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POST-FLOOD RELIEF AND AGRICULTURAL DEVELOPMENT IN BANGLADESH

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Abstract Rice production drastically increased in Bangladesh after severe flood years during the 1980s, 1990s, and 2000s. Currently, Bangladesh is the third largest country in the world in terms of rice production. It was found that the production of Aman rice did not decrease in the rainy season, but the production of Boro rice showed great increase in the dry season, which resulted in the increase of overall production level after flood years. In this study, socio-economic changes in flood years were revealed from the analysis of the newspaper articles during post-flood seasons. Government supports were prompt but also inadequate; hence, in some regions farmers managed irrigation source on their own, which led to an increase of the overall rice production.

Keywords: Bangladesh, floods, relief, rice cultivation, irrigation

1. Introduction

Rice is grown in many countries in Monsoon Asia due to the abundant rainfall during summer season and the fertile soil in the alluvial plains. After the Green Revolution in the late 1960s, many countries have succeeded in increasing rice production by introducing modern technologies such as HYVs (High Yielding Varieties), chemical fertilisers, pesticides, irrigation equipments, and agricultural machines, achieving self-sufficiency in rice production. The agricultural development pathways, however, vary by countries depending on their ecological environments.

Bangladesh is one of the largest rice-producing countries in Monsoon Asia. In 2020, Bangladesh overtook Indonesia to become the third largest country in the world in terms of rice production, after China and India. Rice production in 2020 was 36.6 million tonnes in Bangladesh, though it was 141.3 million tonnes in China (mainland), and 118.9 million tonnes in India (FAOSTAT 2022).

The increase of rice production in Bangladesh can be attributed to the occurrence of severe floods in the country (Asada *et al*. 2005; Matsumoto and Asada 2020). As the country is located in the low-lying delta of the downstream of the Ganges, Brahmaputra, and Meghna rivers, floods occur annually during summer monsoon season (from June to September). Historically, severe floods occurred in 1987, 1988, 1998, 2004 and 2007, in Bangladesh, which affected more than half of the geographical area of the country; however, annual rice production did not show any losses; rather it showed rapid increase in the subsequent years (Fig. 1). Following several major floods between the 1980s and 2000s, rice production in Bangladesh increased significantly, and it finally achieved the third position in the world in rice production.

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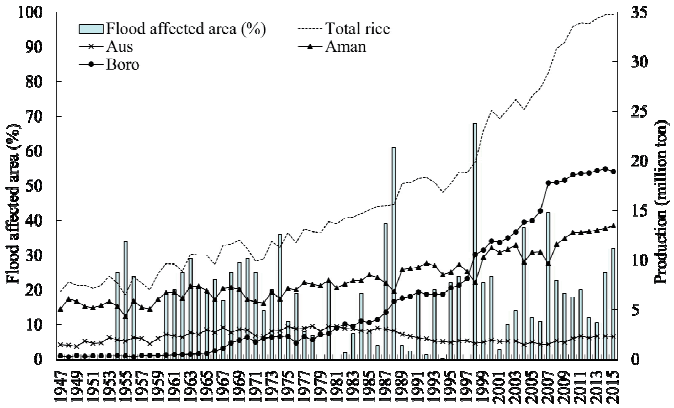

Fig. 1 Rice production in Bangladesh from 1947 to 2015.
Source: Matsumoto and Asada (2020)

The changes in rice production before and after severe floods can be understood from the perspective of the combination of three rice cropping seasons in Bangladesh: Aus (grown from April to June), Aman (from July to November), and Boro (from January to May). Aus and Aman rice are grown in the rainy season depending on both rainwater and irrigation. Boro rice are grown in the dry season depending solely on irrigation.

In the severe flood years, production of Aman rice decreased, but that of Boro rice increased; therefore, the annual rice production did not change from the previous year. In the years following the severe floods, production of Aman rice recovered, and that of Boro rice kept increasing; therefore, the annual rice production drastically increased compared to the pre-flood years.

The cultivated area of Aman rice significantly decreased in the severe flood years as rice seedlings could not be planted due to inundation of flood water. Particularly, the cultivated area of local Aman (both broadcast and transplant) decreased significantly, but that of HYV Aman did not show any decrease (Matsumoto and Asada 2020). The cultivated area of HYV Aman increased significantly as compared to that of local Aman in the following years of floods, which resulted in the increase of yield and production level of the rainy season rice.

