FARMING PRACTICES AND LIVELIHOOD STATUS OF NON-SALINE AND SALINE HOUSEHOLDS IN SOUTHERN BANGLADESH

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ABSTRACT

The study examined the farming practices and livelihood status of farm households in seven districts of Southern Bangladesh. Majority of the farmers in non-saline and saline areas followed the cropping pattern of Fallow – Aman rice – Pulses and Fallow – Aman rice – Fallow, respectively. Cropping intensity was higher in non-saline areas (220.0%) compared to saline areas (101.7%). Profitability of major crops was much higher in non-saline areas compared to saline areas. Based on the poverty indicators, the proportion of deprived households was 41.7 and 56.0% in non-saline and saline areas, respectively. The study recommended that in saline areas, rain water reservoirs should be developed in cooperative way and availability of electricity use should be facilitated to use light irrigation pumps in the crop field from the nearest fresh water reservoir. In addition, canal reform should be done and leasing arrangement of water canals should be stopped to get farmers’ access for irrigation purpose. Moreover, salt-tolerant and short duration pulse and wheat should be introduced in order to improve livelihood of saline farm households in Bangladesh.

Keywords: Crop Intensification; Farming practices; Poverty Situation; Salinity

INTRODUCTION

The coastal zone of Southern Bangladesh has a significant place in the country’s economy (Ahsan, 2013). Nearly 40 million people of the coastal areas of Bangladesh depend on agriculture (BBS, 2015). In this region, agricultural activity centres on the annual cropping of monsoonal rice. Cropping in the dry rabi season is conditioned by land topography, drainage, soil salinity and irrigation availability (ACIAR, 2011). In the rainfed lands, dry-season cultivation is limited by the profitability of traditional
cultivation of pulses (DAE, 2015). Nonetheless where limited irrigation is possible, wheat is a profitable low risk option (Kabir and Rawson, 2011). Around one third of the farmers in the coastal areas are now cultivating only one crop in a calendar year, i.e., Aman rice during monsoon while most of the cultivable lands remain almost barren in dry season (Hossain, 2016). For socioeconomic constraints, the majority of the region can’t afford animal protein and as such, have to depend on plant protein, bulk of which comes from pulses. The excellent nutrition value of pulses is highly complementary to a cereal-based diet in developing countries (UNB, 2017). From the viewpoint of environment, monocropping along with imbalanced use of inorganic fertilizers, pesticides and intensive use of land without application of organic fertilizers have led to a deterioration of soil quality and fertility (Uddin et al., 2016). To combat monocropping, pulses and wheat can contribute to diversification of rice-based systems productivity in Southern Bangladesh.

Importance of the above stated modality has been portrayed in a number of literatures which are: Hasan et al. (2018) found that adoption of climate smart agriculture (CSA) practices was positively associated with household food security in Southern Bangladesh in terms of per capita annual food expenditure. Hossain and Majumder (2018) stated that most of the rural coastal people of Bangladesh were hard poor in which women were major in portion and contributed to ensure food security for the entire family. Shoaib (2013) revealed that mixed land use like transplanted Aman and fish or Boro-transplanted Aman or Boro-fish were the popular forms of land use in the coastal zone of Bangladesh. It is evident from the reviews that there is lack of study incorporating the farming practices, profitability of farm enterprises and overall poverty situation for both farmers of non-saline and saline areas. In view of the above perspectives, the current research focused on farming practices, crop intensification, profitability in saline and non-saline areas Southern Bangladesh.

**MATERIALS AND METHODS**

**Study areas and sample size**

The study was conducted at seven districts of Southern Bangladesh. Based on the level of soil salinity, five upazilas from these districts were selected as non-saline areas and seven upazilas were selected as saline areas. A total of 500 farmers (i.e., 200 from non-saline areas and 300 from saline areas) were investigated following stratified random sampling technique. The area-wise sample distribution is represented in Table 1 as follows:
Table 1. Selection of study areas and sample size

| Districts | Sub-districts | Sample | Districts | Sub-districts | Sample | Total sample |
|-----------|---------------|--------|-----------|---------------|--------|--------------|
| Non-saline areas | | | Saline areas | | |
| Barguna | Betagi | 30 | Barguna | Sadar | 30 | 60 |
| Barguna | Amtali | 20 | Patuakhali | Sadar | 50 | 150 |
| Khulna | Phultala | 50 | Khulna | Batiaghata | 50 | 100 |
| Khulna | Kalapara | 50 | Barisal | Babuganj | 30 | 90 |
| Jhalokathi | Nolcity | 40 | Bhola | Charfashion | 50 | 120 |
| Sub-total | | 200 | Sub-total | | | 300 |

Data collection and analysis

Primary data were collected through questionnaire survey, focus group discussions (FGD) and key informant interviews (KII) with local stakeholders. For analyzing the data, a combination of descriptive statistics, mathematical and statistical techniques were used to achieve the objectives and to get the meaningful result.

