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CONTENTS

Impacts of Salinity in Local Livelihood Strategies: A Study on Kumarkhali Village of Pirojpur District

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Sammi Akter Sathi[2]

[**Abstract :** The study seeks to understand the impacts of salinity on the livelihood strategies of farmers and responses of farmers to various technologies available to cope with the salinity problem. A mixed method approach was employed to successfully study the objectives of the research. The study area of this research was purposively selected Kumarkhali village of Nazirpur union under Pirojpur district, which is one of the saline-prone areas of Bangladesh. The study refers that, higher saline affected area induces decreasing returns in paddy cultivation, which reduces the productivity of land that results in decreasing agricultural profitability. Local people derive their strategies to avoid the negative effects of salinity. Not only they use traditional knowledge but also they use hybrid seeds, they migrated their selves for searching for new job opportunities etc. Salinity is needed to be controlled through government initiatives and farmers demand new technologies like salt-tolerant seed varieties, new fishing and vegetation technique around the pond etc.]

Key Words: Salinity. Livelihood, Changing Job Pattern, Coping Strategies

Introduction

Salinity intrusion has an adverse impact on the coastal areas around the globe. The problem becomes extreme especially in the dry season when rainwater is not available and leaching out salt from the soil. The assertion of irrigated water is highly affected by salinity intrusion in surface water (Shahid, 2010) and salt accumulation in the root zone of soil affects plant growth in coastal soil (Yadav et al., 2009). As Bangladesh is an agrarian country, 60% people of this country are directly or indirectly dependent on

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agriculture for their livelihood.The contribution of the agricultural sector is 20% of its GDP (TheMinistry of Education and Forest [MoEF], 2009). The major part of the land in coastal Bangladesh is alsoused for agriculture. The gross area in the coastal zone of Bangladesh is 144,085 and the net-cropped area is 83,416 hector (Islam, 2004). The victims of salinity intrusion coastal districts areSathkhira, Khulna, Bagerhat, Borguna, Patuakhali, and Barishal. It is observed that dry flow trend is being declined as a result of which sea both in the surface and groundwater(DMB 1997). A huge amount ofland have been identified which are affected by soil salini tyand the area covers about 830,000 million hectaresat different degrees of salinity (CCC, 2009).

Shrimp culture is encouraged bysalinity intrusionand constraints rice cultivation which finally reduces income of the farmers. It also limits employment opportunity for the farmers. (Haider & Hosain, 2013). Effects of salinity intrusion due to shrimp farming significantly reduced the crops and livestock production (Islam & Tabeta, 2016). Rasel et al. (2013) showed that saline soils are mainly found in Khulna, Barishal, Patuakhali, Noakhali and Chittagong districts of the coastal and offshore lands. Due to a number of environmental factors, the coastal soils are moderately saline on the surface, and highly saline in sub-surface layers and substrate. This study provides some baseline information and understanding with regards to the state of salinity of the study area. He also mentions the need for independent crop production planning for different location in the coastal areas (Rasel, 2013). Increased salinity is likely to result in the decline in rice and wheat production, and a more pronounced shortage of drinking water. The livelihood approach of the coastal belt communitymainly depends on the natural resources like crop production, fish, crabs, snails etc. Lower crop production was observed through the surveyed region (Khulna, Satkhira and Bagerhat) due to lower productivity of land caused by salinity. Still, some of the impacts of salinity may be positive, such as shrimp cultivation opened up new avenues for employment for the local people, especially for women. Small farmers get a higher proportion of income (75.0% of total farm income) from shrimp farming than medium farmers (67.4%) and large farmers (73.6%). On average, farmers' income was increased which enhanced overall socio-economic condition and livelihood status (Uddin & Nasrin, 2013). But most studies agree that the adverse impacts will outweigh any of the possible benefits if no action is taken.

Considering the above facts, the present study aims-

1. To explore the effects of salinity on the farmer's livelihood.
2. To classify the present land-use system in the selected area.
3. To understand the coping strategies followed by the village farmers in the selected area.

