



Research in

AGRICULTURE, LIVESTOCK and FISHERIES

ISSN : P-2409-0603, E-2409-9325

An Open Access Peer-Reviewed International Journal

Article Code: 449/2024/RALF

Article Type: Research Article

Res. Agric. Livest. Fish.

Vol. 11, No. 2, August 2024: 173-183.

Comparative Analysis of Production and Marketing Aspects of Deficit and Surplus Paddy Production Areas in Bangladesh

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ARTICLE INFO

ABSTRACT

Received

10 August, 2024

Revised

20 August, 2024

Accepted

31 August, 2024

Online

September, 2024

Key words:

Deficit district
Surplus district
Paddy traders
Paddy marketing
system

The study aimed to compare production and marketing aspects in deficit and surplus paddy production areas in Bangladesh. For this study, a face-to-face interview was conducted with a semi-structured questionnaire. The survey was carried out in two districts in Bangladesh from February to March 2022. Data were collected from a total of 113 paddy farmers from Brahmanbaria, a deficit district, and 128 farmers from Habiganj, a surplus district. According to this study, farmers in surplus districts have excellent geographic characteristics such as medium-high land and a triple crop area, while farmers in deficit districts suffer unfavorable conditions such as low land and flooding. The study also discovered that there are differences between the districts in terms of land availability, paddy cultivation area, and cropping intensity. In production aspects, the size of the farmland and the productivity differ significantly at the 1% level between two districts. Farmers from deficit area, produce less paddy per acre compared to farmers with surplus districts. In the paddy marketing channel, local paddy assemblers (LPA) are the dominant actors in the deficit and LPB/local paddy brokers in the surplus area. Farmers in surplus areas have more marketing facilities and get higher paddy revenue and profits compared to deficit districts. However, farmers in both districts are mostly dependent on traders to sell their produce. In that case, paddy marketing facilities can accumulate through farmers' community investment and the organization of cooperative societies in deficit area. It will help improve farmers' negotiation power at the village level in both districts.

To cite this article: Ahmed J. U. and M. Sultana, 2024. Comparative analysis of production and marketing aspects of deficit and surplus paddy production areas in Bangladesh. Res. Agric. Livest. Fish. 11(2): 173-183.

DOI: <https://doi.org/10.3329/ralf.v11i2.76064>



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INTRODUCTION

Paddy is the main crop in Bangladesh's agrarian economy, which accounts for around 75% of all agricultural land use (Bangladesh Bureau of Statistics, 2022). As the staple food and high per capita consumption of rice in the nation, it satisfies most people's nutritional needs (Ishrat et al., 2016). Bangladesh has three paddy-growing seasons: Aus, Aman, and Boro. In the early wet and pre-monsoon seasons, highland paddy is grown as Aus (Ishrat et al., 2016). Farmers are cultivating less Aus because it has less productivity than the other two crops due to hot weather and the low availability of cultivated irrigation water (Dayal and Love, 2016). The Aman is a wet-season, monsoon-fed, and rain-fed paddy and covers the largest proportion of cultivable land for paddy. It contributed 43.7% of the paddy-cropped area and 38.8% of national production. And the Boro is a dry-season, irrigated paddy that captured the largest share of the production with the highest productivity. Widespread irrigation systems facilitated and resulted in the increase of Boro paddy in the dry season. Currently, Boro occupies 40.4% of the paddy area and 53.7% of the total production (BBS, 2022). There has been a significant change in the agricultural system of paddy, with a combination of irrigation, fertilizers, high-yielding varieties of seeds and pesticides, and mechanization. All these changes contributed to an increase in food grains in Bangladesh (BBS, 2022). Bangladesh has achieved self-sufficiency in paddy production through the development and extensive dissemination of these changes (Bangladesh Rice Research Institute, 2018). Although Bangladesh has achieved self-sufficiency in paddy production, these conditions are not equally similar across regions and districts. According to the ecosystems, geographical location, or agro-climatic conditions, there is a large variation in the level of self-sufficiency between the districts (Department of Agricultural Extension, 2017). Seven million households are producing paddy in the favourable ecosystem known as a surplus production area. Alternatively, five million households are affected by unfavourable conditions such as flood, drought, salinity, and soil quality that cause a paddy shortage (Bill and Melinda Gates Foundation, 2013).

