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FARMERS LEVEL ADOPTION OF BINA DEVELOPED CROP VARIETIES IN MYMENSINGH REGION OF BANGLADESH

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Abstract

The study was conducted in Mymensingh agricultural region remaining four districts of Bangladesh to examine the farmers' level adoption of BINA developed crop varieties. Primary data were used and those were collected from four districts through concerned DAE office and sub-stations of Bangladesh Institute of Nuclear Agriculture (BINA). Both tabular and descriptive statistical analysis was used to fulfill the objectives. The results showed that among the overall farmers level adoption of BINA developed Aus, Aman and Boro varieties, the highest area coverage was found in Aman 4.65% followed by Aus 0.26% and Boro 0.10%, respectively, The overall farmers level adoption of BINA developed pulse and oilseed varieties were 0.63% and 1.44%, respectively. The results also revealed that among the eight cropping pattern in Mymensingh agricultural region Boro-Fellow-Aman was the highest. It was found that farmers' level adoption was highest by Binadhan-7 (15.86%) followed by Binadhan-17 (15.17 %), Binadahn-10 (10.74%), Binadhan-11 (10.69%), BRRIdhan-28 (9.97%), Binadhan-19 (7.07 %), Binadhan-14 (5.76%) and the lowest area was for BRRIdhan-29 (5.28%). Binasharisha-9 and vegetables were cultivated 15.55% and 3.91%, respectively. Results suggested that increasing trend of farmers level adoption of BINA varieties will contribute country's total production as well as will support in achieving food security.

Key words: Adoption, BINA varieties, Mymensingh agricultural region

Introduction

Agriculture is the largest sector in Bangladesh, making up 13.02 percent of total GDP and employing about 40.60 percent of the workforce (BBS, 2020). Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity and feed a projected 9.7 billion people by 2050 (World Bank, 2020). In Bangladesh, Agriculture plays a leading role in the development and stability of the economy. The arable land in Bangladesh is 15.92 million hectares about 55 percent of the total land area which is contributing to feed 160 million people (BBS, 2019). The country has a favorable natural environment for crop production. Of the arable land, 13.39 percent is under single cropping, 25.57 percent double cropping, 11.5 percent triple cropping, 0.10 percent quadruple cropping and 2.86 percent currently fallow land (BBS, 2019).

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Population of Bangladesh is increasing but cultivable land is decreasing day by day. Bangladesh has faced many factors in recent years that driving land use and land cover changes such as population dynamics, rapid changes in economic growth, climate change, construction of roads and highways, electrification, more advanced agriculture technology and irrigation facilities, extended education, improved health services, new residential infrastructure etc. (Hasan *et al.,* 2017). Rapid land use and land cover change (LUCC) induced land degradation, together with climate change and human activities, is thought to be a threat worldwide (Wu, X. *et al*., 2008, Biro *et al.*, 2013, Leh *et al.*, 2013). Keeping this in mind scientists of different agricultural research institutes developed modern/high yielding varieties.

Until recently, the choice of technologies available to farmers was largely determined by the need to increase production, profits and productivity. The main constraints were the availability of capital, knowledge of how to use the technology and market risks that in many countries policies were shielded by government policies. In the past, "good policy practices" was therefore rather straightforward, relating primarily to increasing output and the aim of agricultural policies was to increase productivity in agriculture. Agricultural research and extension services could concentrate for example, on improving the productivity of small farms.

As a result, Bangladesh agriculture is now transforming from a traditional to a modern agricultural system. Now, the country has been successful in maintaining most of its food demand for the existence of the fertile soils on the few vast floodplains that are annually refilled by siltation during the annual flood (Rahman and Islam, 2014), though there are considerable imports of some agricultural commodities. Area coverage of high yielding modern variety is increasing by replacing traditional variety. Here, Cropping Intensity increases up to 216% (MOA, 2018) from 183% in 2008 (BBS 2021). The specific objectives of the present study were: i) to examine the farmers' level adoption of BINA developed crop varieties; and ii) to suggest some policy guidelines**.**

