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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

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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 Amtali	30 20	500
Patuakhali	Sadar	50	Patuakhali	Kalapara	50	
Khulna	Phultala	50	Khulna	Batiaghata	50	
Barisal	Babuganj	30	Satkhira	Sadar Kaligonj	50 50	
Jhalokathi	Nolcity	40	Bhola	Charfashion	50	
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:

Cropping intensity = $(Area_{GC} \div Area_{NC}) \times 100$

Where,

$Area_{GC}$ = Gross cropped area (ha); and $Area_{NC}$ = 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):

$GR = P \times Q$; $GM = GR – TVC$; $NR = GR – (TFC + TVC)$; $BCR = GR \div (TFC + TVC)$

Where,

GR = Gross return; P = Sales price of the product (Tk.); Q = Yield per hectare (unit); GM = Gross margin; TVC = Total variable cost; NR = Net return; TFC = Total fixed cost (Tk.); and 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:

$$\text{Intensity of poverty} = \Sigma\, ck \times 100$$

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	-	-

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
Temperature and rainfall	High	43	21.5	104	34.8
	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. 37190, Tk. 22267, 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. 6902, Tk. 5954, Tk. 16537 and Tk. 11586 for *Aman* rice, pulses, vegetables and spices production, respectively. Total cost of *Aus* rice, *Aman* rice, *Boro* rice and pulses production in case of farmers in non-saline was Tk. 111991, 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		Study areas							
		Non-saline				Saline			
		Aus rice	*Aman* rice	*Boro* rice	Pulses	*Aman* rice	Pulses	*Rabi* crops	
								Vegetables	Spices
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
Fertilizers	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	-

Particulars	Study areas							
	Non-saline				Saline			
	Aus rice	*Aman* rice	*Boro* rice	Pulses	*Aman* rice	Pulses	*Rabi* crops	
							Vegetables	Spices
i. Total variable cost	97643	37284	53144	16416	37190	22267	168793	43291
Fixed costs (Tk./ha)								
Land use cost	8732	4366	8617	4473	4179	4400	7552	8655
Interest on operating capital	4557	1740	2595	659	1923	1005	7815	2097
Depreciation cost	1059	692	766	250	800	549	1170	834
ii. Total fixed cost (Tk./ha)	14348	6798	11978	5382	6902	5954	16537	11586
iii. Total cost (Tk./ha)	111991	44082	65122	21798	44092	28221	185330	54877

Source: Authors' estimation, 2018.

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. 26273, Tk. 229667 and Tk. 65365 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. 20319, Tk. 213130 and Tk. 53779 from *Aman* rice, pulses, vegetables and spices production, respectively.

BCR from *Aus* rice, *Aman* rice, *Boro* rice and pulses production in non-saline areas was 1.23, 1.26, 1.15 and 1.81, respectively (Table 5). On the contrary, BCR from *Aman* rice, pulses, vegetables and spices production in saline areas was 1.23, 1.72, 2.15 and 1.98, respectively. The results imply that farmers in non-saline and saline areas received Tk. 123, Tk. 126, Tk. 115 and Tk. 181; and Tk. 123, Tk. 172, Tk. 215 and Tk. 198 for *Aus* rice, *Aman* rice, *Boro* rice and pulses production; and *Aman* rice, pulses, vegetables and spices production in return from investing Tk. 100, 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 (√) or privileged (×) based on the indicators				
	√	×	√	×	
Education					
No one has completed five years of schooling	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	197/300	103/300	1/6
Health						
At least one member is malnourished		94/200	106/200	208/300	92/300	1/6
One or more children have died		12/200	188/200	34/300	266/300	1/6
Living standards						
No electricity		55/200	145/200	86/300	214/300	1/18
No access to clean drinking water		49/200	151/200	100/300	200/300	1/18
No access to adequate sanitation		33/200	167/200	72/300	228/300	1/18
House having dirty floor		91/200	109/200	273/300	27/300	1/18
Household uses dirty cooking fuel (i.e., cowdung, firewood or charcoal)		200/200	0/200	300/300	0/300	1/18
Household has no car and owns at best one bicycle, motorcycle, radio, refrigerator, mobile or television		55/200	145/200	112/300	188/300	1/18
Score of the households		0.417	0.583	0.560	0.440	-
Intensity of poverty (%)	Deprived households	41.7		56.0		-
	Privileged households	58.3		44.0		-

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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