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AGRICULTURAL EXTENSION | ORIGINAL ARTICLE

Current status of salt tolerant indigenous rice genotypes, problems and feasibility at farmers' level in the coastal areas of Bangladesh

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ABSTRACT

Global climate change accelerates sea level raising that inundated new cultivation areas every year. Thus in Bangladesh new saline areas are created where general cultivation procedures and genotypes cannot be practiced. Focusing on this situation and also to reuse traditional cultivars in their natural habitats, it is imperative to explore their recent few years cultivation scenario. In this research, major focus was given on the current status and prospects of local salt tolerant rice cultivation in coastal areas of Bangladesh taking five years information under consideration from 2016 to 2020. Thus, a survey was conducted in the selected coastal region of Bangladesh by using data of 90 households through structured questionnaire. Research findings revealed about 80 indigenous rice genotypes grown in saline areas with their present characterization and market demands that had worthy potential to grow and expand further. The market value of these genotypes are very high and required very low labor and fertilizer cost. This survey revealed numerous weaknesses, including low yield, longer maturity time, lack of trustable seed sources, farmers' knowledge, switching towards shrimp cultivation, less marketing facility, poor coordination with related organizations and limited financial and management planning. These limitations hampered the cultivation potentials of the local cultivars. This survey work also suggested farmer's level recommendation for flourishing the cultivation of these local cultivars to a profitable level.

Keywords: Local rice cultivation, saline areas, economic and social status, problems, future prospects

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1 Introduction

Gramineae is the sole angiosperm family comprising major food sources of the world. Among them, with third-highest worldwide production, rice represents one of the most important cereals (BBS, 2019). Current rice production (100 million tons) has to touch about 160 million tons by 2050 to feed the ever-increasing population (Ashikari and Ma, 2015). However, world rice production is constantly challenged by the rising incidence of adverse weather events as a consequence of global warming accompanied by limiting natural resources (Thornton, 2012). Although being a tropical crop, rice shows sensitivity to salinity stress and is recently marked as the most salt sensitive cereal crop with a threshold of 3 dSm^{-1} for most cultivated varieties (USDA, 2013). Annually rice yield is significantly reduced with an estimation of 30–50% in salt-affected area (Kumar and Sharma, 2020).

Bangladesh is a seaside deltaic country with a total area of 147,570 km^2 whose southern part is surrounded by the Bay of Bengal. The coastal regions include 19 districts covering about 20% of the country (Haque, 2006). Out of 32% of the coastal and offshore areas, about 1.689 million hectares are coastal lands where 1.056 million hectares are affected by various degrees of soil salinity and only 20-40% are the cultivable lands in Bangladesh (Miah et al., 2020). These coastal areas have a long history of indigenous or local rice cultivation. Bangladesh is already affected by the unfavorable changes of climate and has become one of the potential victims of climate change. Salinity is one of the most important abiotic stresses that influences rice production and which directly reduces plant growth and developments (Galvani, 2007; Lauchli and Grattan). Salinity is also the second most abiotic stresses affecting rice growth and productivity in coastal environments (Todaka et al., 2012). Approximately, 62% of the coastal areas of Bangladesh are affected by salinity. Agricultural land practice in these zones is very small, which is approximately 40% of the country's average (Miah et al., 2020). The severity of the salinity in Bangladesh also surges with the dryness of the soil, which affects country's overall rice production in large extent (Haque, 2006). Although traditional rice genotypes have been cultivating here since several decades. However, the information about local rice cultivars are very limited. Thus, it becomes very crucial to identify existing salt tolerant rice cultivars, which have already been adopted by the farmers (McCouch et al., 2013; Ismail et al., 2012). Before starting large extent breeding program or biochemical analysis for the improvement of the existing salt tolerant local genotypes, basic information about present condition of rice cultivation in coastal area of Bangladesh should be given priority. Therefore the present study was undertaken to set a list of existing local salt tolerant rice genotypes, to find out the problems related to local cultivars and to suggest the feasible solutions at farmer's level in coastal region of Bangladesh.

2 Methodology

2.1 Study areas

The survey was conducted at different locations of coastal region in Bangladesh, focusing on salinity based local salt tolerant rice genotype cultivation. Four major coastal districts were taken under consideration, which broadly consisted with eight Upazilas (sub-district) (Fig. 1) and 34 villages. Data were collected with structured questionnaire. The locations of data collection were Batiaghata, Khulna (22.7417°N 89.5167°E); Rupsha, Khulna (22.8333°N 89.5833°E); Dacope, Khulna (22.5722°N 89.5111°E); Koyra, Khulna (22.3417°N 89.3000°E); Shyamnagar, Satkhira (22.3306°N 89.1028°E); Assasuni, Satkhira (22.5500°N 89.1681°E); Sharankhula, Bagerhat (22°17′30″N 89°47′30″E); Shankorpasa, Pirojpur (22°34′40″N 89°59′24″E).

According to BBS (2019), local rice genotypes cultivation is reducing day by day and High Yielding Variety (HYV) performances are better than local cultivar in terms of production. Whether local cultivar still providing the desired benefit to the farmers or not and is there any list of the name of local rice genotypes with their comparative production information for which they adopted it? The answer to these questions has rarely been cleared in the literature. Thus, in the next segment, these basic questions were answered using farmer's level data, which formerly were collected through a set of sub-questions. These are important as they ensure the 'skeleton' around which comprehensive information will be available to answer the main question.