Descriptive statistics

Data on farming practices in non-saline and saline areas were presented mostly in the tabular (i.e., sum, average, percentages, etc.) and graphical (i.e., figures and graphs) forms.

Crop intensification index

To measure the cropping intensity, the following formula was used for calculation:

\[ \text{Cropping intensity} = \left( \frac{\text{Area}_{GC}}{\text{Area}_{NC}} \right) \times 100 \]

Where,

\( \text{Area}_{GC} = \) Gross cropped area (ha); and \( \text{Area}_{NC} = \) Net cropped area (ha).

Profitability of major crops

Profitability of major crops production was measured in terms of gross return, gross margin, net return and benefit cost ratio (undiscounted). The formulas needed for the calculation of profitability were discussed as follows (Stigler, 1994; Dillon and Hardaker, 1993):

\[ \text{GR} = P \times Q; \quad \text{GM} = \text{GR} - \text{TVC}; \quad \text{NR} = \text{GR} - (\text{TFC} + \text{TVC}); \quad \text{BCR} = \frac{\text{GR}}{(\text{TFC} + \text{TVC})} \]

Where,

\( \text{GR} = \) Gross return; \( P = \) Sales price of the product (Tk.); \( Q = \) Yield per hectare (unit); \( \text{GM} = \) Gross margin; \( \text{TVC} = \) Total variable cost; \( \text{NR} = \) Net return; \( \text{TFC} = \) Total fixed cost (Tk.); and \( \text{BCR} = \) Benefit cost ratio.
Multidimensional poverty index

Multidimensional poverty index (MPI) is an index designed to measure the intensity of poverty (Uddin and Dhar, 2017). It comprises three equally weighted poverty dimensions; health, education and living standards. The health dimension is measured by the two equally weighted indicators, nutrition and child mortality. Education is captured by the two equally weighted indicators, years of schooling and child enrolment. Living standards are measured by the six equally weighted indicators; cooking fuel, sanitation, water, electricity, floor and assets. The following formula was used to appraise the intensity of poverty:

\[ \text{Intensity of poverty} = \sum c_k \times 100 \]

Where,

\( c = \) Households deprived of the indicators; and \( k = \) Weighted score of the indicators.

RESULTS AND DISCUSSION

Major agronomic and cropping practices

Table 2 depicts the major agronomic and cropping practices followed by the farmers in the study areas. In the non-saline areas, majority of the farmers followed the cropping patterns of Fallow – Aman rice – Pulses, Fallow – Aman rice – Boro rice and Aus rice – Aman rice – Pulses whereas in saline areas, most of the farmers followed the cropping patterns of Fallow – Aman rice – Fallow, Fallow – Aman rice – Pulses and Fallow – Aman rice – Chili/Maize/Rabi crops. These cropping patterns reveal that there is a lack of dry season crops in the study areas. In this regard, Shahidullah et al. (2006) stated that only a single cropping pattern of single Fallow – Fallow – T. Aman rice occupied 35% of total cropped area in the South East coastal region of Bangladesh. Most of the farmers in non-saline areas cultivated crop through manual irrigation (55% farmers) whereas in saline areas, majority of the farmers (78% farmers) were depended on rainfed irrigation.