Conceptual frame work

This study will be following the conceptual Framework given below:

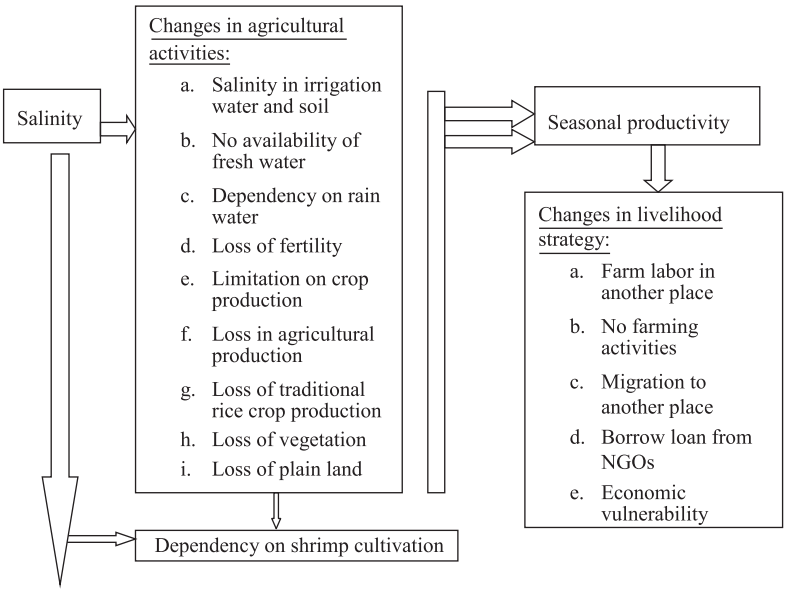


Figure : Conceptual Framework of the Study (Authors' Construction)

Methodology

This research is descriptive in nature. Both qualitative and quantitative methods have been used in this study. Quantitative study quantifies the extent of variation of a situation or issue where qualitative study describes variation in a situation or issue. The study area has been selected purposively. As Kumarkhali village of Nazirpur union of Nazirpur Thana in Pirojpur district is one of the most salinity affected areas of the country therefore, this particular area has been selected as study area of this empirical study. The sample populations of this study were both male and female who are related to the agricultural activities and also knowledgeable about this. The study involves a non-probability sampling technique because there has limited and unorganized information about the larger population from which the sample size has been taken. All the inhabitants of the study area who are directly related to agriculture were considered as a population of the study. Purposive or judgmental sampling has been used to select the sample who are especially informative. Both primary and secondary sources have been used in this study. The study focuses more on a primary intervention which has been done through Key Informant Interviews, Survey and Case Study. For collecting survey data 60 households have been purposively selected. Primary data has been collected from the participants of the study area by

using a semi-structured questionnaire. Three Key Informants Interviews were taken. They are more knowledgeable about the salinity and overall study area. Key informants were interviewed face to face by using guide questionnaire. Again qualitative data has been cross checked over the telephone conservation with key informants. After completing the survey from 60 respondents, 6 cases have been selected according to the effects of salinity on the livelihood. The in-depth interview has been used as a case study's data collection tool. A special guide questionnaire also constructed for collecting data from the respondents. To measure the effects of salinity on the livelihood strategies of farmers' frequency distribution, percentage, mean, mode, median, cross tabulation and correlation have been used. Key informant interviews and case study have been analyzed by thematic analysis for better understanding of the real situation of the salinity affected in farmer's livelihood. SPSS program and Microsoft Excel have been used for organizing the field data. Pie charts, bar diagram, seasonal calendar, and table have been used for graphical presentation of field data. These graphs displayed major research finding and analysis more attractively and easily.

Limitations of the study

One of the major limitations of the work was the study covers only a small area in the coastal zone. The research had to depend on the perception of the local communities on salinity issues. The case study was of limited scale and scope, such that the survey results may not be the full representative of the views of the whole population. It was difficult to draw full attention and keep the flow of response during interviews with some household heads. Involvement of a local member during the survey also helped in the process of interview. In addition, the household head who responded was more often male than female.