2.2 Data collection and sampling

This research was conducted through a five-step procedure (Fig. 2). First, selected coastal areas were visited to get an overview and idea about farmer's problems and related research gap. Secondly, related literature was thoroughly studied including the works that focused on salinity, rice production in the coastal line and farmers attribute to the local rice farming in southern part of the country. By revising earlier studies, the research gap was recognized and a theoretical framework for this research was developed. Thirdly, an acceptable sampling scheme was selected, as well as a structured survey questionnaire was designed for having trustworthy information from the rice farmers. The synopsis of this scheme is itemized in Table 1. The snowball sampling technique was carried out to select participants for this survey (Khan, 2019). This is a very effective method for interviewee in rural areas like Bangladesh, as here people are linked to each other for diverse social interactions. Fourthly, face to face survey was conducted in coastal region, a remote southern part in Bangladesh during September 2020 to February 2021. Data collection was ended through structured interviews. Finally, descriptive data analysis was made, and outcomes were presented. All these steps are illustrated in Fig. 2.

A realistic size of sample to achieve the objectives of the study was taken into consideration. For this study, the target was to attain a sample size of 100.

Table 1. An overview of sampling scheme used for this study

Sampling	Scheme sketch
Target families	Families of rice grower in selected coastal region
Sampling frame	Families of local rice genotypes growing
Sample size	90 Families
Sampling method	Snowball sampling through structured interviewee's and reference within his linkage
Analysis category	Descriptive statistic