Materials and Methods

The study was conducted in Mymensingh agricultural region of Bangladesh remaining four districts namely Mymensingh, Sherpur, Netrokona and Jamalpur (Fig. 1). Among these four districts eight upazilas were selected purposively remaining two upazilas of each district. In total 120 farmers were randomly selected, 30 from each district and 15 from each upazilas to collect primary data for conducting the research. Primary data were used for this study which was collected through pre-designed interview schedule using structural questionnaire from the farmers. In the questionnaire per hectare area of BINA developed rice (Aus, Aman and Boro), pulses and oilseed were included to fulfill the objectives. Besides, secondary data from various issues Bangladesh Bureau of Statistics (BBS) was also used. Tabular and descriptive statistics using mean, average and percentage were used to analyze the collected data. The period of data collection was 2019-2020.

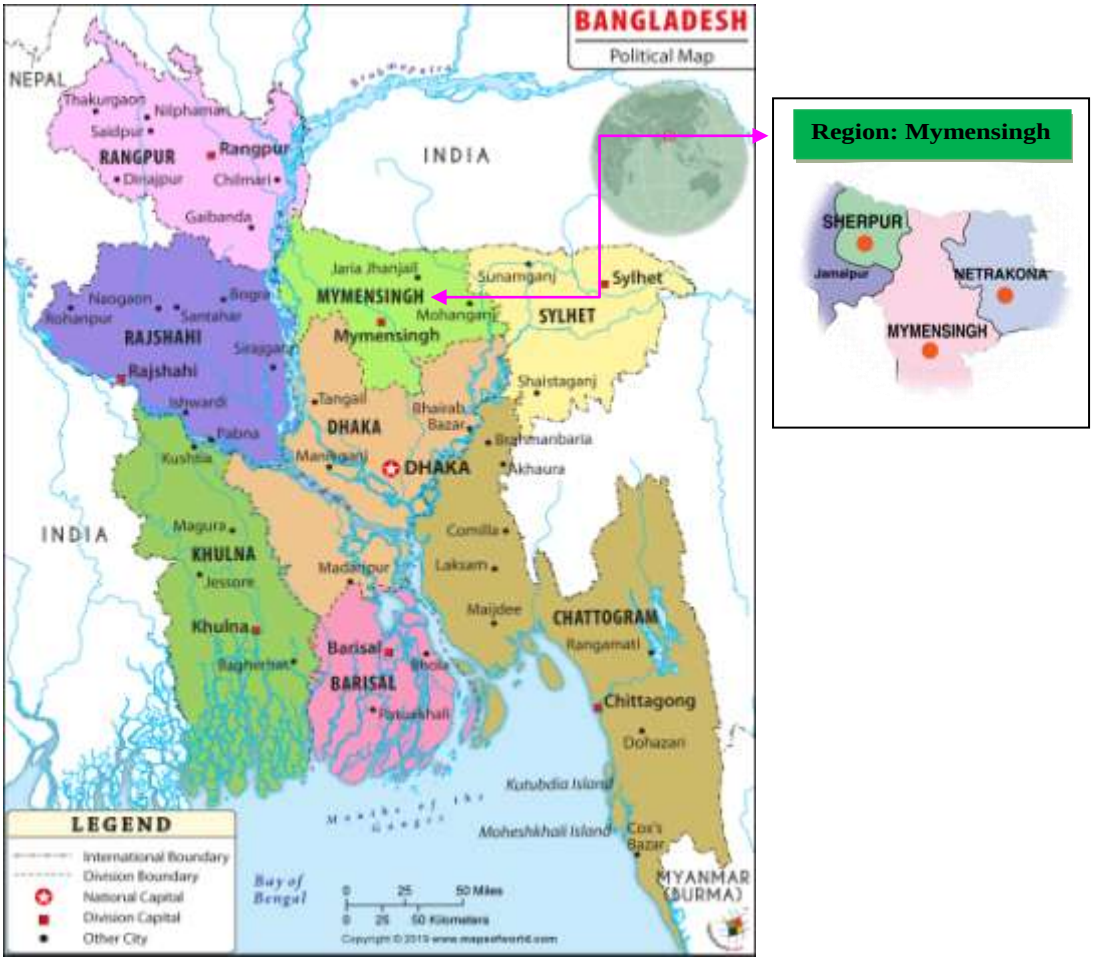

Fig. 1. Map of the Study area of Bangladesh

Results and Discussion

The results presented in Table 1 depicted that adoption of the rice varieties among three rice seasons (Aman, Boro, Aus), Aman was the highest coverage by 4.65% followed by Aus 0.78 % and the lowest for Boro i.e. 0.10 % in the Mymensingh agricultural region. In Aus season, the highest area coverage was found 7.44 % in Netrokona district followed by Jamalpur (1.76%) Sherpur (0.93%) and Mymensingh (0.07%) district. In Aman season, the highest area coverage was found 8.95% in Netrokona district followed by Sherpur (8.21%), Jamalpur (4.26%) and Mymensingh (2.05%) district. The area coverage found 0.38% in Jamalpur district and 0.02% in Mymensingh district of Boro season. In Aman season, the highest area (7741 ha) was found in Netrokona district and the lowest was found (2847 ha) in Jamalpur district.

The overall area coverage of BINA developed pulse and oilseed varieties were 4.62% and 5.82%, respectively (Table 2). Amongst the four districts the highest area coverage for BINA developed pulse varieties was found in Sherpur (20.62%) followed by Netrokona (19.32%). In case of oilseed varieties, the highest area coverage was in Netrokona (46.67%) followed by Mymaensingh (6.17%), Sherpur (5.61%) and Jamalpur (1.49%).