Changes of the cultivated area of Boro rice in the severe flood years played a key role in increasing annual rice production in Bangladesh. In flood years, the cultivated area of HYV Boro rice significantly increased in the dry season (Matsumoto and Asada 2020). The cultivation of Boro rice requires supplement of irrigation water. However, it is noteworthy that the rate of increase in Boro rice was higher than the rate of increase in irrigated area, which indicates that Boro rice in some fields might have been grown without irrigation in the dry season after floods. Although it can be considered that the area of Boro rice could have been expanded by using residual flood water where irrigation was not available, it could not be confirmed by satellite observation (Asada *et al*. 2017).

This study attempts to reveal the socio-economics behind the drastic changes of the cropping system described above, based on secondary information. By analysing newspaper articles, the following questions were examined: (1) Why did the cultivated area of HYV Aman not show any decrease in the flood years, but showed an increase in the subsequent years? (2) Why did the cultivated area of HYV Boro increase drastically in the post-flood seasons? (3) Why did the

irrigated area for Boro rice not increase drastically compared to the increase in HYV Boro area?

In this study, articles of the English newspaper, *The Bangladesh Observer,* were used as data source. All articles during the post-flood seasons (from September to February) in the four severe flood years (1988-89, 1998-99, 2004-05 and 2007-08) were reviewed in the National Dietary Library (Kansai branch) in Japan, and the essential articles, such as those on post-flood rehabilitation, agricultural innovation, and agricultural issues were collected for the analyses. The number of the collected articles was 285 in 1988-89, 338 in 1998-99, 402 in 2004-05 and 338 in 2007-08. Among them, 29 articles were used for analysing Aman cultivation (Table 1), 25 for Boro cultivation (Table 2), and 25 for irrigation (Table 3). The eight-digit numbers in brackets mean year, month, and date of each article in the tables (YYYY/MM/DD).

2. Analysis of newspaper articles in flood years

Summary of articles on Aman cultivation

The floods had both direct and indirect impacts on Aman cultivation in Bangladesh. During floods, vast tracts of cultivable lands were under water, and there was no proper system to drain out the water from the inundated fields (19881114). Further, arable lands were covered with sand due to stagnant floodwater, and farmers were unable to bear the expenses of removing the sand (20071024). In other places, arable lands and dwellings were lost due to river erosion (20071107).

Insect attacks were a major indirect impact of floods. The newly transplanted Aman seedlings were badly affected by the different kinds of insects such as marza poka, pamuri poka (19881008), ledha, shishkata poka (19881101), sheet blight, and rot blight (20071107), caused by stagnation of flood-water and heavy rainfall (20071121). Farmers could not purchase costly pesticides due to their economic crisis created by the devastating flood, while pesticides available in the local markets were highly adulterated and costly (19881008).

With the recession of flood water, farmers started planting seedlings of transplant Aman paddy in October, though the season for planting was almost over (19981006). Farmers were busy in collecting and planting of Aman seedlings (19981017). The comparative solvent farmers could collect seedlings at much higher prices than the usual rate, while the poor and marginal farmers faced financial hardships (19981006). Farmers began to cultivate the transplant Aman paddy late due to the flood, but the cultivation target was finally achieved (20041030). As the soil became fertile after the recent flood, bumper Aman cultivation was expected if there would be no disaster again (20070909).

Transplant Aman cultivation was hampered due to a lack of seeds, seedlings, and price hike of Aman seeds and fertilisers. Though Department of Agricultural Extension (DAE) distributed Aman seeds and prepared seedlings for poor and marginal farmers, it was not enough. Many farmers tried to buy the seeds at a higher price while poor farmers were unable to do so, waiting for the government's support (20040904). DAE allocated Tk 1.49 crore for buying seeds and fertilisers for rehabilitating flood-affected farmers (20070925). DAE provided farmers with necessary bank loans, HYV seeds, fertilisers, pesticides and other agriculture inputs to boost production (20071109). Private banks, such as Sonali Bank and Agrani Bank, also provided agri-loan or agri-credit programme for flood-hit farmers (19880930; 19980922).

