support to them in terms of research and infrastructure could lead to even better results.

Labor-use is another important aspect in boro rice as the crop is highly labor intensive. The findings showed that land preparation, transplanting along with irrigation and harvesting utilized more than 80 percent of total labor used. The factor –wise cost of cultivation was lowest on marginal farms and highest on small farms, whereas the returns per hectare were highest on small farms and lowest on large farms clearly indicating that farm size did not have any positive correlation with the from boro rice cultivation. The marketed quantity was lowest on marginal farms and highest on large farms as the marginal farmers consumed most of what they produced owing to their poor resource-base and lower income. Large farmers on the other hand had alternative sources of income so they were in a better position to market their produce at their own convenience. Overall boro rice was a profitable crop on all size group of farms and promises to bring new revolution in production of food crops in Bihar.

Limitations:

The study was exploratory in nature and was confined to a small area and a small smaple size owing to time and resource constraints at the disposal of the author. Being a micro level study the findings may not be generalized , though they do give important indications towards the economic aspects of boro rice cultivation in Eastern regions of the country.

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Table-1: Size group wise detail of farms growing boro-rice.

Size group	Total area under boro-rice (ha)	No. Of farmers growing boro-rice
Marginal (>1 ha)	20.85 (0.80)	26
Small (1-2 ha)	28.60 (1.79)	16
Medium (2-4 ha)	29.30 (2.93)	10
Large (<4 ha)	46.82 (5.85)	8
All farms	125.57 (2.09)	60

- Figures in the parenthesis shows the per farm area.

Table-2: Variety-wise details of boro rice grown on sample farms.

Variety grown	No. Of farmers growing
Sujata	10
Pusa-2-21	12
Saket-4	8
Gautam	30
All farms	60

Table-3: Farmer's profile: occupation pattern and literacy on sample farms.

Size group	Sample size	Total adults	Adults engaged in agriculture	Engaged in non-agril. Occupations	Total literates
Marginal	26	146 (5.62)	84	62	29 (19.86)
Small	16	98 (6.13)	64	34	39 (39.80)
Medium	10	66 (6.6)	36	30	35 (53.03)
Large	8	46 (5.75)	18	28	29 (63.04)
All farms	60	356 (5.93)	202	154	132 (37.08)

* Figures in the parentheses denote the percentage of all farms under the respective categories.

Table-4:Operation-wise labour-use per hectare in boro rice cultivation on sample farms (Man days)

Size group	Land preparation	Sowing/trans -planting	Inter-culture operation	Manuring/ Fertilizer. Application	Irrigation	Harvesting and threshing	Total
Marginal	59 (22.61)	70 (26.82)	44 (16.86)	6 (2.30)	42 (16.09)	40 (15.33)	261 (100)
Small	52 (18.91)	83 (30.18)	45 (16.36)	8 (2.91)	45 (16.36)	42 (15.27)	275 (100)
Medium	51 (17.83)	78 (27.27)	42 (14.69)	7 (2.45)	53 (18.53)	55 (19.23)	286 (100)
Large	45 (15.73)	77 (26.92)	40 (13.99)	10 (3.50)	52 (18.18)	62 (21.68)	286 (100)
All farms	51.75 (18.68)	77 (27.80)	42.75 (15.43)	7.75 (2.80)	48.00 (17.33)	49.75 (17.96)	277 (100)

- Figures in the parentheses denote the percentage of total labour used under each category.

Table-5: Factor-wise cost in Boro rice cultivation on sample farms (Rs./ha)

Size-group	Cost of human labour	Cost of bullock labour	Cost of seed	Cost of manures & fertilizer	Plant protection cost	Cost of irrigation	Misc Cost	Imputed value of land	Total factor cost
Marginal	2407 (22.62)	800 (7.52)	551 (5.18)	850 (7.99)	151 (1.42)	1850 (17.38)	914 (8.59)	3120 (29.32)	10643 (100)
Small	2418 (22.01)	852 (7.76)	578 (5.26)	1008 (9.18)	205 (1.87)	1954 (17.79)	729 (6.64)	3240 (29.50)	10984 (100)
Medium	2603 (24.40)	632 (5.92)	665 (6.23)	1120 (10.50)	260 (2.44)	2006 (18.80)	502 (4.71)	2880 (26.99)	10668 (100)
Large	2641 (25.39)	613 (5.89)	690 (6.63)	1235 (11.87)	301 (2.89)	1805 (17.35)	417 (4.01)	2700 (25.96)	10402 (100)
All farms	2592.2 (24.29)	724.25 (6.79)	621 (5.82)	1053.25 (9.87)	229.25 (2.15)	1903.75 (17.83)	640.5 (6.00)	2985 (27.96)	10674 (100)

- Figures in the parentheses denote the percentage of total factor cost.

Table-6: Return per hectare from boro-rice cultivation on sample farms. (Rs./ha)

Size group	Grain yield (Qtls.)	Gross returns	Total factor cost	Net returns	B: C Ratio	Cost of production
Marginal	57	25650	10643	15007	1:1.41	186.72
Small	61	27450	10984	16466	1:1.50	180.07
Medium	53	23850	10668	13182	1:1.24	201.28
Large	51	22950	10402	12548	1:1.21	203.96
All farms	55.5	24975	10674.25	14300.75	1:1.34	192.33

- Sale price of boro-rice @ Rs. 450/- per quintal.

Table-7: Post harvest uses of boro rice on sample farms. (Quintals)

Size group	Total produce	On-farm consumption	Kept for seed	Marketed quantity
Marginal	1188.45	645.57 (54.32)	72 (6.06)	470.88 (39.62)
Small	1744.60	1008.55 (57.81)	94.05 (5.39)	642.00 (36.80)
Medium	1552.90	881.27 (56.75)	99.32 (6.40)	572.31 (36.85)
Large	2387.82	983.54 (41.19)	122.34 (5.12)	1281.94 (53.69)
All farms	6973.77 (100)	3518.93 (50.46)	387.71 (5.56)	2967.13 (42.55)

* Figures in the parentheses show the percentage of the total produce in the respective category of farm.