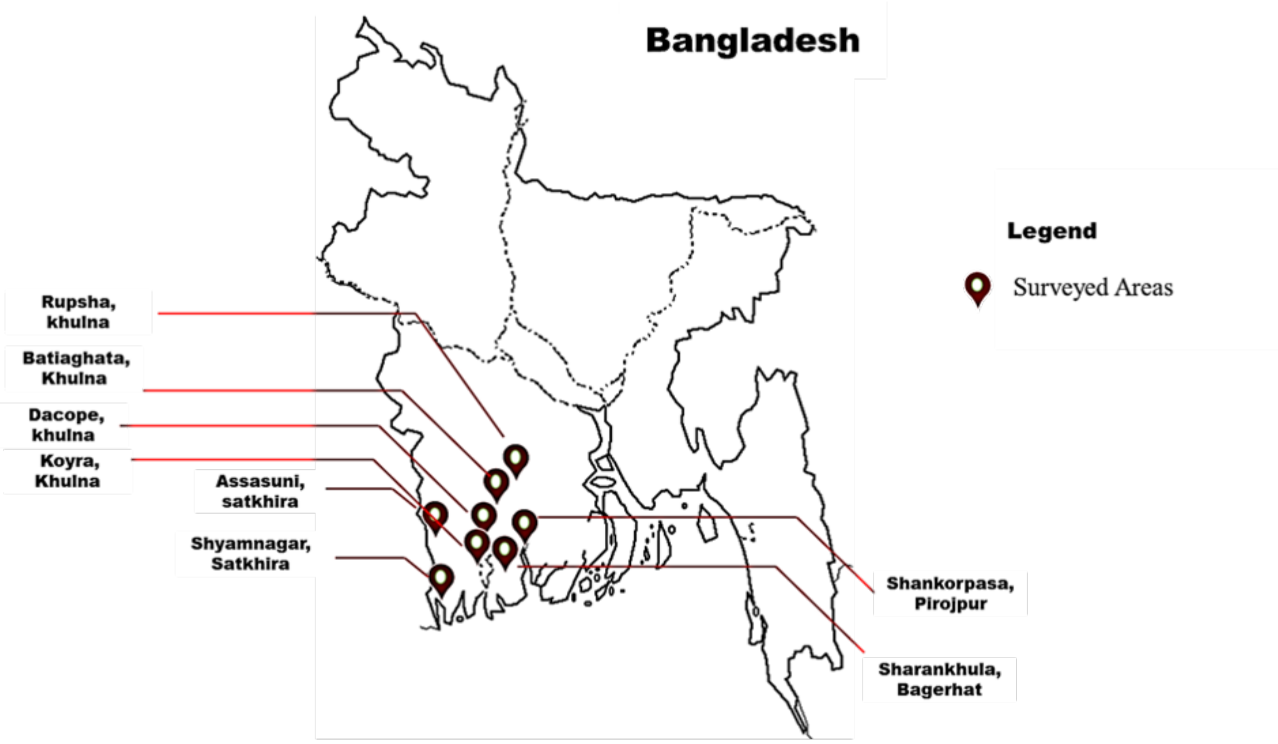


Figure 1. Location map of the study area

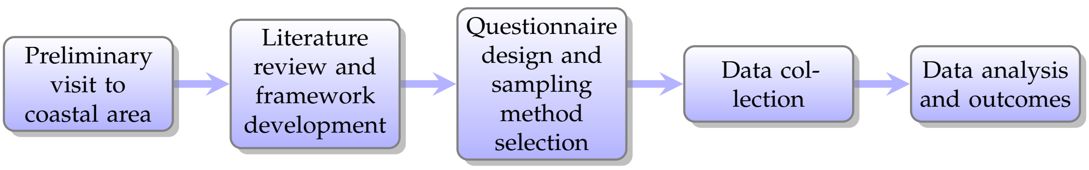


Figure 2. Methodological steps used for this research

However, we were capable to survey 90 families for a number of causes: such as due to the geographical location, problematic local transportation services in far away coastal areas of Bangladesh. "Individuals, either connected or unconnected, living together or taking food from the similar kitchen constitute a household or family" (Saim and Khan, 2021). The researchers were made all possible efforts to establish desired connection with the respondents, so that they could feel free to answer to the queries contained in the questionnaire. During the interview, the researchers clarified the purpose of collecting data to the respondent and did not face any difficulty at the time of collecting data. The collected information were assembled, tabulated, and analyzed according to the objectives of the study.

3 Results

3.1 Demographic information

The interviewees' ages were grouped into five categories, including 25-36, 37-48, 49-60, 61-72, and 73-84. There were 12.0%, 15.5%, 35.0%, 32.0% and 5.5% participants in groups i, ii, iii, iv and v respectively. This age distribution is shown in Fig. 3. These results showed that most of the participants (72.22%) were under experienced farmer groups (age's range 49-84). Of these 90 participants, only fifteen were found to be educated (completed secondary education). One of them was a kindergarten schoolteacher, five was businessman and the rest were farmers. Among the rest of the farmers, 38% participants were illiterate and 45% had primary education (Fig. 4). Fifty five participants described their profession both as small seasonal businessman like, shrimp growers, vegetable, rice and other crops farmer which refer presence of professional fluctuation depending on the seasons. More or less, everyone was actively or passively involve in rice farming as well as in seasonal shrimp business. On the other hand, being involved in small seasonal farming, 50 participants said that they did not have monthly fixed income.

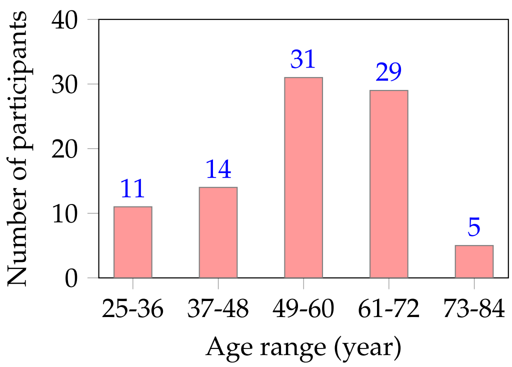


Figure 3. Distribution of age of the participants

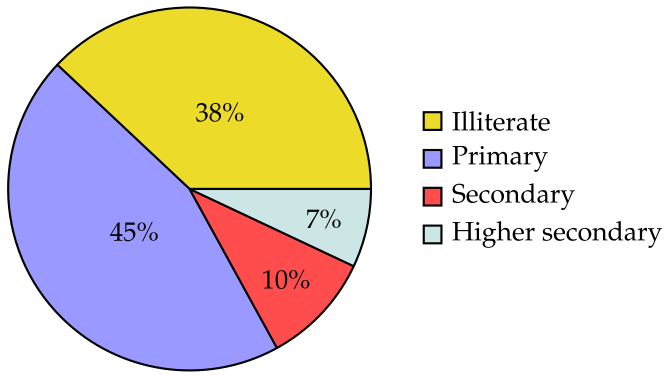


Figure 4. Distribution of the farmers based on their educational qualification

However, it was found that some of them disclosed their average monthly income that varies between 12,000 to 18,000 BDT. Very few participants knew their fixed monthly income because of having temporary professions. With reference to family composition of the households, the average household size was found to be six members that was a bit higher than the national average of 4.89 (BBS, 2016) with a maximum of 12 and a minimum of two members. It was noticed that 10 household had no children. Seven was the highest numbers of children in the households and on an average, each household had three children. It was also found that average number of children involve in rice farming per household was three and maximum six person from a family. These family compositions were presented in Fig. 5. The highest proportion of the respondents (64%) had small farm size, where around a quarter (26%) of them had medium farm and rest 10% of them had large farm size (Fig. 6). This finding was categorized based on national farm size categories of farmers (DAE, 1996).

3.2 Seed sources of local rice genotypes

Information about early seed provider from where farmers collected their first seed for cultivation, is crucial to get the overall information about local rice genotypes, its adaptation rate, and the current status of early seed providers and to make future prospects plan in this potential sector. This survey displayed that different locations had different walking distance in minutes to reach at first seed provider house (Fig. 7). This finding revealed that the information about salt-tolerant local rice genotypes might be passed along to the neighboring farmers of the early recipient farmers and the early recipient farmers may be lived in saline-prone areas and so do their neighbors.