From Table 3, it was observed that there are ten cropping pattern in Mymensingh region. Among 120 farmers and eight cropping pattern the Boro-fallow-Aman was the highest as well as its rank was I, followed by Aman-Vegetables-Boro-Fallow, Aman-Mustard-Boro, Potato-Boro-Fallow-Fallow/Aman-vegetables-fallow-fallow, Boro-Aus-Aman/Boro-Jute-Aman, Aman-Mustard-Boro-Fellow and Vegetable-Fellow-Aman was the lowest which was ranked as VIII.

From Table 4, it was observed that farmers' level adoption was highest by Binadhan-7 (15.86%) followed by Binadhan-17 (15.17 %), Binadahn-10 (10.74%), Binadhan-11 (10.69%), BRRI-28 (9.97%), Binadhan-19 (7.07 %), Binadhan-14 (5.76%) and the lowest area was for BRRI-29 (5.28%). The area of Binasharisha-9 was 15.55% and vegetables (3.91%) in Mymensingh agricultural region among the studied farmers.

Table 1. District wise adoption of BINA developed rice varieties in Mymensingh region.

District	Rice (ha)						BINA Cultivated Area (%)		
	Total Cultivated Area (HYV)			BINA Cultivated Area					
	Aus	Aman	Boro	Aus	Aman	Boro	Aus (%)	Aman (%)	Boro (%)
Mymensingh	16591.00	214185.00	585760.00	12.00	4396.00	97.00	0.07	2.05	0.02
Sherpur	2150.00	58850.00	66116.00	20.00	4833.00	90.00	0.93	8.21	0.14
Netrokona	1545.00	86510.00	160357.00	115.00	7741.00	370.00	7.44	8.95	0.23
Jamalpur	1137.00	66840.00	106517.00	20.00	2847.00	398.00	1.76	4.26	0.38
Mymensingh region	21423.00	426385.00	918750.00	167.00	19817.00	955.00	0.78	4.65	0.10

Source: Field Survey, 2019-20

Table 2. District wise adoption of BINA developed pulse and oilseed varieties in Mymensingh region

(Area in hectare)

Region	Pulse		Oilseed		BINA Cultivated Area in %	
	Total Cultivated Area	BINA Cultivated Area	Total Cultivated Area	BINA Cultivated Area	Pulse (%)	Oilseed (%)
Mymensingh	545	17	2737	169	3.12	6.17
Sherpur	97	20	2175	112	20.62	5.61
Netrokona	88	17	1052	491	19.32	46.67
Jamalpur	700	12	10047	150	1.71	1.49
Mymensingh region	1430	9	16011	231	4.62	5.82

Source: Field survey, 2019-20.