The Rangpur Dinajpur Rural Service (RDRS) distributed transplant Aman seedlings among 300 flood and river erosion affected farmers who may cultivate one bigha of land under agricultural rehabilitation project (20040901). DAE and Bangladesh Army distributed Aman

Table 1 Newspaper articles on Aman cultivation in the post-flood seasons in Bangladesh

Year	Month	Date	Headline
1988	9	7	Crops on 10,000 acres washed away in Narail
1988	9	30	Tk 346 cr Sonali Bank agri scheme taken up
1988	9	30	Aman Seedlings
1988	10	8	Insects damage aman seedlings in Bagerhat
1988	11	1	Pests attack aman crops in Satkhira
1988	11	11	Government distributing seeds, fertilizers free of cost
1988	11	14	Water logging affects cultivation in Tangail
1998	9	22	Tk 300 cr Agrani Bank loan plan for flood-hit farmers
1998	9	27	Pests attack aman fields in Thakurgaon, Rangpur
1998	10	6	Cultivation of transplanted aman paddy starts in full swing
1998	10	17	2090 acres brought under post-flood aman farming
1998	10	31	Harvesting of Paijam, Swarna varieties of paddy begins in 15 days
1998	12	18	Pests damage 40 p.c. aman crops in Comilla
2004	9	1	Aman seedlings distributed among Kurigram farmers
2004	9	4	T-Aman cultivation being foiled in Mymensingh
2004	10	30	T-aman target achieved
2004	11	5	Harvesting of aman begins in N-region easing Monga situation
2004	11	19	Pests attack Aman paddy fields in Comilla
2007	9	7	Express saplings being donated to flood affected districts
2007	9	8	Aman seedlings distribution starts among poor farmers
2007	9	9	Aman cultivation on in full swing in Narsingdi
2007	9	25	Tk 1.40 cr allocated to rehabilitate flood-hit farmers
2007	9	30	Seedlings among farmers of Gaibandha
2007	10	23	Cultivation of BRRI Dhan-33 to combat Monga urged
2007	10	24	45000 hectares may remain uncultivated in 9 upazilas
2007	11	7	River erosion, pest attack frustrate farmers in Lalmonirhat
2007	11	9	4.65 lakh hectares under Aman farming
2007	11	19	Aman Harvesting improving monga situation in Nilphamari
2007	11	21	Pests attack causing huge loss of crops in Comilla

seedlings among the farmers. Farmers were given need-based ideas, modern methods, technical support, and agricultural credit and monitoring programmes to aid in minimising losses (20070908). DAE distributed late varieties of Aman and paddy seedlings free of cost among poor and marginal farmers with which farmers could at least transplant one bigha of land (20070930). In addition, farmers from different areas distributed surplus Aman seedlings among the flood affected farmers (20070907).

After the floods, they needed to survive the Monga, the period of food shortage in the late rainy season. Farmers were encouraged to cultivate short duration BRRI Dhan-33, a kind of HYV Aman to combat Monga (20071023). Harvesting of early varieties, such as Paijam and Swarna, started in early November (19981031). The Monga situation eased as harvesting of transplant Aman paddy began from the third week of November (20041105). Farmers harvested transplant Aman paddy, which improved the Monga situation (20071119).

Summary of articles on Boro cultivation

After floods, the central government urged the farmers to work hard to boost agricultural production within the short possible time to meet the food deficit in the country (19981002). The government allocated a huge budget with Tk 16.38 crore for flood rehabilitation programmes to help the farmers (20040908). A total number of 11,250 flood-hit farmers of Tangail Sadar Upazila were brought under post-flood agricultural rehabilitation programme of the government (20040906). The Bangladesh Krishi Bank (BKB) started a programme to distribute loan for Boro cultivation. The loan was utilised for land preparation, purchasing quality seeds, fertilisers, pesticides and other agricultural inputs to boost rabi crops production (20040930). Nationalised commercial banks and Bangladesh Rural Development Board (BRDB) disbursed money as post-flood agriculture rehabilitation loan among the farmers (20071103; 20071116). A day long training on modern technics of Boro, and utilisation of fertilisers in the crop fields was held by DAE (19881226). HYV Boro plots for 50 acres in all upazilas were prepared to instruct the farmers (19890211).

Intensive Rabi Cultivation Programme (IRCP) was fixed, but the shortage of seeds impeded the achievement. Farmers preserved paddy seeds every year, but in flood years they lost seeds for their survival (19881219). Farmers were unable to prepare seedbeds for IRRI-Boro (HYV Boro) cultivation due to water logging and non-drainage of the accumulated water (20071110). Seeds of rabi crops were not available at the local market and even in Bangladesh Agriculture Development Corporation (BADC) office (19981122). Farmers protested as BADC did not supply enough seeds in time, and dishonest middlemen were selling the seeds at high prices in the market (20071112). As a result, production cost of Boro increased by 40 percent in flood years (20080118).