From Table 2, it was found that the adoption rate of indigenous salt tolerant rice cultivars was higher within the farmers who were located closer to the identified early seed recipient that was increased over

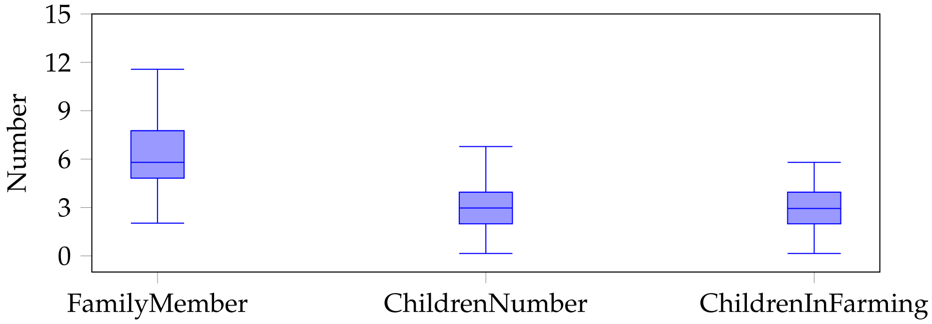


Figure 5. Box and whiskers plot showing family status of the surveyed households

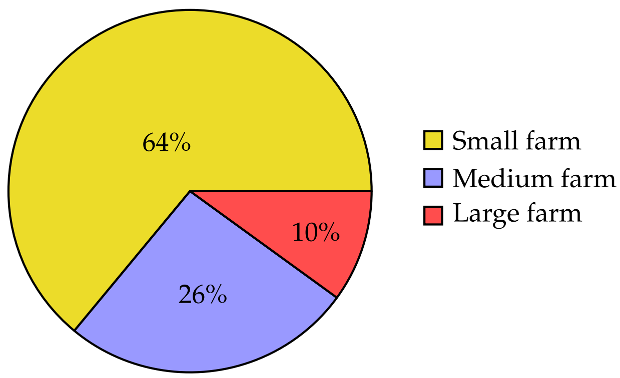


Figure 6. Distribution of the respondent rice farmers based on farm size

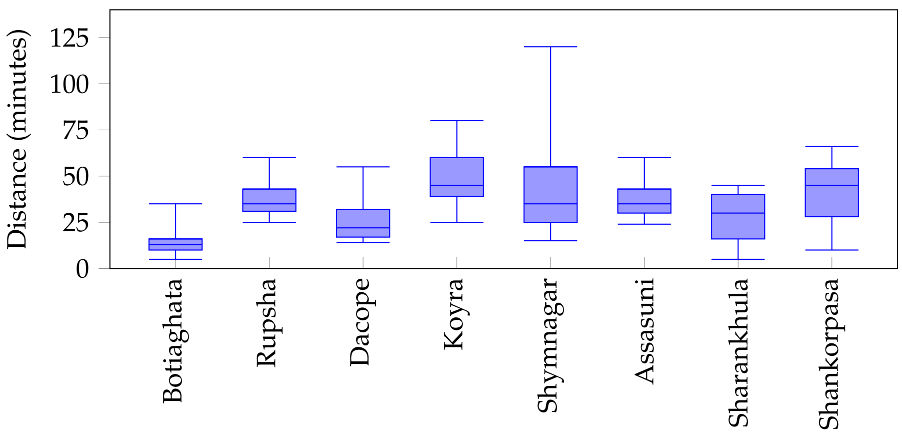


Figure 7. Distance of the first seed provider house (minutes) in different locations of the coastal region

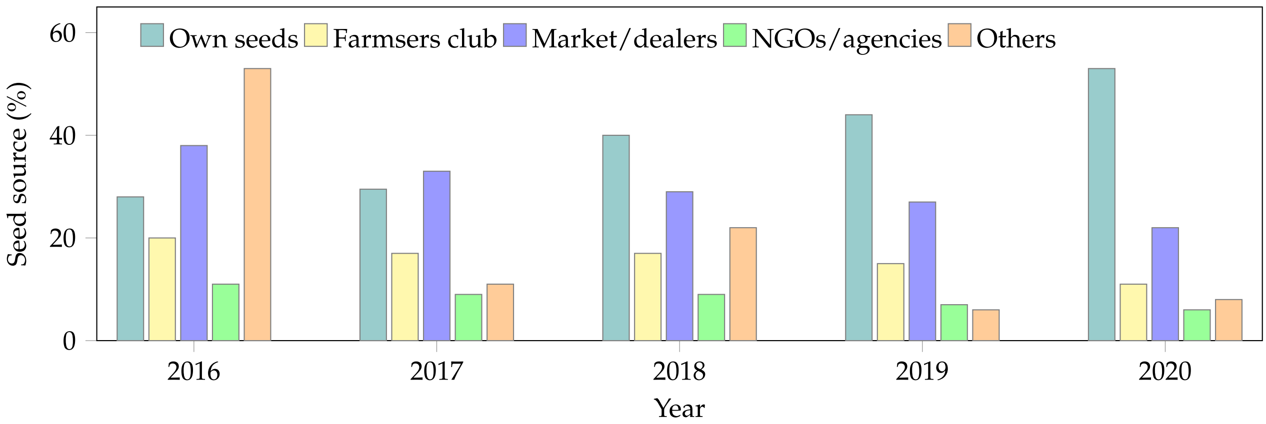


Figure 8. Seed Source of local salt-tolerant rice genotypes during 2016 to 2020 in the coastal region of Bangladesh