Empirical Data Discussion& Result Analysis

Socio-Demographic Data

There were 60 respondents who participated in this study. Among them 52 respondents were male and 8 respondents were female. Respondents came from different age cohort. The respondents involved in this study came from different age groups. The age of the youngest respondent is 18 whereas the oldest respondent is 78 years old. Participants in this study were not very much literate. About 30% of the respondents were not literate even they do not know how to write their name. About 18.3% of respondents can only read and write. About 31.7% respondents just passed primary education (Five years of schooling) and only 13.3% of respondents passed secondary school certificate (Ten years of schooling). There are no higher educated respondents.

Quantitative Data Analysis

The following data table shows that 43% respondents cultivate their own land and another 31 % cultivate land by lease, 19% are agricultural labor and only 7 % are the sharecropper. The highest 37% respondents work 16-20 days in a month.

Table-01: Land usages of the study area

		Percent age
❖ Nature of involvement in agricultural activity	❖ Agricultural labor ❖ Cultivate own land ❖ Taken lease ❖ Share cropper	19% 43% 31% 7%
❖ Working days in a month	❖ 11-15 ❖ 16-20 ❖ 21-25 ❖ 26-30	10% 37% 28% 25%

Source : Field data, 2016

Table-02: Perceptions and information about salinity

		Percentage
➢ Level of salinity in the study area	➢ High ➢ Moderate ➢ Low	33% 62% 5%
➢ Types of changes i n livelihood options	➢ Occupation ➢ Crop variety ➢ Temporary shifting in another places in search of work	39% 51% 10%
➢ Kinds of activities in new location	➢ Rickshaw puller or van puller ➢ Soil gopher ➢ Mason ➢ Labor in farm land ➢ Bus helper	40% 8% 13% 21% 18%

Source : Field data, 2016

In the study area, several respondents have been provided multiple answers about the level of salinity in the locality. The table-02 shows that among all the respondents the highest 62 percent said that the level of salinity is moderate, where 33 percent said that salinity level is highest in the study area. Among all the respondents it is clear that due to salinity the larger 51 percentage tried to cope up with this situation by doing crop variety and the highest 40 percent worked as rickshaw or van puller in the new location.

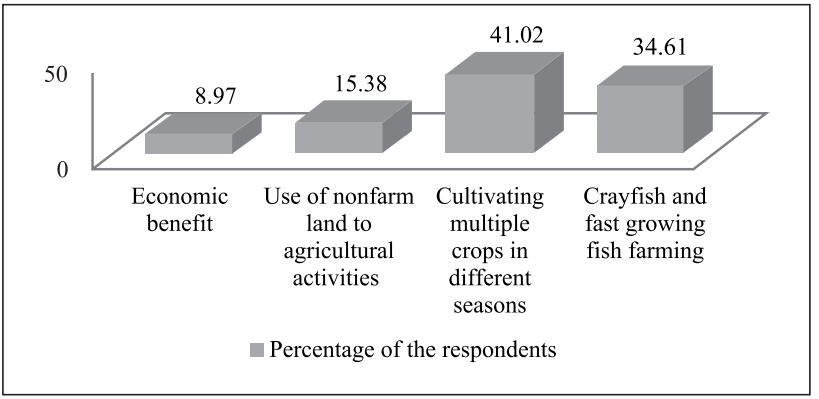
Table-03: Salinity, productivity and livelihood strategy:

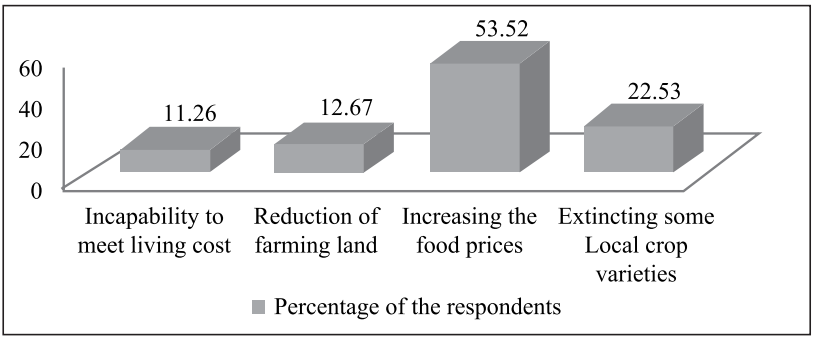
	Yes	No
Changing occupation in lowest income season	65%	35%
Changing livelihood options due to salinity	100%	0%
Migration of people because of salinity	72%	25%
Temporary leaving in other places to search for a work	27%	73%
Shifting previous rice production to IRRI rice production.	95%	5%
Limitation on the choice of production due to salinity	100%	0%
Effects of this changing pattern of earning sources on economy	78.3%	21.7%
Response on salinity tolerant crops	41.7%	58.3%
Taking measures	57%	43%
Taking measures by Government/NGOs	25.0%	71.7%

Source : Field data, 2016

All the respondents in the study area changed their livelihood option due to salinity. Table-03 shows that 65% respondents change their occupation in the lowest income season, 95% respondents shifted their previous rice production to IRRI and 100% respondents face the limitation on the choice of production due to salinity. Even 27% respondents temporarily leave in other places. Though 57% respondents take effective measures and they are not effective at all and only 25% agree on the measures taken by Government/NGOs. Again, a major portion of respondents, about 71.7% argued that they do not take effective measures.

Figure-01: Positive effects of changing earning source



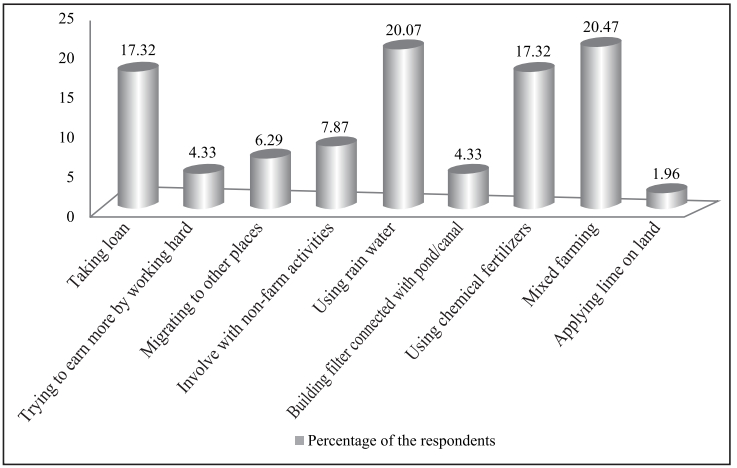


Source : Field data,2016

It is clearly seen in the figure-01 and figure-02 that, there are several effects that the respondents faced due to change in earning sources. The majority as 53.52 percent respondents focused on the increase in food prices, while 22.53 percent mentioned about the extinction of the local crop varieties, 12.67 percent respondents emphasized on the reduction of farmland and 11.6 percent described their incapability to meet the living cost.

With some negative effects, there are also several positive effects of change in earning source. In the figure, it is clear that every respondent focused on some positive areas. Especially 41.02 percent participants focused that they can cultivate multiple crops in different seasons where in the past they only produced some specific crops. 34.61 percent participants involved with crayfish and fast-growing fishes farming which is beneficial than the local crops. 15.38 percent mentioned that nowadays they can use their non-farm fallow land for doing agricultural activities. And 8.97 percent participants agreed that now they are economically benefited.