Even though in surplus districts paddy production is high, farmers still cannot make a high profit. Because the produced paddy is distributed through a complex and long paddy marketing system in the country, different types of traders are involved. These traders are different by the nature of the business, working place, functions performed, volume of transactions, and area of distance coverage (Khan, 2013). In the absence of the farmer's organization, the farmers have to go through traders to sell paddy. Individual farming practices expose farmers to high transaction costs and low bargaining power with traders (Mustafa, 2019). The majority of farmers sell paddy soon after the harvest because they get immediate cash from the traders. Therefore, farmers have a handicap in dealing with traders. Ultimately, traders benefit from high margins from paddy trading, but the farmers do not get better prices; often they sell paddy at a loss (Zaman, 2003).

There are several studies on paddy cultivation systems in Bangladesh, such as Razzaque and Rafikuzzaman (2007), Ishrat et al., (2016), and Taj and Anurup (2018). There are also several studies, such as Tasnoova and Iwamoto (2006), Alam and Palash (2006), Rahman et al., (2006), Raha and Akbar (2010), Reardon et al., (2012), Rahaam et al., (2013), and Siddique (2019), that explain the paddy marketing systems of different surplus production districts in Bangladesh. There is scanty research that compares the production and marketing aspects of deficit and surplus paddy production areas in Bangladesh. In this regard, the current study tries to compare production and marketing aspects in the deficit district of Brahmanbaria and the surplus district of Habiganj in Bangladesh. The specific objectives of the study are:

- To compare the agricultural structures of Brahmanbaria and Habiganj districts
- To compare paddy production aspects of farmers in Brahmanbaria and Habiganj districts.
- To compare the paddy marketing aspects of farmers in Brahmanbaria and Habiganj districts.

MATERIALS AND METHODS

Area selection for the study

The study was conducted in two districts of Bangladesh: Brahmanbaria and Habiganj. Brahmanbaria experiences a 3% paddy shortage, while Habiganj has an 81% paddy production surplus (DAE, 2017).

Brahmanbaria is located approximately 115 kilometres east of Dhaka, the nation's capital. The district lies within the Old Meghna Estuarine Floodplain agroecological zone (AEZ), which is a large, low-lying area situated between the southern Surma-Kusiyara Floodplain and the northern edge of the Young Meghna Estuarine Floodplain. The district frequently floods, particularly in areas along the rivers, where cultivators own most of the land. The soil composition varies, with silt loam predominating in the highlands and silty clay to clay in the lowlands. Noncalcareous Dark Grey Floodplain soils are the primary soil type, with moderate organic matter content and medium moisture-holding capacity (BBS, 2022). Much of the cultivated land remains uncultivated and waterlogged for months each year. Agriculture is the primary income source for about 55% of the district's residents (BBS, 2013). Farmers in Brahmanbaria typically produce only one crop per year, Boro. The district is well-connected to neighbouring areas via roads, highways, and waterways, and it hosts around 500 semi-automatic and automatic rice mills, as well as numerous paddy and rice traders (BBS, 2013). Consequently, Brahmanbaria has become the nation's second-largest paddy and rice distribution centre. Sarail, one of the district's nine sub-districts, and the Shahajadapur union were selected for data collection due to the area's reputation for significant paddy production.

On the other hand, Habiganj is located in the northeastern region of Bangladesh, about 167 kilometres from Dhaka. The district occupies the relatively higher parts of the Surma-Kusiyara Floodplain, formed by sediments from rivers draining into the Meghna catchment area from nearby hills. The terrain mainly consists of smooth, broad ridges and basins. The soil in this region is grey, with heavy silty clay loams on the ridges and clays in the basins. Noncalcareous Grey Floodplain soils are the predominant type, with moderate organic matter content (BBS, 2022). Agriculture occupies 60.22% of the district's total land area, with 57.6% of households engaged in agricultural activities. Paddy cultivation accounts for 80% of the activities of marginal and small-scale farmers (BBS, 2013). Farmers in Habiganj are able to cultivate crops three times a year, according to a crop calendar. The district is well-connected to Dhaka and other regions through roads, motorways, and railways. Known for its extensive paddy production, the Chunarughat sub-district consists of nine unions was chosen for data collection from the Habiganj district.