the years (Dimara and Skuras, 2003). However, the tendency of cultivation of local cultivars had been reducing day by day (BBS, 2019) along with a change in their seed source and increasing own seed collection. In survey regions, several local seed providers, including farmers club, NGOs, research institutions, farmers own seed bank, and some other minor sectors were found. In this survey, farmers were asked about the seed source, among the users in 2016, 28% of them used their own seeds from the previous season. In the same year, about 20% of the users obtained the seeds from farmers' club and another 11% obtained the seeds from NGOs/research institutions; 38% farmers obtained seeds from markets or dealers in 2016 (Fig. 8). In 2017, 2018, 2019, 2020 own seed source was increased by 30%, 40%, and 44%, respectively (Fig. 8). On the contrary, during the same period, the proportion of users who obtained these seeds from the others sources had greatly declined (Fig. 8). This survey demonstrated that local rice seed sources were drastically changed over the years following the reduction of other seed sources, which indicated lower market availability and limited cultivation of these genotypes. Only own seed or farmers seed was the key source for local rice genotype. The reason might be due to its low productivity or less research effort to improve its productivity or might be due to less attention given from different GOs or NGOs for indigenous rice genotypes cultivation.

3.3 Status of LSTRG in the coastal area

Although the main focus of this research is to analyze present status of local salt tolerant rice genotypes (LSTRG) and providing farmer's level solution along with demand based suggestions, it is imperative to know the condition of the farmers involved in rice farming from last few years for a clear idea of this research topic. In Table 2, it was indicated that number of local rice growers was reduced continuously. Moreover they were involving themselves in HYV or other crop cultivation and most of the farmers seemed to have shrimp hatchery for their new source of income. Based on this survey, Sharankhula, Bagerhat had the highest local rice growers that was around 16.9% in 2016 and Assasuni, Satkhira had the lowest growers that was around 7.2% (Table 2). Every next year, declining trends for local rice production seemed very clear. A total 80 local rice genotypes were identified through this survey (Table 3). On average, 2-4 varieties were cultivated at the survey time throughout the survey areas. Kharif-2 was the cultivation season, rest of the season generally used for cultivation of watermelon, melons, vegetables, maize, etc. The local genotypes were mostly medium to long maturity crops (Table 3). Short to medium (10-15 days) inundation with saline water adversely affected rice production with around 25-50% yield reduction. Average yield of local rice genotypes varies between 1.04 and 4.04 t ha^{-1} and under saline flood the yield varies between 0.44 and 2.96 t ha^{-1}, and the outcomes of the survey was broadly presented in Table 3. For most of the local genotypes, farmers did not use any chemical fertilizer. This result was displayed in Fig. 9 indicating low fertilizer use for local cultivars where every respondent agreed with this point, and 35 respondents mentioned they did not need to use chemical fertilizer, 20 respondents told about very low use, 22 mentioned low use, only 13 respondents thought about medium dose of fertilizer requirement. The mentionable one was that they never used high dose of fertilizer.

3.4 Use of developed varieties

The cultivation of developed variety is increasing day-by-day throughout the country (BBS, 2019). Cultivation of developed variety followed an increasing trend in surveyed areas (Fig. 10). The findings revealed that HYV rice genotypes were cultivated by

Table 2. Survey results of local rice genotype status in the selected coastal region of Bangladesh

Location	Sampled villages (no.)	Respon-dents (no.)	LSTRG (total no.)	Cultivated LSTRG (no.)	Avg. land used (ha)	LSTRG growers (%)				
						2016	2017	2018	2019	2020
Batiaghata, Khulna	6	18	24	3-4	1.45	12.5	9.3	6.4	3.6	3.4
Rupsha, Khulna	2	7	16	2-3	0.45	8.1	7.2	6.15	4.9	2.31
Dacope, Khulna	6	13	14	2-3	0.96	9.6	8.2	6.9	5.5	4.6
Koyra, Khulna	5	16	28	4-5	0.61	16.8	12.3	5.6	3.6	1.2
Shyamnagar, Satkhira	3	10	22	3-4	2.02	14.3	13.6	11.8	10.7	7.51
Assasuni, Satkhira	4	11	8	2-3	0.31	7.2	6.69	5.81	3.2	2.34
Sharankhula , Bagerhat	5	9	14	3-4	0.89	16.9	14.1	10.7	7.3	5.1
Shankorpasa, Pirojpur	3	6	8	2-3	0.81	12.9	9.81	6.71	4.32	3.12
Total	34	90								

LSTRG = Local salt-tolerant rice genotype

76.67% peoples whereas 34.44% rice growers grew indigenous genotypes. However, these results were gradually changed in 2020 where 80% rice farmers cultivated HYV and 20% farmers cultivated local rice varieties (Fig. 10).