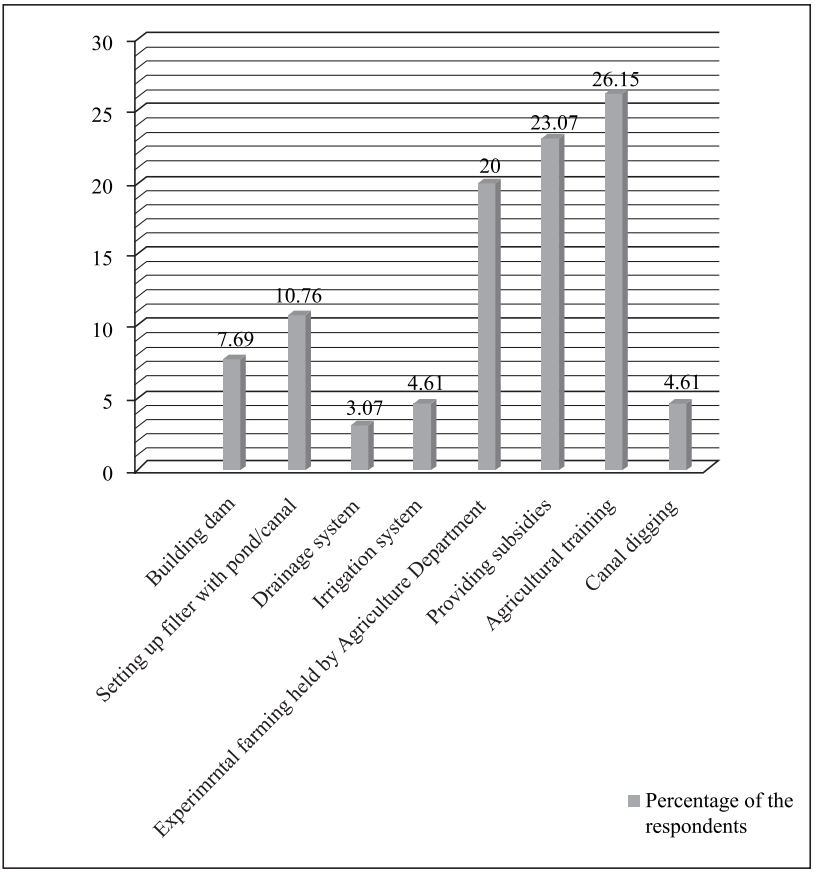
Figure-03 : Measures take to deal with salinity by local people



Source : Field data,2016

In order to minimize the level of losses due to salinity and also the impacts, farmers in the study area have been taken several measures. The data table represents that the highest 20.47 percent respondents adopted mixed farming strategy to cope up with salinity, 20.07 percent farmers followed rain-fed cultivation, 17.32 percent participants used chemical fertilizer when cultivated several crops, other 17.32 percent took loan from the local NGOs, 7.87 percent participants involved with non-farm activities in lowest income season, 6.29 percent participants migrated to other places for not to cope up with salinity and for facing the adverse impact of salinity, 4.33 percent participantswho are mainly the rich farmers built filter connected with ponds to irrigate the lands, other 4.33 percent participants tried to earn more by working hard in the land, and the lowest 1.96 percent participantsapplied lime on the land to minimize the effects of salinity.

Figure-04: Potential measures may have taken by Government/NGOs to minimize the impacts of salinity



Source : Field data,2016

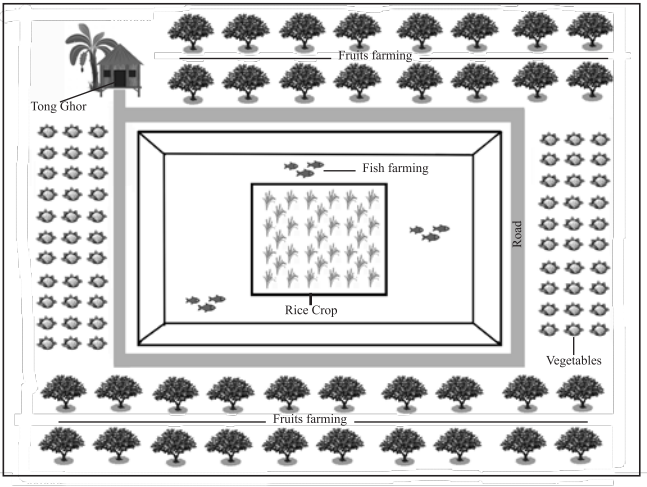
The above figure shows that Government has been taken several activities in order to minimize the impacts of salinity. 26.15 percent respondents said that the local Government agents launched several agricultural training based on the concept of salinity on the farm land, 23.07 percent respondents mentioned about the subsidies provided by the Agriculture Department, 20 percent respondents focused on the experimental farming also provided by the Agriculture Department, 10.76 percent respondents focused on setting up filter connected with ponds/canal to irrigate the land, 7.69 percent respondents said about building dam on canal, 4.61 percent respondents said that Government provided the irrigation system, 4.61 percent respondents viewed about canal digging, and the rest 3.07 percent respondents focused on the drainage system.

