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Impact of short duration and high yielding *aman* rice varieties in Manga areas of Bangladesh

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'Manga', a near-famine situation which hits the northern region of Bangladesh every year, has forced poor people either to borrow money from usurers at an excessively high interest rate or to sell their labor in advance at an unusually low rate to keep their families from starvation. Many people sell their meager produce of *aman* crops well before harvesting to tide them over during the acute shortage of employment and food. The five districts of the northern region of Bangladesh that are most affected by manga are Kurigram, Gaibandha, Lalmonirhat, Nilphamari, and Rangpur. Other locations significantly affected are the areas cultivated with rice variety Binadhan-7, which is grown for its low crop duration of 110-120 days and for its average yield of 4.07 t/ha. These characteristics are similar to those of local rice varieties Sarna (4.29 t/ha) and BR-11 (4.29 t/ha). Early maturing rice varieties, which are harvested during *aman*, facilitate rabi crop cultivation (winter crops). These crops include potato, mustard, and wheat among others. The cultivation of early maturing varieties also allows for the engagement of farm laborers in harvesting and processing activities during the manga period of October and November.

Keywords: Binadhan-7, higher yield, Manga, northern region of Bangladesh, short duration *aman* rice

INTRODUCTION

'Manga', or seasonal famine in Bengali, is a common phenomenon in the region especially during lean periods. It affects people's life significantly. They have to sell their assets and valuables for survival. They are losing assets day by day as an effect of manga.

Rice is the staple food of about 135 million people in Bangladesh (BRRI, 2016). There are three rice-growing seasons in Bangladesh: *aus*, *aman*, and *boro*.

However, Short duration varieties are those with durations to maturity between 110-125 days, while long duration varieties have maturity periods of

140-145 days in *aman* season. Some short duration T. *aman* rice varieties are BRRI dhan33, BRRI dhan39, and Binadhan-7 (BINA, 2009; BARI, 2011). Binadhan-7 is also a short duration, high yielding, transplanted *aman* variety; it was released in 2007 and produces good quality rice. Its crop duration is 110-120 days from seed to seed. It is more tolerant to diseases and major insect pests. It produces a grain yield of 5-5.5 t ha⁻¹. Its rice grains are tasty, long, and bright (white) color which can bring higher market prices. It is versatile since it can not only be cultivated in *aman* season but also *boro* and *aus* seasons. Due to a shorter crop duration and higher grain

yield of Binadhan-7, it facilitates the subsequent cultivation of crops grown in the rabi crops like potato, oilseeds, and wheat. By cultivating this variety at the right time, farmers and residents of the region can better face the manga problem in the month of "Kartik" (October-November) and the socio-economic impact on manga-prone areas can be mitigated. Short duration rice (SDR) has created increased job opportunities for agricultural day laborers during manga. It has increased food and fodder supply in manga periods. The introduction of SDR varieties in cropping systems made the cultivation of mungbean possible for nutrition and soil nitrogen enhancement and increased cropping intensity.

The objectives of the study were to investigate the adoption and impact of modern high yield rice varieties during 2010 and 2011 in the northern five districts of manga-prone area.

MATERIALS AND METHODS

This article is based on information from different sources. Various secondary data were reviewed. The availability of scientific literature with a focus on seasonal poverty in the context of Bangladesh agriculture is very limited. The topic is strongly interlinked with poverty in general and issues like ecological vulnerability, coping strategies, and the economy. Valuable information related to manga was found in those publications. However, as these reports are generally not based on a systematic analysis, they may sometimes be biased. For analysis at macro level, statistical data, mainly from the Department of Agricultural Extension (DAE) (2011), was used. Crop management operations such as transplanting, harvesting, and threshing were done manually. The varieties were evaluated for early maturity and their potential, through measurement of basic agronomic traits. Data on the cultivation, crop intensification records, and adoption of the rice varieties (BRR1 dhan33, Binadhan-7, and BU-1) were collected from the DAE under the five districts of Rangpur, Kurigram, Nilphamari, Lalmonirhat, and Gaibandha during 2010 and 2011, and socio-economic data were collected from RDRS (Rangpur Dinajpur Rural Service), Rangpur.

RESULTS AND DISCUSSION

The areas cultivated with modern (short duration) high yielding *aman* rice varieties and yields are shown separately for 2010 and 2011 in Table 1, while areas under modern (short duration) rice varieties with other high yielding cultivars are

shown in Table 2. Total *aman* rice cultivation during 2010 with both short duration and other varieties represented 608,273 ha of which Rangpur had the highest area (160,520 ha) and Lalmonirhat the lowest (85,210 ha). Of the four short duration varieties (BRR1 dhan33, BRR1 dhan39, Binadhan-7, and BU-1), BRR1 dhan33 was grown in the largest area (35,805 ha), followed by Binadhan-7 (22,830 ha), and BU-1 was grown in the smallest area (230 ha). The area with the highest percentage of short duration varieties grown against the total area appeared in Nilphamari (16.5%), followed by Lalmonirhat (13.47%), Rangpur (12.81%), and Gaibandha (3.6%). Overall, the total *aman* cultivated areas decreased by 50% in 2011 compared to the prior year, while the Binadhan-7 cultivated area continued to increase. The total coverage by major *aman* varieties decreased with the exception of Binadhan-7. The yield of the four varieties slightly increased in 2011 compared to 2010 (Table 1).