4 Discussion

The coastal area of Bangladesh covers near about 20% of the country, which is about 30% of the net cultivable area (Haque, 2006). In dry season, soil and river water salinity increase, while it decreases during the monsoon season. Land use varies both temporally and spatially with season. Due to salinity, the coastal area remains fallow during winter (Shelley et al., 2016). Wet-season Kharif-2 is the main cropping season for crops and farmers mostly use traditional rice varieties, which can withstand salinity but have a poor yield. The listed 80 indigenous rice genotypes (Table 3) or in some place it can be more have been cultivated from ancient time period in the coastal saline affected areas of Bangladesh. Seed sources are diverting towards farmers own preservations from market/dealers or from related organizations (Fig. 8) and these situation discouraging local rice growers by reducing the market facility.

4.1 Benefits of cultivating LSTRG

Through this survey, it had been found that the market demand for local rice is very high, although its production is less. There were so many positive factors or support behind this situation. Some mentionable reasons were being acquainted with their cultivation procedures, intercultural caring, and stress resistant capacity. The cultivation process was very easy requiring very less or no fertilizer (Fig. 9), which might increase soil health as local varieties were cultivated only in kharif-2 season that might give more scope to add organic matter to soil. On the other hand, disease and pest attack was very low, that's why farmers did not need to use high dose of agrochemicals (Fig. 9), which might cause less environmental pollution. From survey, it was also found that some rice cultivars could withstand and survive in saline submerged condition for a long period of time, could withstand strongly in both high and low tidal condition and even in year round submerged land (Horkoj, Mohini, Ranga Balam, Benapol, Kachra). Plant height of some cultivars was increased with increasing water height up to 5 ft to 8 ft (e.g., Morichshail, Rani chailet, Chapashail), some cultivars could live under water for 5-7 days without affecting their yield (Koijhuri). However, for most of the rice genotypes, yield reduction was about 25-50% depending on submerged length with saline water. Seed preservation technique was very easy and weeding was not necessary in most of the cases.

4.2 Reasons for declining LSTRG

The national average rice yield in Bangladesh is 4.6 t ha $^{-1}$, which is very low compared to other rice-growing countries (Anonymous, 2015). As local cultivars grown in saline area has relatively lower yield (2-4 t ha $^{-1}$) compared to HYV (6-8 t ha $^{-1}$) (Faroque et al., 2021), which might be one of the major reasons for farmers switching towards HYV or other crops cultivation. Again, local seed source from markets, dealers, and agricultural related organization seemed to follow a declining trend. Whereas shrimp cultivation might become more popular and economical. This can affect farmers switch towards other profession instead of rice cultivation. Moreover, developed rice varieties can be cultivated at least two times in a year but local verity is grown in only one season. Excess salty flood water that might cause a yield

Table 3. Yield and related attributes of indigenous rice genotypes in the selected coastal region of Bangladesh

Sl.	Name of LSTRG	Duration (days)	Yield (t ha^{-1})	S. yield (t ha^{-1})	Sl.	Name of LSTRG	Duration (days)	Yield (t ha^{-1})	S. yield (t ha^{-1})
1.	Morichshail	130-135	3.55	2.37	41.	Moyna Mothi	100-110	1.63	0.74
2.	Kachra/ Jolpayra	110-120	2.35	1.21	42.	Gopal Vhug	100-110	3.41	2.22
3.	Rani Chailet	120-130	3.85	2.96	43.	Gobindo Vhug	100-110	2.67	1.33
4.	Mohini Salot	120-135	2.37	1.78	44.	Durga Vhug	120-130	2.37	1.22
5.	Vhute Salot	110-120	3.26	1.78	45.	Khobri Malothi	120-135	2.96	2.22
6.	Bashful Balam	100-110	3.27	1.78	46.	Birishail	120-135	2.37	1.33
7.	Thal Mugor	110-120	2.52	1.93	47.	Bawon Khir	110-120	3.41	2.52
8.	Patnai	120-135	3.15	2.37	48.	Rajao Khai	100-110	1.78	1.04
9.	Kute Patnai	120-135	2.96	2.35	49.	Dud Kolom	115-120	2.37	1.33
10.	Lati Patnai	120-135	2.56	2.22	50.	Chopeshath	100-110	2.96	1.78
11.	Tiki Patnai	110-120	2.26	1.93	51.	Kumvo	100-110	3.56	2.22
12.	Shola Patnai	110-120	2.52	1.21	52.	Mandari	120-135	1.78	1.19
13.	Benapole	100-110	2.37	0.89	53.	Gunchi	110-120	1.04	0.74
14.	Khato Kumra	100-110	2.07	1.2	54.	Kalo Zira	110-120	2.22	1.04
15.	Jamay Naru	100-110	2.67	1.78	55.	Begun Bichi	120-130	2.85	1.93
16.	Jamay Babu	120-135	1.04	0.59	56.	Hori Dhan	120-130	3.11	1.93
17.	Joyte Balam	110-120	2.76	2.07	57.	Rupesshore	120-135	2.67	1.78
18.	Ranga Balam	110-115	2.96	1.78	58.	Holde Batail	120-135	2.37	1.33
19.	Chikon Dhan/Balam	130-135	4.04	2.67	59.	Boyar Bot	120-135	2.67	1.78
20.	Holud Gotayl	110-120	3.26	1.78	60.	Khejur Chori	120-135	2.37	1.33
21.	Sada Gotayl	100-110	2.67	2.07	61.	Koijhuri	110-120	2.37	1.04
22.	Sada Gethi	115-120	1.78	1.04	62.	Darshail	120-135	2.82	1.81
23.	Lal Gethi	110-120	2.37	1.04	63.	Jamai Naro	110-120	2.96	1.78
24.	Shola Gethi	120-130	2.67	1.78	64.	Rothna	120-135	2.67	1.33
25.	Khude Gethi	110-120	2.37	1.19	65.	Horkoj	120-135	2.37	0.89
26.	Chini Kanai	110-120	2.67	1.74	66.	Tikaram	120-135	1.78	0.59
27.	Sada Chini Kanai	120-130	3.26	1.19	67.	Boran	120-135	1.33	0.89
28.	Sada Muta	115-120	2.36	1.78	68.	Anarul	130-135	1.19	0.44
29.	Kalo Muta	120-130	2.52	1.63	69.	Shakkor Khana	120-135	1.78	0.89
30.	Lal Muta	120-135	2.96	2.05	70.	Lal Mou	120-135	2.37	1.78
31.	Fokir Muta	120-135	2.85	2.22	71.	Kew Mou	120-135	2.67	1.81
32.	Ranga Muta	120-135	2.96	2.37	72.	Lokma	120-135	2.96	1.33
33.	Bash Paier	120-130	2.85	2.22	73.	Sholir Pona	110-120	2.37	1.78
34.	Nera Jamai	110-120	3.85	2.96	74.	Khekshail	110-120	1.78	1.04
35.	Nera Shitha	120-135	2.37	1.04	75.	Nera Shitha	120-135	2.33	1.81
36.	Kumroghor	120-130	2.37	1.63	76.	Sholir Pona	110-120	2.22	1.04
37.	Shaheb Kuchi	110-115	2.52	1.93	77.	Dhula Beej	120-135	2.22	1.04
38.	Chapshail	100-110	3.85	2.73	78.	Dakshail	120-135	2.67	1.78
39.	Kolmilotha	115-120	1.78	0.89	79.	Thal Moyo	120-135	2.37	1.04
40.	Mohini	120-130	2.2	1.04	80.	Soylopana	120-135	2.33	0.59