Distribution of Boro seeds started in November in the post-flood seasons (20041119). DAE fixed a production target of Boro rice and the government distributed quality Boro seeds, fertilisers and other agri-inputs among the small and marginal flood-hit farmers (20041210; 20071119). The government planned to buy urea to meet the deficit, but the price had surged in the international market (20041102). They imported about 374,500 metric tons of urea and other kinds of fertilisers (20071110).

Food shortage continued even in the dry season after severe floods. Uncultivated land had to be brought under Boro cultivation for food demand (20080119). Boro seedlings were planted by the middle of March, but extra seedlings were still available to be planted in more lands (20080227). In addition, new cultivable lands appeared, such as char lands in Padma, which were silted up with the sand carried by the flood water (20050112). Farmers cultivated more than the targeted areas in the huge flood-ravaged char areas on the Brahmaputra and the Jamuna basins to cover the flood losses (20071215). Landless people could grow Boro rice in rivers and char lands with massive deposition of silt. They attempted to use shallow tubewells (STWs); however, water did not permeate through the distant lands (20080229).

Summary of articles on irrigation

The government gave top priority to irrigation and fertiliser management in the Boro season (20070903). Barind Multipurpose Development Authority (BMDA) installed 120 pumps for irrigation (20080224). As the power operated pumps would substantially reduce the cost of irrigation as compared to the diesel operated pumps, the schemes for the extension of power supply for power pumps were initiated (19890130). The government gave around Tk 4 crore as subsidy in irrigation sector through electric bills to last the Boro seasons (20071029), in addition to

Table 2 Newspaper articles on Boro cultivation in the post-flood seasons in Bangladesh

Year	Month	Date	Headline
1988	11	29	Call to produce HYV crops to minimise imports
1988	12	19	Seed scarcity hits boro cultivation
1988	12	26	Training on boro cultivation
1989	2	11	58 demonstration plots to motivate, train farmers set up
1998	10	2	Call to boost agricultural production
1998	11	22	Farmers face acute seed crisis in northern region
1998	12	24	BADC to disburse 440 tons of boro seeds in Rangpur
2004	9	6	Farmers under agri-rehab scheme
2004	9	8	Post-flood rehabilitation in Sherpur
2004	9	30	Tk 122.75 cr BKB loan for rabi crops cultivation
2004	11	2	Govt plans to buy urea fertilizer to meet deficit
2004	11	19	Distribution of Boro seeds begins
2004	12	10	Free fertilizer, seeds distribution in Magura
2005	1	12	Padma now becomes cultivable land in Goaland upazila
2007	11	3	Tk 101.09 cr agri-loan to be disbursed in Narsingdi
2007	11	10	More fertilizer, rice to be imported to meet demand
2007	11	10	Logged water of 27 beels to foil Boro cultivation in Jessore
2007	11	12	Dealers' corruption creates acute crisis in Boro cultivation
2007	11	16	RAKUB to give Tk 1.50 cr agri-loan in Gaibandha
2007	11	19	Record Boro farming targeted in 16 N dists
2007	12	15	Bumper mustard, increased Boro output likely in N-region
2008	1	18	Production cost of Boro increases by 40 pc this yr
2008	1	19	Fertilizer, seeds ensured for Boro output
2008	2	27	Boro farming to exceed target in N-region
2008	2	29	Crop farming continues in dried-up riverbeds in greater Rangpur

the cash subsidy to farmers in the middle of the Boro season to help them to reduce their irrigation costs (20080210).

The government tried to increase the irrigation area by providing tubewells just after the severe floods, but the problem was that there were no stock of tubewells in offices. In the absence of indigenous pumps, imported STWs could not be distributed. It was apprehended that the post-flood rehabilitation programme would face set-back for want of tubewells (19890112). The government decided to import power pumps from Japan, South Korea, and China (19890120).