Data collection and sampling

In this study, the main method of data collection was a face-to-face interview using a semi-structured questionnaire in a random sampling method. The survey was carried out from February to March 2022. A total of 113 paddy farmers in the Brahmanbaria district were interviewed. The samples included 49.5% small-scale farmers, 24.8% large-scale farmers, and 25.7% medium-scale farmers. In addition, information was gathered from 128 farmers in the Habiganj district in total. 3.9% of the sample's farm households were on a large scale, 25.8% were on a medium scale, and 70.3% were on a small scale. For this study, the collected data comprised of farmers' paddy production and marketing aspects. Secondary data were also collected from different renowned articles, government publications, and international publications.

Data analysis

For calculating farmers' characteristics and other functions descriptive statistics were used with the SPSS 18 version and MS Excel for performing data analysis. For comparing the continuous variables independent sample T-test and for numerical variables chi-square test was executed.

RESULTS AND DISCUSSION

Agricultural structures in Brahmanbaria and Habiganj districts

The agricultural structures of the Brahmanbaria and Habiganj districts are shown in Table 1. It is shown that Habiganj district has a larger total land area, gross farmland area, and net farmland area than Brahmanbaria district. In addition, Habiganj has more land planted with paddy and produces more than the Brahmanbaria district. Compared to Brahmanbaria, the Habiganj district has a higher cropping intensity. Farmers in the Brahmanbaria district can cultivate a crop twice in year in low-land and flood-affected areas. On the other hand, in Habiganj, has a medium-high land size with a favorable cropping pattern that allows farmers to cultivate three times. Furthermore, the Brahmanbaria district has a more population, more households, and more farm households than the Habiganj district. All these contributory differences in the agricultural structure are the potential reasons for the deficit and surplus conditions in both districts.

Table 1. Agricultural structure of Brahmanbaria and Habiganj districts

Particulars	Unit	Brahmanbaria (Deficit)	Habiganj (Surplus)
Total land area		465,000	651,000
Gross farmland area	Acre	512,000	659,000
Net farmland area		305,000	364,000
Total land area under paddy		273,913	300,060
Total annual paddy production	Ton	571,250	631,981
Intensity of cropping	%	167	181
Cropping pattern	Season	Fallow-crop- crop	Crop- crop- crop
Total population	Person	2,840,498	2,089,001
Total households Number	HH	465,720	342,178
Total number of farm households	FHH	254,790	197,143

Source: District Statistics 2013, Bangladesh Bureau of Statistics, Yearbook of Agricultural Statistics, 2017, Department of Agricultural Extension, 2018

General characteristics of Brahmanbaria and Habiganj district farmers

Table 2 presents the characteristics of farmers from two different districts. The data reveals a significant age difference between the farmers in these districts, with Brahmanbaria farmers being younger and thus likely less experienced compared to those in Habiganj. This difference is statistically significant at the 1% level.

Education levels are low in both groups, with most farmers having only an elementary education or less.

There are also significant differences in land ownership between the two groups, again at the 1% level. In Brahmanbaria, some farmers own a larger proportion of land compared to those in Habiganj, where landholdings are generally smaller.

Finally, the two districts differ in terms of occupational status, with a significant difference at the 5% level. Farmers in Brahmanbaria primarily rely on paddy cultivation, while those in Habiganj diversify between paddy farming and another crops cultivation.

Table 2. General characteristics of Brahmanbaria and Habiganj farmers

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128		T-value
	n	%	n	%	
Age (mean)	45.7(9.7)	-	51.7(2.9)	-	43.5***
Education level					0.5
Primary or less	70	61.9	81	63.3	
Upper than primary	43	38.1	47	36.7	
Total	113	100.0	128	100.0	
Land Scale					21.4***
Small	56	49.6	90	70.3	
Medium	29	25.7	33	25.8	
Large	28	24.8	5	3.9	
Total	113	100.0	128	100.0	
Occupation status					5.6**
Paddy cultivation only	85	75.2	78	60.9	
Paddy and others' crop	28	24.8	50	39.1	
Total	113	100.0	128	100.0	

Note 1: the significant levels at * p < 0.05, ** p < 0.01, ***p < 0.001

Note 2: Parenthesis Indicates SD; Source: Survey data, 2022

Production characteristics of Brahmanbaria and Habiganj farmers

Table 3 explains the production characteristics of farmers in Brahmanbaria and Habiganj district. Brahmanbaria farmers hold more cultivated land compared to Habiganj. Therefore, farmers' annual cultivated land is significantly different between the two districts at a 1 % level. However, Habiganj farmers get high productivity compared to Brahmanbaria farmers. The paddy productivity is significantly different between the deficit and surplus districts at a 1% level.