LSTRG = Local salt-tolerant rice genotype; S. yield = yield under salinity condition

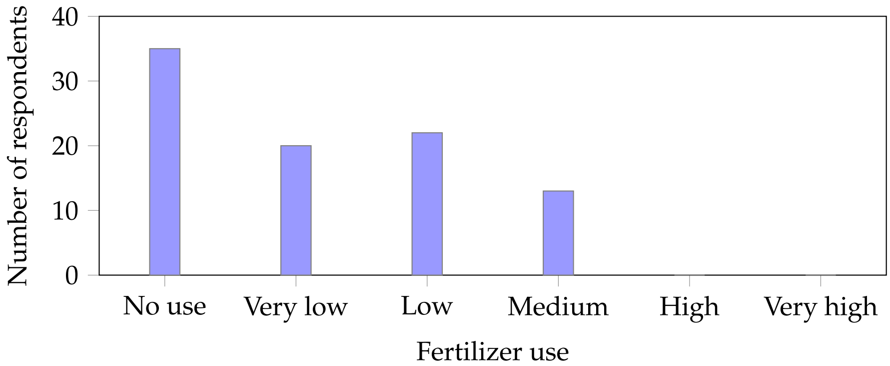
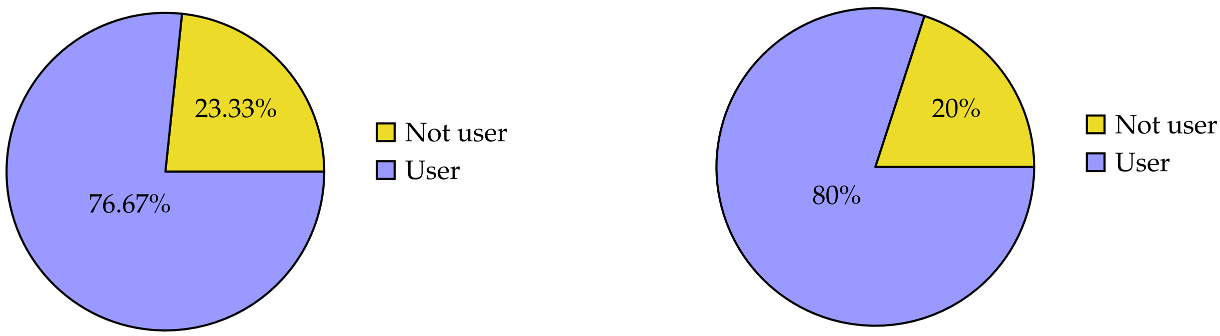


Figure 9. Extent of chemical fertilizer use for local rice genotypes cultivation. No use: 0 kg ha^{-1}, Very low: 1-25 kg ha^{-1}, Low: 26-50 kg ha^{-1}, Medium: 51-75 kg ha^{-1}, High: 76-100 kg ha^{-1}, Very high: $\geq$125 kg ha^{-1}