The shortest duration varieties (BRR1 dhan33 and Binadhan-7) cultivated in 2011 were compared with the commonly grown high yielding varieties (Sarna and BR-11) (Table 2). It appeared that cultivated areas with high yielding *aman* rice varieties still held a higher proportion of the total cultivated areas for Sarna (29.88%) and BR-11 (44.50%). In contrast, the short duration variety Binadhan-7 proportionally was grown in a higher acreage (7.56%) than its BRR1 dhan33 counterpart (3.78%). But both varieties were yet grown in a smaller area than that for the high yielding varieties Sarna and BR-11. The increase of areas cultivated with Binadhan-7 compared to the areas with BRR1 dhan33 was due to its higher average yield (4.07 t ha⁻¹) than that of BRR1 dhan33 (3.78 t ha⁻¹). Bangladesh Agriculture Research Institute (BARI) (2013) also reported similar results.

After arrival of short duration rice varieties, the socio-economic condition of the people of the manga prone area have improved. BRR1 dhan33, BRR1 dhan56, BRR1 dhan57, and Binadhan-7 are not only short duration photo insensitive, but also drought resistant and high yielding rice varieties in drought and salinity prone area during *aman* season. The variety can also be useful in manga mitigation (BRR1, 2010; BINA, 2012). Rashid et al. (2012) reported that farmers in the Sathkira district of Bangladesh have found that the tandem of short duration *aman* rice and mustard varieties has helped increase their income, as it enabled them to cultivate mustard and *boro* rice on time in

Table 1: Total *aman* cultivated areas (Short duration plus high yielding) and yield in the districts of the northern region of Bangladesh during 2010 - 2011 and its changes.

Year	Variety	Rang	Gai	Kuri	Lal	Nil	Total area (ha)	Yield (t/ha)
2010	BR-33	9565	1060	7500	4230	13450	35805	3.59
	BR-39	1805	1245	2500	837	3000	9387	3.41
	Binadhan-7	9170	2220	2515	6375	2550	22830	3.86
	BU-1	112	16	12	40	50	230	3.59
	Sub- total	20652	4541	12527	11482	19050	68252	-
	% of SDV	12.81	3.6	10.32	13.47	16.5	11.22	-
	Total <i>Aman</i> areas	160520	125800	121293	85210	115450	1084863	608273
2011	BR-33	4260	1600	2905	3259	12850	24874	3.78
	BR-39	470	415	1241	1140	5154	8420	3.78
	Binadhan-7	11737	2665	5234	6142	15285	41043	4.07
	BU-1	33	28	1	22	0	84	3.68
	Sub- total	16500	4708	9381	10563	33289	74441	-
	% of SDV	10.2	3.69	7.72	12.79	28.98	13.70	-
	Total <i>Aman</i> areas	155870	105380	93425	80947	107375	542997	-

Source: AD Office, Rangpur, 2010 and 2011. Rang: Rangpur; Gai: Gaibamda, Kuri: Kurigram. Lal: Lalmonirhat, Nil: Nilphamari.

Table 2: Areas where modern short duration rice varieties with other high yielding cultivars were cultivated during 2011 in the districts of the northern region of Bangladesh.

Variety	Rang	Gai	Kuri	Lal	Nil	Total area (ha)	percentage	Yield (t/ha)	Days to maturity
Sarna	52665	2500	23796	34486	48805	162252	29.88	4.29	145-155
BR-11	75883	62522	54718	32030	16464	241617	44.50	4.29	145-150
Binadhan-7	11737	2665	5234	6142	15285	41063	7.56	4.07	110-120
BR-33	4260	1600	2905	3259	12850	24874	4.58	3.78	115-120

Rang: Rangpur, Gai: Gaibamdha, Kuri: Kurigram, Lal: Lalmonirhat, Nil: Nilphamari.

their rice-mustard-rice cropping system. In that case, optimum time of transplanting and harvesting play an important role for rice production (Kim et al. 2016).

CONCLUSION

Most importantly, the cultivation of Binadhan-7 is growing because of its low crop duration (110-120 days) with average yield (4.07 t ha^{-1}) equivalent to those of Sarna (4.29 t ha^{-1}) and BR-11 (4.29 t ha^{-1}). The shorter duration of Binadhan-7 has allowed farmers to cultivate pulses, oil seeds and vegetables.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

The research has been successfully done with helping from others. HR and Bir designed and performed the experiments and also wrote the manuscript. MI, MA, NM, ZN and SI performed experimental treatments, weeding, interculture operation, data collection, and data analysis. RI, TKO and KW designed experiments and reviewed the manuscript. All authors read and approved the final version. Two authors (M.H. Rahman and M.S.H. Bir) equally contributed to this work and should be considered as joint first authors.

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