Qualitative Data Discussion

Land use pattern :

Salinity intrusion degrades soil quality which in turn reduces rice production. When the rice fields are converted into shrimp ponds, total rice production decreases accordingly. Not only rice but also other kinds of food grains, vegetables, and tree plantation are not possible here because of salinity.

Figure-05: New Farming Adaptive Strategy Model (Gher)



Source : Field data, 2016

Local people adopt new strategies for mixed farming. In the figure-04, we see that there are aisled around the total land and on the aisled farmers cultivate different types of vegetables. And also on one side, there are different fruits trees. Inside the aisled, there is a shallow pond for shrimp and firstly growing fish. The center land remains plain to grow rice grow

especially hybrid rice crop. By consuming the rainwater inside the land they mainly produce rice and also the vegetables. When at the time to farm shrimp, the farmers have to consume the saline water because crayfish can only farm in salty water. In some cases, farmers provide lame into the pond. As a result salinity of land increases day by day and crop productivity level become lower.

Agricultural crop production was mostly affected by shrimp farming as its effects reflected on land fertility. Cultivation of shrimp needs storage of saline water for a long period which results in percolation of salt. Moreover, shrimp producers keep on adding extra salt to the water to ensure the better growth of shrimp during monsoon. The extra salt gets stored in the field and adds to the salinity level further. Thus, shrimp farming increases soil salinity in the non-saline area that hampers crop cultivation seriously. Crop and vegetable yield reduces in shrimp prone areas due to lack of salt tolerant varieties. In the study area, the fruit tree like jackfruit, date, palms, etc. was reduced gradually.

Table-04 : Salinity &itseffects on livelihood from qualitative data

1. Land use pattern	➢ Seasonal cultivation ➢ Growing fishes and crayfish ➢ Cultivating vegetables ➢ Followed New Farming Strategy Model ➢ Cultivation of IRRI rice crop in place of Aman rice ➢ Shrimp cultivation ➢ Can't produce anything
2. Effects of salinity on livelihood	➢ Forced to make land fallow for a long time ➢ Destroying most of the crops ➢ The cost becomes higher than the earning ➢ Makes land unsuitable to grow any crops ➢ Straggling with traditional rice production ➢ Makes unemployed for a long period ➢ Constantly decreasing the traditional variety ➢ Destructing soil fertility ➢ Works as a day laborer ➢ A lower amount of production insufficient for family
3. Coping strategies	➢ Loaned from several NGOs ➢ Engage with other activities like day laborer ➢ Used of chemical fertilizers which are costly and not effective in reality.

Introduction of shrimp farming dramatically changed the traditional cropping pattern and the productions of major crops were declined significantly. Livelihoods of the marginal people, a saline water shrimp farming zone, has been negatively impacted by the introduction of shrimp farming due to loss of traditional income generation sources.

Figure-06 : Seasonal calendar of theeffects of salinity on livelihood

	Income level of the respondents'			The level of salinity				Occupations of the respondents'					
Month	High	Low	No	High	Medium	Low	No	Farming			Day labor	another place	Seasonal business
								Rice		Fish			
January													
February													
March													
April													
May													
June													
July													
August													
September													
October													
November													
December													