Table 3. Cropping patterns with number of farmers selection in Mymensingh region

Patterns	Mymensingh	Jamalpur	Sherpur	Netrokona	All Areas	Rank
Boro-Fellow-Aman	15	-	-	20	35	I
Boro-Vegetables-Aman	03	-	-	06	09	V
Boro-Aus-Aman	06	-	-	-	06	VI
Boro-Jute-Aman	04	-	-		04	VII
Vegetable-Fellow- Aman	-	-	-	02	02	VIII
Boro-Aman-Mustard	02	-	08	02	12	III
Boro-Vegetable-Fellow-Aman	-	22	04	-	26	II
Boro-Potato-Fellow-Fellow	-	08	03	-	11	IV
Aman-Vegetables-Fellow-Fellow	-	-	11	-	11	IV
Boro-Mustard-Aman-Fellow	-	-	04	-	04	VII
Total	30	30	30	30	120	

Source: Field survey, 2019-20.

Table 4. Area wise farmers level adoption among the farmer's land of crop varieties in Mymensingh region

Varieties	Mymensingh		Jamalpur		Sherpur		Netrokona		All	
	In hectare	(%)	In hectare	(%)	In hectare	(%)	In hectare	(%)	In hectare	(%)
Binadahn-10	2.01	13.09	1.87	8.40	2.24	14.12	1.79	8.87	7.91	10.74
Binadhan-7	2.78	18.11	2.05	9.21	2.91	18.35	3.94	19.53	11.68	15.86
Binadhan-11	1.78	11.60	2.45	11.01	1.17	7.38	2.47	12.25	7.87	10.69
Binadhan-17	2.86	18.63	2.92	13.12	2.80	17.65	2.59	12.84	11.17	15.17
Binadhan-14	0.21	1.37	2.45	11.01	0.92	5.80	0.66	3.27	4.24	5.76
Binadhan-19	0.58	3.78	0.79	3.55	2.28	14.38	1.56	7.73	5.21	7.07
Binasarisha-9	3.11	20.26	4.58	20.58	1.17	7.38	2.59	12.84	11.45	15.55
BRRI-28	1.03	6.71	1.88	8.45	0.51	3.22	3.92	19.43	7.34	9.97
BRRI-29	0.93	6.06	1.98	8.89	0.65	4.10	0.33	1.64	3.89	5.28
Vegetables	0.06	0.39	1.29	5.80	1.21	7.63	0.32	1.59	2.88	3.91
Total	15.35	100	22.26	100	15.86	100	20.17	100	73.64	100

Source: Field survey, 2019-20.

From Figure 2, it was found that in Mymensingh district in case of rice, the highest area covered by Binadhan-17 (18.63%) followed by Binadhan-7 (18.11%), Binadahn-10 (13.09%), Binadhan-11 (11.60%), BRRI-28 (6.71%), BRRI-29 (6.06%), Binadhan-19 (3.78%) and the lowest area was for Binadhan-14 (1.37%). It was also found that Binasharisha-9 and vegetables covered 20.26% and 0.39%, respectively.

From Figure 3, it was found that in Jamalpur district in case of rice, the highest area covered by Binadhan-17 (13.12%) followed by Binadhan-11 (11.01%), Binadhan-14 (11.01%), Binadhan-7 (9.21%), BRRI-29 (8.89%), BRRI-28 (8.45%), Binadahn-10 (8.40%) and the lowest area was for Binadhan-19 (3.55%). It was also found that area of Binasharisha-9 (20.58%) and Vegetables (5.80%).