Table 2. Major agronomic and cropping practices in the study areas

| Particulars                  | Study areas |          |          |
|------------------------------|-------------|----------|----------|
|                              |             | Non-saline | Saline   |
|                              |             | No. of farmers & % of farmers | No. of farmers & % of farmers |
| Major cropping pattern       |             | Fallow – Aman rice – Pulses | 159 & 79.5 |
|                              |             | Fallow – Aman rice – Boro rice | 130 & 65.0 |
|                              |             | Aus rice – Aman rice – Pulses | 29 & 14.5 |
Farming practices in southern Bangladesh

| Particulars | Study areas |
|-------------|-------------|
|              | Non-saline | Saline |
|              | No. of farmers | % of farmers | No. of farmers | % of farmers |
| Fallow – *Aman* rice – Fallow | - | - | 211 | 70.3 |
| Fallow – *Aman* rice – Pulses | - | - | 122 | 40.7 |
| Fallow – *Aman* rice – Chili/Maize/Rabi crops | - | - | 36 | 12.0 |
| Land topography | | |
| Sandy loam soil | 116 | 58.0 | 190 | 63.3 |
| Loam soil | 84 | 42.0 | 110 | 36.7 |
| High | 43 | 21.5 | 104 | 34.8 |
| Temperature and rainfall | | |
| Medium | 144 | 72.0 | 166 | 55.2 |
| Low | 13 | 6.5 | 30 | 10.0 |
| Irrigation technique | | |
| Irrigated | 30 | 55.0 | 66 | 22.0 |
| Rainfed | 170 | 45.0 | 234 | 78.0 |

Source: Field survey, 2018.

Analysis of crop intensification

Cropping intensity is explained as the number of crops grown in a given cropland per year (Bhaskar, 2009). The whole process is named as crop intensification. Considering the gross and net cropped area, the study found that cropping intensity was higher for the farmers in non-saline areas (220%) than saline areas (101.7%) (Table 3). The results implied that farmers in non-saline areas grow crops for nearly 2.2 times per year in a particular crop land but it was 1.1 times in case of farmers in saline areas. The result is quite similar with Uddin and Dhar (2018) where the author found higher cropping intensity in case of government input supported households (228.6%) compared to the non-supported households (172%).

Table 3. Crop intensification index (CII)

| Particulars | Study areas |
|-------------|-------------|
|              | Non-saline | Saline |
| Gross cropped area (ha) | 0.66 | 0.61 |
| Net cropped area (ha) | 0.30 | 0.60 |
| Cropping intensity (%) | 220.0 | 101.7 |

Source: Authors’ estimation, 2018.
Profitability of major crops

For calculating profitability of major crops, total production cost composed of variable and fixed costs was taken into consideration. The components of variable cost were: i) human labour; ii) power tiller; iii) seed/seedlings; iv) fertilizers; v) irrigation; vi) herbicides and insecticides and vii) fencing. Table 4 represents that total variable cost of farmers in non-saline areas was Tk. 97463, Tk. 37284, Tk. 53144 and Tk. 16416 for Aus rice, Aman rice, Boro rice and pulses production, respectively. On the other hand, total variable cost of farmers in saline areas was Tk. 168793 and Tk. 43291 for Aman rice, pulses, vegetables and spices production, respectively. Fixed cost items for crop production were: i) land use cost; ii) interest on operating capital; and iii) depreciation cost. It is seen from Table 4 that total fixed cost of farmers in non-saline was Tk. 14348, Tk. 6798, Tk. 11978 and Tk. 5382 for Aus rice, Aman rice, Boro rice and pulses production, respectively whereas in saline areas, it was Tk. 44082, Tk. 65122 and Tk. 21798, respectively. In saline areas, total cost of farmers for Aman rice, pulses, vegetables and spices production was estimated at Tk. 44092, Tk. 28221, Tk. 185330 and Tk. 54877, respectively.