Table 3. Production characteristics Brahmanbaria and Habiganj farmers

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128		T-value
	Mean	Std. Dev.	Mean	Std. Dev.	
Annual cultivated land (acre)	7.1	8.6	6.9	6.4	10.01***
Productivity (acre/ton)	2.3	0.15	2.6	0.16	33.80***

Note 1: The significant levels at * p < 0.05, ** p < 0.01, ***p < 0.001

Note 2: 1 Acre = 0.4045 hectare; Source: Survey data, 2022

Paddy marketing channels in Brahmanbaria and Habiganj District

The paddy marketing channels that mean traders who engaged in paddy buying from farmers are shown in Table 4. Farmers in the Brahmanbaria district sell their paddy primarily to local paddy assemblers (LPAs), 1 (one) to local paddy brokers (LPBs), 12 (twelve) to Rice millers, and just 1 (one) farmer distributes processed rice straight to consumers. It demonstrates most Brahmanbaria farmers sell to LPA/Bepari. On the other hand, in Habiganj, the majority of farmers sell to the local paddy broker (LPB), and 20 (twenty) farmers sell to LPA or Bepari. In both districts, the main and most active traders are different to whom farmers mostly sell paddy.

Table 4. Paddy marketing channels of farmers in two districts

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128	
	n	%	n	%
Local Paddy Assembler/LPA	91	80.5	20	15.6
Rice miller	12	10.6	-	-
Local Paddy Broker/LPB/Aratdar	1	0.9	98	76.6
Consumer	1	0.9	-	-
Self-consumption	8	7.1	10	7.8
Total	113	100.0	128	100.0

Note 1: LPA/Bepari: LPA is a non-licensed seasonal paddy trader. They generally purchase paddy at the farmer's house and sell it to the LPB/Aratdar. They give cash payments to farmers. They also give transport, loans, and bags to farmers.

Note 2: Local Paddy Broker/LPB/Aratdar: LPB is a full-time licensed paddy trader. They have a permanent shop, a storage, labour facility, and a transport facility. They purchase paddy from farmers and sometimes from LPA/Bepari. After collecting paddies, they sell the whole paddy to Rice millers.

Note 3: Rice miller: Full-time licensed paddy-processed trader Buy a large volume of paddy from LPA/Bepari, LPB/Aratdar and sometimes from farmers. They have milling facilities, storage, transportation, and permanent or contract labour.

Source: Survey data 2022

Marketing facility conditions of farmers in Brahmanbaria and Habiganj districts

Table 5 displays the details of the marketing facilities' condition of farmers in two districts. The marketing facilities' condition vary greatly between the two districts' farmers. Transportation facilities for farmers, such as tractors and tricycles, differ at a significant level of 1%. Additionally, the Habiganj district has better yard, storage, and steam facility conditions than Brahmanbaria. Farmers have significant differences in access to information sources like radio at 1% and television at 5% level. Differences are subject to a wide range of conditions, depending on the district. Moreover, Habiganj farmers have more marketing facilities compared to Brahmanbaria farmers.

Table 5. Marketing facility conditions of farmers in both districts

Particulars facility	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128		T-value
	n	%	n	%	
Truck	8	7.1	8	6.2	0.60
Tractor	1	0.9	6	4.7	16.29***
Tricycle	4	3.5	20	18.9	16.50***
Storage	18	15.9	27	25.5	1.62
Steam	25	22.1	30	28.3	0.87
Yard	34	30.1	35	33.0	1.78
Radio	8	7.1	49	46.2	12.90***
Television	20	17.7	30	28.3	5.80**

Note: The significant levels at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Survey data, 2022

Stages of selling paddy in Brahmanbaria and Habiganj districts

Table 6 compares the two districts' farmers' stages of selling paddy to different traders. In Brahmanbaria, farmers sell their paddy earlier, even before harvest than in Habiganj. On the other side, farmers in Habiganj sell more paddy after storage.