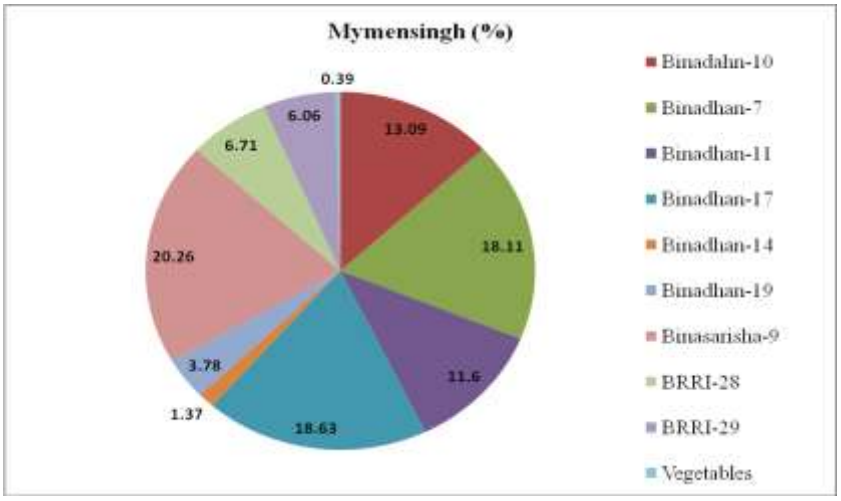

Fig. 2. Farmers level adoption among the farmer's land of crop varieties in Mymensingh district (in %)

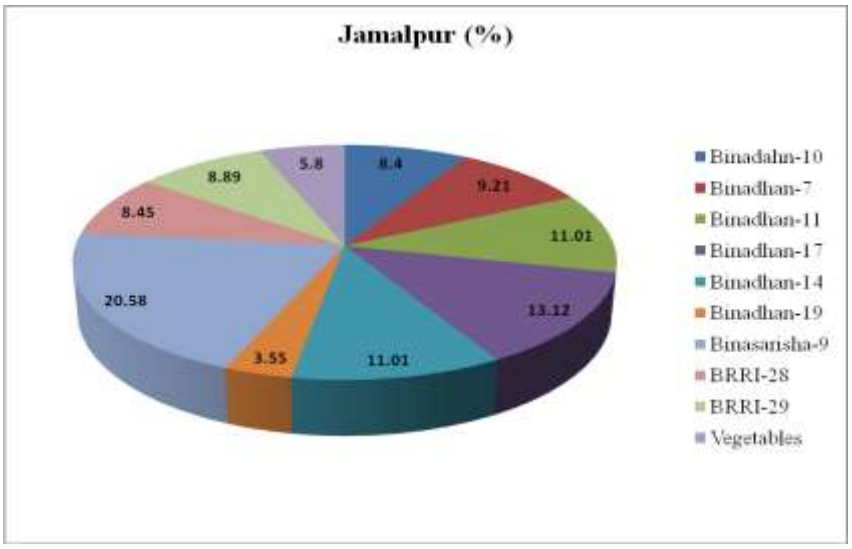

Fig. 3. Farmers level adoption among the farmer's land of crop varieties in Jamalpur district (in %)

From Figure 4, it was found that in Sherpur district in rice, the highest area covered by Binadhan-7 (18.35%) followed by Binadhan-17 (17.65%), Binadhan-19 (14.38%), Binadahn-10 (14.12%), Binadhan-11 (7.38%), Binadhan-14 (5.80%), BRRI-29 (4.10%) and the lowest area was for BRRI-28 (3.22%). It was found that area of Binasharisha-9 (7.38%) and Vegetables (7.63%).

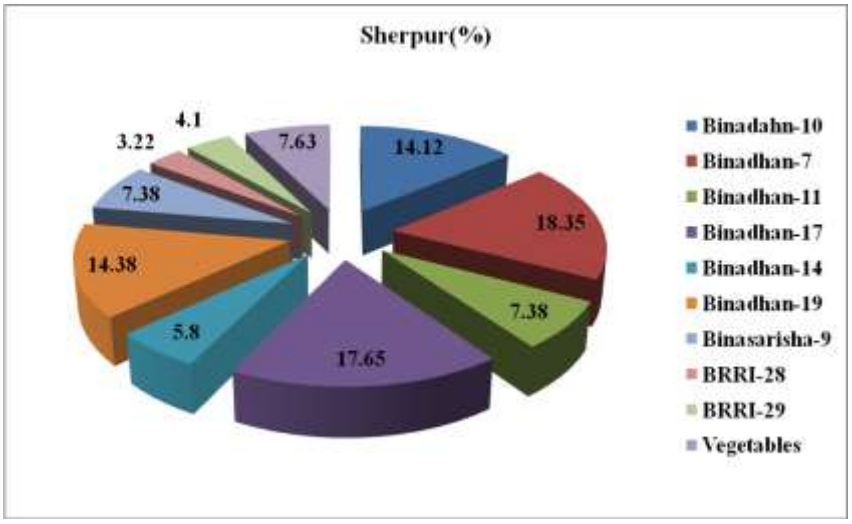

Fig. 4. Farmers level adoption among the farmer's land of crop varieties in Sherpur district (in %)