Table 4. Cost of major crop production in the study areas

| Particulars | Non-saline | Saline |
|-------------|------------|--------|
|             | Aus rice   | Aman rice | Boro rice | Pulses | Aman rice | Pulses | Rabi crops |
| Variable costs (Tk./ha) | | | | | | | |
| Human labor | 30562 | 18793 | 29192 | 10449 | 20461 | 14167 | 39275 | 19702 |
| Power tiller | 4375 | 13315 | 11228 | 2463 | 12152 | 4002 | 6216 | 9585 |
| Seed/seedlings | 4077 | 3243 | 3368 | 1563 | 2664 | 1770 | 2520 | 2950 |
| Urea | 4567 | 1458 | 4678 | 1386 | 1430 | 1765 | 7410 | 5980 |
| TSP | 2765 | 455 | 2564 | 472 | 463 | 345 | 5570 | 2985 |
| MoP | 1655 | - | 1198 | - | - | - | 7582 | 1198 |
| DAP | 670 | - | 795 | - | - | - | 4410 | 780 |
| Others | 499 | 20 | 121 | 83 | 20 | 218 | 2750 | 111 |
| Total | 10156 | 1933 | 9356 | 1941 | 1913 | 2328 | 27722 | 11054 |
| Irrigation | 46985 | - | - | - | - | - | 29700 | - |
| Herbicides and insecticides | 1488 | - | - | - | - | - | - | - |
| Fencing | - | - | - | - | - | - | 50000 | - |
Gross return from crop production included the monetary value of physical output obtained from the production process. Gross return from *Aus* rice, *Aman* rice, *Boro* rice and pulses production was Tk. 137749, Tk. 55543, Tk. 74890 and Tk. 39454 for the farmers in non-saline areas; and from *Aman* rice, pulses, vegetables and spices production was Tk. 54233, Tk. 48540, Tk. 398460 and Tk. 108656 for the farmers in saline areas, respectively (Table 5). Gross margin of the farmers in non-saline areas was Tk. 40106, Tk. 18259, Tk. 21746 and Tk. 23038 from *Aus* rice, *Aman* rice, *Boro* rice and pulses production; and in saline areas it was Tk. 17043, Tk. 20319, Tk. 213130 and Tk. 53779 from *Aman* rice, pulses, vegetables and spices production, respectively. From Table 5, it is seen that net return from *Aus* rice, *Aman* rice, *Boro* rice and pulses production in non-saline areas was Tk. 25758, Tk. 11461, Tk. 9768 and Tk. 17656 while in saline areas, and it was Tk. 10141, Tk. 123, Tk. 21567 and Tk. 65365 from *Aman* rice, pulses, vegetables and spices production, respectively. *Nahar and Hamid (2016)* found the similar result where the authors evaluated the economic impact of soil salinity on paddy production in South-West region of Bangladesh. The study revealed that net return figures turned out to be Tk. 10635 and 7762 per acre in low and high saline regions, respectively.
Table 5. Return from major crop production in the study areas

| Particulars                              | Study areas |            |            |            |            |            |            |            |
|------------------------------------------|-------------|------------|------------|------------|------------|------------|------------|------------|
|                                          |             | Non-saline | Saline     |             |            |            |            |            |
|                                          |             | Aus rice   | Aman rice  | Boro rice  | Pulses     | Aman rice  | Pulses     | Rabi crops |
|                                          |             |            |            |            |            |            |            | Vegetables |
|                                          |             |            |            |            |            |            |            | Spices     |
| Productivity (maund/ha)                  | 157         | 53         | 96         | 39         | 50         | 37         | 996        | 102        |
| Price (Tk./maund)                        | 838         | 772        | 700        | 1012       | 808        | 1312       | 400        | 887        |
| Return from main product (Tk./ha)        | 131566      | 40916      | 67200      | 39454      | 40400      | 48540      | 398460     | 90474      |
| Return from by-product (Tk./ha)          | 6183        | 14627      | 7690       | -          | 13833      | -          | -          | 18182      |
| iv. Gross return (Tk./ha)                | 137749      | 55543      | 74890      | 39454      | 54233      | 48540      | 398460     | 108656     |
| v. Gross margin (Tk./ha) (iv - i)        | 40106       | 18259      | 21746      | 2303=8     | 17043      | 26273      | 229667     | 65365      |
| vi. Net return (Tk./ha) (iv - iii)       | 25758       | 11461      | 9768       | 17656      | 10141      | 20319      | 213130     | 53779      |
| vii. Benefit cost ratio (BCR) (iv + iii) | 1.23        | 1.26       | 1.15       | 1.81       | 1.23       | 1.72       | 2.15       | 1.98       |

Source: Authors’ estimation, 2018.

Households’ intensity of poverty

Multidimensional poverty index (MPI) was used to demonstrate the farmers’ livelihood condition in the study areas in terms of appraising poverty circumstances. In this analysis, a basket of goods and services was considered as the minimum requirement to live a non-impoverished life. People who did not have an income sufficient to cover that basket were deemed as poor (HDR, 2015). The MPI combined two key pieces of information to measure acute poverty: the incidence of poverty or the proportion of people (within a given population) who experienced multiple deprivations, and the intensity of their deprivation - the average proportion of (weighted) deprivations they experienced.