There were many irrigation-related challenges. Frequent disorder of machines, shortage of spare parts, irregular supply of power, and corruption and malpractice of officials working in the fields impeded achieving the purpose of increasing the irrigation areas (19890103). Irrigation of IRRI-Boro land was hampered as deep tubewells (DTWs) were lying inoperative for want of necessary repairs (19990105). The renovation of disordered DTWs by the BMDA in Thakurgaon district solved the irrigation problems of the farmers (20040929). The government started an initiative to reactivate the worn-out DTWs to bring the cultivable lands under the coverage of irrigation (20041231). BMDA and the concerned government departments activated a large number of non-functional power-driven DTWs to ensure smooth irrigation (20050115).

Table 3 Newspaper articles on irrigation in the post-flood seasons in Bangladesh

Year	Month	Date	Headline
1988	10	5	Govt to buy 4,000 pumps for farmers
1988	10	8	Deep tubewells for irrigation
1988	10	9	31 deep tubewells to be installed
1988	10	27	Barisal irrigation project withers away
1988	11	7	Spares of DTW stolen away, irrigation hit
1988	11	18	Power pump engines used in boats
1988	11	29	Irrigation pumps being misused in Gaibandha
1989	1	3	Irrigation facilities in Lalmonirhat meagre
1989	1	12	Tubewells not available at BADC office
1989	1	20	16,000 shallow tubewells to be sold
1989	1	30	Lack of power impedes irrigation in haor area
1989	2	4	Spares worth Tk 62.339 sold from BADC godown
1989	2	27	Shallow tubewell engines stolen away, irrigation hit
1999	1	5	Deep tubewells out of order, Irri farming facing set back
1999	1	9	25,000 acres may remain fallow for want of irrigation in Sunamganj
2004	9	29	Irrigation facility at Haripur UZ
2004	12	31	4,459 BADC, DTWS will be reactivated to boost output in northern region
2005	1	15	N regions' Boro farming gaining momentum
2005	1	30	Boro farmers baffled in Jamalpur
2007	9	3	Govt. to attach priority to irrigation, fertilizer: CA
2007	10	29	Farmers not getting irrigation subsidy
2008	2	10	Farmers to get cash subsidy in middle of Boro season to reduce irrigation cost
2008	2	12	Boro production target likely to flop in Kurigram, Lalmonirhat
2008	2	18	71 STW engines stolen in 2 weeks in Chuadanga
2008	2	24	BMDA irrigation facilities in Gaibandha

Even if tubewells were supplied, it was not always possible to increase the irrigated area. Organised gangs of spare part lifters were active in stealing valuable spares of the DTWs (19881107). Engines of STWs used for irrigation, were stolen from villages at night (19890227); 71 STW engines were stolen from different crop fields by a gang of thieves. Those stolen STW heads were then sold in shops (20080218). Further, corruption among officials was also a problem. Huge quantities of DTWs and STWs spare parts and other accessories were sold from the BADC godown by storekeepers (19890204). Prices of diesel, kerosene, and irrigation water went beyond farmers' purchasing capacity. They could not irrigate fields regularly, and their prepared lands dried up (20050130). Farmers applied for electric connections for irrigation, but the shortage of electricity hampered the increase of irrigation lands (20080212). Power-pumps supplied by the BADC were also used for other purposes. They were supplied to the farmers at subsidised rates, but the engines were used in country boats, husking machines, etc (19881118, 19881129).

In the area where irrigation was not available, local farmers demanded the authority to

construct a dam along the sluice gate, and excavate a canal to facilitate the cultivation of Boro. After the government failed to do so due to various problems, people took the initiative to voluntarily construct an alternative dam with the help of bamboo at the proposed location (19990109).

3. Conclusion

From the analysis of the newspaper articles, the following results were obtained in this study:

For Aman cultivation in the rainy season, the food shortages of Monga season were particularly severe after the severe floods; hence, it was necessary to replant Aman seedlings at the earliest after flood waters receded. HYV seeds and seedlings were selectively distributed on the government initiative, and the HYVs continued to be grown in the following years, which may have increased yield levels of Aman rice.

In the dry season after the floods, Boro cultivation was intensified to recover the loss of Aman rice and to ensure food security for farmers. Boro rice seedlings were transplanted to lands that had not been cultivated in the previous years, and even on silted riverbeds and char lands, resulting in an expansion of the cultivated area. However, irrigation did not always reach those marginal lands.

Increase in irrigation facilities was essential to increase the area under Boro rice; however, irrigated area could not be expanded immediately because of a lack of sufficient tubewells, and even if there were, they were frequently out of order. In areas lacking irrigation equipments, farmers had to secure water for Boro rice by themselves.

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