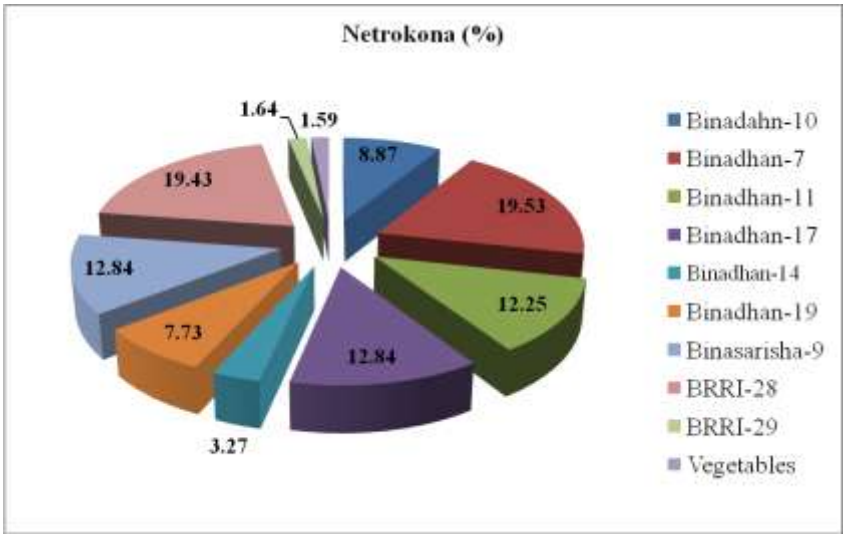

Fig. 5. Farmers level adoption among the farmer's land of crop varieties in Netrokona district (in %)

From Figure 5, it was found that in Netrokona district in rice, the highest area covered by Binadhan-7 (19.53%) followed by BRRI-28 (19.43%), Binadhan-17 (12.84%), Binadhan-11 (12.25%), Binadahn-10 (8.87%), Binadhan-19 (7.73%), Binadhan-14 (3.27%), and the lowest area was for BRRI-29 (1.64%). It was found that area of Binasharisha-9 (7.38%) and Vegetables (7.63%).

Table 5. Area wise farmers level yield among the farmers land in Mymensingh region.

Varieties	Mymensingh (t ha^{-1})	Jamalpur (t ha^{-1})	Sherpur (t ha^{-1})	Netrokona (t ha^{-1})	Average (t ha^{-1})
Binadhan-10	5.09	4.98	5.19	5.08	5.09
Binadhan-7	3.5	5.52	4.76	4.26	4.51
Binadhan-11	4.09	4.26	4.19	5.2	4.44
Binadhan-17	4.75	4.62	4.58	4.62	4.64
Binadhan-14	4.95	4.39	4.75	4.72	4.70
Binadhan-19	3.58	4.53	3.78	4.88	4.19
Binasarisha-9	1.53	1.72	1.67	1.53	1.61
BRRI-28	3.61	5.12	5.49	4.87	4.77
BRRI-29	5.05	4.97	5.01	5.05	5.02

Source: Field data, 2019-20.

From Table 5, it was found that in Mymensingh region, Binadahn-10 showed the best performance among the Boro varieties i.e. the highest average yield of Bindhan-10 was 5.09 t ha^{-1}, followed by BRRI dhan-29 (5.02 t ha^{-1}), BRRI dhan-28 (4.77 t ha^{-1}) and the lowest was for Binadhan-14 (4.70 t ha^{-1}). For aman rice, Binadhan-17 showed the best performance among the Aman varieties i.e. the highest average yield of Bindhan-17 was 4.64 t ha^{-1} followed by Bindhan-7 (4.51 t ha^{-1}) and the lowest was for Bindhan-11 (4.44 t ha^{-1}) in the study areas. For Aus rice, the highest yield of Binadhan-19 was found in Netrokona district (4.88 t ha-1) and the lowest yield was found in Jamalpur district (4.53 t ha^{-1}). The average yield of Binadhan-19 was 4.19 t ha^{-1} among the study areas.