Table 6. Multidimensional poverty index (MPI) to measure poverty intensity

| Indicators                                      | Study areas | Weights |
|------------------------------------------------|-------------|---------|
|                                                |             | Non-saline (n = 200) | Saline (n = 300) |
|                                                |             | No. of households deprived (\(\checkmark\)) or privileged (\(\times\)) based on the indicators |
|                                                |             | \(\checkmark\) | \(\times\) | \(\checkmark\) | \(\times\) |
| Education                                      |             | 120/200 | 80/200 | 255/300 | 45/300 | 1/6       |
| Indicators                                                        | Study areas                  | Weights |
|------------------------------------------------------------------|------------------------------|---------|
|                                                                  | Non-saline (n = 200)         | Saline (n = 300) |
| No. of households deprived (✓) or privileged (✗) based on the indicators | ✓                           | ×       |
| At least one school-age child not enrolled in school              | 113/200                      | 87/200  |
| Health                                                           |                              |         |
| At least one member is malnourished                              | 94/200                       | 106/200 |
| One or more children have died                                   | 12/200                       | 188/200 |
| Living standards                                                 |                              |         |
| No electricity                                                   | 55/200                       | 145/200 |
| No access to clean drinking water                                | 49/200                       | 151/200 |
| No access to adequate sanitation                                 | 33/200                       | 167/200 |
| House having dirty floor                                         | 91/200                       | 109/200 |
| Household uses dirty cooking fuel (i.e., cowdung, firewood or charcoal) | 200/200                      | 0/200   |
| Household has no car and owns at best one bicycle, motorcycle, radio, refrigerator, mobile or television | 55/200                       | 145/200 |
| Score of the households                                          | 0.417                        | 0.583   |
| Intensity of poverty (%)                                         | Deprived households          | 41.7    |
| (%)                                                              | Privileged households        | 58.3    |

Source: Authors’ estimation, 2018.

Note: Score of deprived households in non-saline areas = (120/200 × 1/6) + (113/200 × 1/6) + (94/200 × 1/6) + (12/200 × 1/6) + (55/200 × 1/18) + (49/200 × 1/18) + (33/200 × 1/18) + (91/200 × 1/18) + (200/200 × 1/18) + (55/200 × 1/18) = 0.417; score of households in non-saline areas = (80/200 × 1/6) + (87/200 × 1/6) + (106/200 × 1/6) + (188/200 × 1/6) + (145/200 × 1/18) + (151/200 × 1/18) + (167/200 × 1/18) + (109/200 × 1/18) + (0/200 × 1/18) + (145/200 × 1/18) = 0.583; scores of deprived or privileged households in saline areas were calculated accordingly; percentage of deprived households in non-saline areas = 0.417 × 100 = 41.7; percentage of privileged households in non-saline areas = 0.583 × 100 = 58.3; and percentage of deprived or privileged households in saline areas were calculated accordingly.

It is evident from Table 6 that in non-saline and saline areas, the proportion of deprived households was 41.7% and 56.0%; and the proportion of privileged households was 58.3% and 44.0%, respectively. The households were deprived or privileged based on all the indicators of a single dimension or at a combination of the indicators across dimensions. The reason for a better livelihood condition of households in non-saline areas compared to households in saline areas was that the farmers in non-saline areas could grow crop round the year in their cropland.
maintaining a variety of crop diversification, but the farmers in saline areas had limited scope for crop production due to high level of salinity in their cropland which ultimately reduced their income than the farmers in non-saline areas.

CONCLUSION

The present study has been undertaken to understand the context for practice change in dry season cropping in Southern Bangladesh. The study revealed that in the non-saline areas, majority of the farmers followed the cropping patterns of Fallow – *Aman* rice – Pulses, Fallow – *Aman* rice – *Boro* rice and *Aus* rice – *Aman* rice – Pulses, whereas in saline areas, most of the farmers followed the cropping patterns of Fallow – *Aman* rice – Fallow, Fallow – *Aman* rice – Pulses and Fallow – *Aman* rice – Chili/Maize/Rabi crops. These cropping patterns indicated that there is a lack of dry season crops in the study areas for which it is needed incorporating pulse crops in coastal Southern regions; and wheat in Southwest regions of Bangladesh to enhance crop intensification. Crop intensification analysis revealed that farmers in non-saline areas grow crops for more than two times per year in a particular crop land but it was less than two times in case of farmers in saline areas. Profitability of major crops was much higher in non-saline areas compared to saline areas. The study also indicated that farmers’ poverty intensity in terms of deprivation of health, education and living standards in non-saline areas were reasonably lower with regard to farmers in saline areas.

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