Table 6. Stage of paddy sell paddy to different traders in two districts

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128	
	n	%	n	%
Only after harvest	89	85.6	89	75.4
After storage	15	15.4	27	24.6
Total	105	100.0	118	100.0

Source: Survey data, 2022

The utmost reasons of farmers to sell paddy to different traders in both districts

Farmers gave their opinions on some reasons why they sell to different traders, as shown in Table 7. Farmers sell more to the LPA/Bepari because they offer credit and transportation facilities. LPA/Bepari reaches the farm gate to purchase paddy and bring it with rental or own transport. Farmers' accessibility to loans and ease of transportation service are different at the 1% significant level. Farmers receive immediate cash and bags from LPA/Bepari as well. Farmers have to transport paddy to LPB/Aratdar and Rice millers if they sell it to them. It requires labour and transportation expenses, which force farmers to spend money. In contrast, in Habiganj, most farmers sell LPB/Aratdar. Due to the road infrastructure and the proximity of the LPB's shops, farmers in Habiganj can transport paddy to the shop. Additionally, they receive cash and credit facilities from LPB/Aratdar. As a result, farmers frequently make sales to LPB/Aratdar. Additionally, the distance of the selling centre from the farm gate is also significantly different between the districts at the 1% level. The farmers of Brahmanbaria need to travel more than Habiganj farmers from the farm gate to the selling centre.

Table 7. The utmost reasons of farmers to sell paddy to different traders in two districts

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128		T-value
	n	%	n	%	
Easy to transport	90	79.6	64	50.0	23.9***
Get immediate cash	90	79.6	101	78.9	0.1
Get loan facility	90	79.6	33	25.8	71.2***
Get bags	21	18.6	20	16.4	0.3
Selling center, distance/km	5.0	-	1.7	-	634.8***

Note: The significant levels at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Survey data, 2022

Paddy selling situation of farmers to main traders

Table 8 depicts the selling situation of farmers to different paddy traders in both districts. In Brahmanbaria, farmers who sell to LPA/Bepari have cultivated larger land than Habiganj. The farmer's annual paddy production and selling amounts are also higher than those of Habiganj farmers. On the contrary, farmers who sell paddy to LPB/Aratdar, their cultivated land size, production, and paddy selling amount are higher than in Habiganj. Among the farmers who sell to Rice millers in Brahmanbaria, their paddy production is the highest among all the farmers in both districts. However, only a very small number of farmers in Brahmanbaria can sell paddy to Rice millers because of the lack of marketing facilities.

Table 8. Paddy selling situation of farmers to main traders in two districts

Particulars	Unit	Brahmanbaria (Deficit)		Habiganj (Surplus)	
		LPA n=91	Rice miller n=12	LPA n=20	LPB n=98
Total paddy cultivated land (mean)	acre	6.3	6.6	6.1	7.5
Annual total paddy production (mean)	ton	14.8	15.2	11.1	14.8
Annual paddy selling amount (mean)	ton	10.0	10.6	7.5	10.7

Note1: 1 Acre = 0.4045 hectare
Survey data, 2022

Economic benefits for farmers in two districts

Table 9 reveals the economic benefit scenario after selling paddy to traders in two districts. The farmers who sell paddy to LPA/Bepari in both districts are making less profit than other traders. Since Brahmanbaria is the second-largest paddy distribution centre, there is a huge demand for paddy for Rice millers. Furthermore, there is strong competition among traders in Brahmanbaria. As a result, farmers can get a little higher revenue and profit if they can sell to Rice millers than if they sell to LPA or Bepari. However, the majority sell to LPA/Bepari due to a lack of marketing facility conditions. Alternatively, Habiganj district farmers get less revenue and profit from LPA/Bepari than those who sell to LPB/Aratdar. In this district, LPB/Aratdar is very powerful and active. Thus, most of the farmers sell their paddy and depend on LPB/Aratdar.

Table 9. Economic benefits of farmers in two districts Unit:(BDT/ton)

Particulars	Brahmanbaria (Deficit)		Habiganj (Surplus)	
	LPA n=91	Rice miller n=12	LPA n=20	LPB n=98
Paddy revenue	24,403	27,506	26,000	27,500
Production cost	22,100	21,410	21,500	21,700
Marketing cost	600	1,400	490	830
Profit	1,703	4,696	4,010	4,970

Note 1: Revenue indicates the per-ton price of paddy that farmers sold.