In case of oilseed variety, the highest yield of Binasarisha-9 was found in Jamalpur district (1.72 t ha^{-1}) and the lowest yield was found in Mymensingh and Netrokona district (1.53 t ha^{-1}). The average yield of Binasarisha-9 was 1.61 t ha^{-1} in the Mymensingh agricultural region.

Constraints to BINA developed varieties at farm level

The farmers in the study areas encountered some constraints to BINA developed varieties/technologies (Table 6). The first rank problem was inadequate supply of seeds to the farmers, lack of motivation to the farmer's to cultivate the BINA released varieties, lack of coordination of BINA, DAE and farmers, lack of training facilities to the farmers about BINA technologies, farmer didn't got risk to accept new technologies or varieties and lack of supervision to the farmer's field.

Table 6. Constraints to BINA released varieties at farm level in Mymenshingh region

SL. No.	Constraints	Rank
1.	Inadequate supply of seeds to the farmers	1
2.	Lack of coordination of BINA, DAE and farmers	3
3.	Lack of motivation to the farmer's to cultivate the BINA released variety	2
4.	Lack of training facilities to the farmers about BINA technology	4
5.	Farmer didn't get risk to accept new technology or variety	5
6.	Lack of supervision to the farmer's field	6

Conclusion and recommendations

Increasing yield as well as agricultural productivity is urgent for economic growth and development for any country in the world. The study found that in Mymensingh region, farmers level adoption percentages are worthwhile in BINA developed varieties in all the seasons.

Based on study findings and field experience, the following recommendations are put forwarded for wider adoption of BINA developed varieties.

a) Seeds of BINA developed varieties should be made locally available to the farmers. For this reason the institute should encourage private seed companies to come forwarded for improvement seed production.

b) Motivational campaign through providing training, booklets and other supporting materials to farmers should be continued.

c) Existing extension services and field demonstration of BINA developed varieties should be strengthen for higher diffusion.

d) Ensure market facilities and higher prices of BINA developed varieties.

If we could increase extension activities then the area coverage of BINA varieties will be increase. On that case country's total production will be increased, which will support in achieving food security as well as Sustainable Development Goals (SDGs).

Conclusion

Farmers level adoption of BINA developed variety is viable and the continuation for variety expansion, it should be ensured the seed demand at proper time. To facilitate the dissemination more training, demonstration, collaboration with DAE and BADC as well as research and its budget should be increased which would support in production as well as will support in achieving food security.

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References

BBS, 2021. Statistical Yearbook of Bangladesh, Bangladesh Bureau of statistics, Statistics Division, Ministry of Planning, Govt. of the People's Republic of Bangladesh, Dhaka. p.136.

Biro, K., Pradhan, B., Buchroithner, M. and Makeschin, F. 2013. Land use/land cover change analysis and its impact on soil properties in the Northern part of Gadarif region, Sudan. Land Degrad. Dev., 24: 90–102.

Hasan, *et al.*, 2017. Projections of Future Land Use in Bangladesh under the Background of Baseline, Ecological Protection and Economic Development. Sustainability 2017, 9, 505.

Leh, M., Bajwa, S. and Chaubey, I. 2013. Impact of land use change on erosion risk: An integrated remote sensing, geographic information system modeling methodology. Land Degrad. Dev. 24: 409–421.

MoA (2018). Ministry of Agriculture, Agriculture for Development Strides, p. 5

Rahman, K.M.M. and Islam, M.A. 2014. Nutrition-sensitive agriculture in Bangladesh: a review. Food Security. 6: 671–683.

World Bank, 2020. World Bank, Washington, DC. https://openknowledge. worldbank.org.

Wu, X., Shen, Z., Liu, R. and Ding, Z. 2008. Land Use/Cover Dynamics in Response to Changes in Environmental and Socio-Political Forces in the Upper Reaches of the Yangtze River, China. Sensors, 8: 8104–8122.