Source : Field data, 2016

From the above table, we see that from April to August the income level of the farmers is higher than the other months. During these months the farmers mainly harvest their all crops that's why they can earn well rather than others. In April to May, it's time to harvest rice crop and also in this period fishes be worth or appropriate to sell. Besides these in June and July farmers cultivate vegetables in the aisle area. So during the farming period, their income level is higher. The data table shows that in the months January, February and March the income level is lower. During these months the salinity level is of the lower level, so farmers can grow some Aman rice in their plain land. But from September to December there have no earns because during this period no crops can grow and the land tends to follow. In the study area, the respondents engage in several occupations of a year. For most of the cases, they are not permanent with farming. Because of salinity, their cultivation is completely seasonal, so a long period of a year there has nothing to do. So they engage in some other activities. the table

illustrates that from December to May they engage with rice cultivation and with rice from March to May they also farm fishes. June and July are the seasons for vegetable cultivation. May is the time to harvest rice, so the marginal farmers sometimes work in another farm land as day-laborers. From September to December all the farmlands become fallow and in that case, most of the farmers engage with several non-farm activities which can be said as a day-laborer. Sometimes they also work as a farm laborer in another place from August to November, because in this period is the farming season in the non-saline area. Due to the decreasing level of productivity, large numbers of farmers do some seasonal and also small business from March to April and from June to August.

Some literature shows that salinity intrusion decrease agricultural production especially the loss of rice and huge land degradation which results in fallow lands (Ahmed & Haider, 2014). Researchers like Islam & Tabeta (2016) in their findings showed that local crop varieties have the stability and local varieties seemed not more likely to have yield reduction than the high yielding variety. So the marginal farmers engage with local crop varieties than others. But in the study area, it seemed that most of the farmers more likely to disengage with local varieties and the dependency on the hybrid crop production increasingly higher. In some literature, the researchers in their studies concerned with the losses due to salinity and the recommendation were to engage with saline tolerant crop varieties (Rabbani, Rahaman & Mainuddin, 2013; Baten, Seal & Lisa, 2015). And in some studies, researchers also mentioned that the farmers also in some cases changed their farming system by engaging with shrimp farming and also become employed (Islam & Tabeta, 2016). This research work didn't directly agree with that literature. In the study area, a huge number of farmers are losing their interest in farming and engage in non-farm activities. In some cases, farming is only for meeting the physiological need of the family members. They prior more on non-farm sector than the farm day by day.

Coping strategies followed by village farmers :

The coping strategies followed by village farmers are not very encouraging. Survey findings indicate that they did not adopt any consistent strategy for coping with the salinity problem. There is no significant pattern in farmers' responses to soil salinity. They use their lands for crop production which are located with minimal soil salinity. They try to diversify their production on these agricultural lands. They also emphasize the need for more active government participation for solving the salinity problem.

The survey findings indicate that, in the high saline area, more than 60 percent of the farmers apply lime, urea or phosphate amendments to reclaim their salty land and more than one-third (36 percent) of the respondents cannot specify the reclaiming amendment for salinity remediation. Applying

lime, urea and phosphate to deal with salinity are not economical. Moderate to the low level of salinity could be managed through the leaching process either naturally or artificially. To manage salinity, more water needs to be applied other than regular water requirement of the crop. However, there is a high risk of increasing salinity content at the root zone in case of irrigation with saline contaminated water. Deep-water irrigation is required in case of the high concentration of salinity in the root zone.

In some studies, the researchers mentioned about uses of chemical fertilizers emphasized on changing cropping pattern and also the better water management options. We found a similar situation in the study area.

Conclusion

This study attempts to disclose the economic impact of salinization on paddy production in the Kumarkhali village of Nazirpur union in Nazirpur Upazilla in Pirojpur district. Salinity is a severe problem that affects crop production as well as livelihood practices of the existing farmers. A higher saline affected area induces decreasing returns in paddy cultivation, which reduces the productivity of land that results in decreasing agricultural profitability. Salinity is needed to be controlled through government initiatives and farmers have to use salt-tolerant seed varieties. Recently cultivated rice varieties are not much salt-tolerant and the existing salt-tolerant rice verities are not spread all over the area. Thus the respective authority needs to give effort for spreading salt-tolerant rice varieties. Moreover, implementation and coordination of the concerned policies attract special attention to making the agricultural production system in the coastal regions sustainable.

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