Note 2: The production cost indicates the cost per ton of paddy. Production costs consisted of material costs and hired labour costs.

Note 3: Marketing costs consist of cleaning and drying, bagging, loading and unloading labour costs, transportation fees, and other costs. Note 4: USD = BDT 105.

Source: Survey data, 2022

Marketing constraints for farmers

Table 10 demonstrates that farmers in two districts face several marketing-related challenges. Farmers claim that in both districts, they encounter a variety of marketing difficulties. Brahmanbaria farmers are most affected by the distance of the selling centre. Farmers face acute problems include the lack of an adequate paddy market and the high price of paddy that is significantly at 1% level. Government selling centres or paddy wholesale markets do not exist for farmers. Farmers are unable to negotiate high paddy prices with the traders. Farmers in Brahmanbaria have more dreadful infrastructural issues than farmers in Habiganj since they do not have a good road system. They only use boats to travel during the wet season. Information related to paddy supply, demand, and price are difficult to get for farmers. They typically get their information from various traders. Farmers also have less negotiating power over paddy pricing because of their heavy reliance on traders. As a result, farmers sell paddy at the price set by the trader.

Table 10. Marketing constraints of farmers in two districts

Particulars	Brahmanbaria (Deficit) N=113		Habiganj (Surplus) N=128		T-value
	n	%	n	%	
Distance from the selling centre	47	44.8	-	-	NA
Lack of adequate paddy market	40	38.1	64	54.2	10.26***
Lack of high price	45	42.9	55	46.6	1.63
Lack of market information	37	35.2	26	22.0	2.79
Lack of infrastructure development	43	40.9	37	31.4	0.69

Note: The significant levels at * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Survey data, 2022

CONCLUSION

This study aimed to compare paddy deficit and surplus production districts in Bangladesh, focusing on paddy production and marketing. It highlights several key differences between Brahmanbaria and Habiganj districts in terms of agricultural structures, production, and marketing practices.

In Brahmanbaria, a paddy deficit district, farmers face unfavorable geographical conditions, such as low-lying land and annual flooding. In contrast, farmers in Habiganj, a surplus district, benefit from favorable conditions like medium-high land and the ability to cultivate three crops a year. The availability of land, the area dedicated to paddy cultivation, and cropping intensity also vary significantly between the two districts. The cropping patterns of farmers differ markedly as well.

The study found notable differences in production aspects between the districts. The size of paddy-cultivated farmland and productivity are significantly different, with deficit farmers in Brahmanbaria producing less per acre compared to their surplus counterparts in Habiganj.

Marketing practices also vary, particularly in the key players involved. In the deficit district, local paddy agents (LPA) or "Bepari" are the main actors in the marketing channel, while in the surplus district, larger traders like local paddy brokers (LPB) and "Aratdar" dominate. Farmers in surplus area have access to better marketing facilities compared to deficit area farmers. Consequently, farmers in surplus area achieve higher revenues and profits from paddy sales than those in the deficit district. Despite these differences, farmers in both districts largely rely on traders to sell their produce.

Both groups of farmers face common challenges, including inadequate paddy markets, high paddy prices, lack of information, and poor infrastructure. However, deficit farmers are more vulnerable in terms of productivity, infrastructure, and profitability. To address these issues, agricultural extension services should be expanded in Brahmanbaria to provide stress-tolerant seeds and promote modern agronomic practices to improve productivity. Infrastructure improvements are also necessary in the deficit district.

Farmers could enhance marketing facilities by pooling resources through community investment and forming cooperative societies, which would strengthen their bargaining power at the village level in both districts. In addition, the government should consider establishing paddy wholesale markets and implementing market regulations. This would help farmers secure better prices and reduce their dependency on traders in both districts. Further investigation is needed for a deeper understanding of these dynamics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

ACKNOWLEDGEMENTS

The authors are very much thankful to The United Graduate School of Agricultural Sciences at Kagoshima University in Japan, provided with funding to carry out this research as well as the survey supporters, agriculture officers and paddy farmers in the Brahmanbaria and Habiganj district during the survey period.

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