(a) Developed variety user before 2016

(b) Developed variety user in 2016

Figure 10. Size of developed variety user

reduction of about 25-50% seemed a great problem that discouraged local variety selection. Furthermore, insect-pest from the field cultivating developed variety might attack on local variety field, which include rice swarming caterpillar, brown plant hopper, rice yellow stem borer, rice hispa, leaf roller, earthworm, rat, leaf spot, and excess deposition of plankton which might a reason of declining yield of rice. Harvesting duration was 10-15 days higher in local genotypes compared to HYV. On the other hand, lack of proper soil management and land use technique might reduce soil fertility. Besides wrong variety selection according to land type probably made this condition even worse. Continuous cultivation of same variety in a given piece of land might reduce organic matter and nutrient from soil due to having same root zone. Moreover, increasing market demand forother economic crops converted rice field into other crop fields. Lack of proper information from respective sectors forced farmers to cultivate rice at their own wish. Furthermore, they did not get proper price of their product due to dishonest middleman although market price for the product isvery high. In some place local transport facility added more problems in this sector. On the other hand, company dealers encouraged farmers to accept HYV (higher yield although along with the need of higher fertilizer and agrochemicals). Activities of these private sectors were utterly discouraging farmers to use local rice cultivars in coastal area of Bangladesh.

4.3 Strategies to overcome problems associated with LSTRG from survey

Although local cultivars had low yield potential, farmers preference and choice for them was very high (surveyed result mentioned in table). Several ways or demands were identified through this survey work and farmer's level suggestion might be utilized for increasing cultivation areas of local variety. Firstly, if incorporation of high yield potential in these varieties and reduction of maturity duration through breeding or genetic engineering technology would become possible then it might met the farmer's choice and demand. Secondly, proper maintenance techniques of soil could reduce soil salinity and improve nutrients availability of that soil. Incorporation of crop residues and green-manure crops and balanced use of organic and inorganic fertilizers in soil might prevent soil organic matter exhaustion. Thirdly, as soil fertility of the country is declining progressively, keeping land fallow for a particular period of time is very important to improve soil organic matter status, soil fertility and productivity. Farmers usually apply more fertilizers without understanding the definite requirements of the soil. In place of using granular urea, the urea super granule is an effective to shrink fertilizer application for ideal yield (Paul et al., 2014; Qurashi et al., 2014). Fourthly, alternative crop management having different root length might improve soil physico-chemical and biological health due to their is proper utilization of soil nutrient. Fifth, keeping a distance between the lands of local and developed cultivar might be very effective against disease and insect-pest attack that would reduce the use of agrochemicals. Sixth, use of genetically pure, healthy and disease-free seed was highly desired to get optimum yield. Seventh, organizing training facility for farmers about the appropriate cultivation process might improve the overall problem in large extent. For these purposes, both government and non-government organizations should focus on this sector. They could have increased local seed supply, seed production, distribution, provide emergency loan for local rice growers, and increase research on the development and quality improvements of local rice. Lastly, farmers benefit should be prioritized so that they can get proper price of their products. Thus, maintaining proper market channel and price, supply of low cost fertilizer especially organic fertilizers should be kept under consideration. Spreading agricultural knowledge and information from many sources contribute in better farming and enhance living standard (Kashem, 2014). This will strengthen the linkage between researchers and extension personnel, which is significant to spread the technology and understand the farmers' needs. The positive results is that, about 2.3% rice yield is increasing per year over the last three decades (Hossain et al., 2006). While, researchers know actual desires of the farmers of a particular region, they can fix their research goals also. Likewise, regional and international collaboration might be needed to interchange knowledge and technology to upsurge rice production in a viable manner.

5 Conclusion

In this survey, we focused on five (05) years information of local salt tolerant rice genotypes, which have been growing in the coastal saline region of Bangladesh. Although, Bangladesh is self-reliant in rice production, however, with the increasing population and future climatic threats, it needs to be enhanced. Bangladesh has the prospect to enhance local rice production and trade, which can add to the home economy. Our survey displayed that the farmers having old age, higher agricultural skills, and preferred local rice germplasms for cultivation in the saline areas. Suitable breeding techniques to accommodate the potentiality of these germplasms for salinity stress environments are crucial for withstanding ever increasing salinity in coastal areas of Bangladesh. The development of more high-yielding, early-harvesting, salt tolerant, and disease-pest resistant local varieties might indorse the ultimate production of rice. Furthermore, proper crop and land management schemes may boost rice production. Therefore, awareness creation among the farmers through extension campaign, public-private partnership with farmers by maintaining an acceptable market chain should be given priority. This study also had some pitfalls, which suggested towards further future research in this aspect. During data collection, it was found that the snowball technique was not sufficient to collect data for a large sample. Thus, our sample size ended with the number of 90 households from 8 Upazilas of 4 districts. Any forthcoming study should consider a large sample size and areas, so that the sample could represent all the salinity areas of Bangladesh. Moreover, a large sample size with equal numbers of participants from each location might reveal new findings. Mostly, the results emphasized the present status of local rice genotypes considering the several factors responsible for making the local rice cultivation a burden for the coastal line rice growers. The findings from this study might be employed to overcome the difficulty of local salt tolerant rice cultivation and also to make the cultivation of local rice genotypes an inclusive benefit for the coastal rice farmers in Bangladesh.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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