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STUDY ON AGRONOMICALLY AND ECONOMICALLY DOMINANT CROPPING PATTERNS IN SOME SELECTED AREAS OF BARISAL DISTRICT

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Abstract

The study area was Shanuhar village of Babugonj Upazila of Barisal district, which was selected purposively based on agronomic suitability of growing Rabi crops. Necessary data were collected through focus group discussion (FGD) with 30 farmers including small, medium, and large farm households, school teachers, village leaders all the remaining by using pre design check list and structure schedule during May 2007 considering Rabi season of 2006-2007. Usually, farmers of the village could not sow their crops within the optimum time. They transplanted Aman rice in late due to inundation of land and planting of Rabi crops in late because of land unsuitability and long duration of T. Aman rice. Boro rice was adopted about 75% of the cropped area in Rabi season and but yield was low because of inadequate irrigation facilities. In contrast wheat needs comparatively less irrigation than Boro rice. Moreover, mungbean, mustard, lentil and grass pea produce reasonability good yield in rainfed condition. About 20- 25 % land become suitable for seeding wheat by first week of December after harvesting NfV T. Aman which indicated good prospect of growing wheat in the study village. Wheat is a more profitable Rabi crop than other crops like grass pea, mustard, lentil. Farmers earned the highest per hectare gross return (Tk.98646) and gross margin (Tk.22870) from the Wheat – *Aus* rice -T. Aman rice pattern whereas Boro rice - Fallow - T. Aman pattern produced the lowest gross return (Tk.65918) and gross margin (Tk.10134). Higher benefit was achieved from the pattern Wheat –*Aus* rice -T. Aman rice because of less production cost and high price of wheat grain, though three cereals crops could exhaust soil nutrient so that Mungbean-Aus rice – T. Aman pattern may be alternate option to sustain soil health as well as productivity of the selected area.

Keywords: Agronomically, economically, dominant cropping patterns.

Introduction

Bangladesh is a country whose economy is largely based on agriculture which contributes 23.87% to the Gross Domestic Product (GDP) at current prices. The total cultivable land is estimated to be 9.10 million hectares with an average cropping intensity of 179 percent. (BBS, 2009; DAE, 2009). High population growth (1.4%) with low growth in agricultural productivity adversely affects the

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living standard in the country (BBS, 2009; DAE, 2009). Economic development in Bangladesh cannot be achieved unless there is a breakthrough in the agricultural sector.

The present production of rice in no way can meet the total food needs and especially nutrient requirements of the country. Crop diversification is an important issue now-a-days. Wheat is a very good substitute of rice and can play a vital role to feed the people of the country. The popularity of wheat as a food is gaining momentum year after year and it has reached such a point that very few people in Bangladesh refuse to take as food. On the other hand, wheat, chilli, and pulses production needs relatively small quantity of irrigation water and fertilizers as compared to Boro rice. Considering these circumstances, the Government of the People's Republic of Bangladesh is determined to increase wheat and pulses area and production in the country, especially in coastal districts. In Bangladesh, cultivable land is limited and there is little scope to expand. So, to increase the wheat and pulses production, productivity of the crops should be increased through adoption of improved technologies.

The coastal districts of the current southern lands of Bangladesh have been created by siltation, particularly over the last 70 years. The land growth is still occurring (Rawson *et al.*, 2006). During the Kharif season, they are cropped with T. Aman or T. Aus rice, irrigated by the fresh waters of the monsoon, but in the Rabi season, the salt rises as the land dries and crusts are formed on the surface, making it unsuitable for productive cropping.

A number of new cropping patterns are being practiced by the farmers in the coastal districts. It is very much important to identify the profitability of the major Rabi crops based cropping patterns for the farmers of Barisal area. The rate of expansion of crop area and improvement in yield depend on the profitability of cropping systems. However, study on profitability of dominant cropping patterns adopted in the southern coastal areas of Bangladesh is scarce. The present study gives detailed information of the mentioned site with the following objectives:

i. to identify the major cropping patterns and agronomic practice;

ii. to determine the economically viable dominant cropping pattern ; and

iii. to identify the problems and prospect of growing wheat.

Methodology

Data were collected from Shanuhar village of Babogonj Upazila of Barisal district. The village was selected purposively based on agronomic suitability of growing Rabi crops. Necessary data, such as farmers' perception about prevailing cropping pattern, crops establishment and harvesting time, detail input use pattern for each crop, identified major cropping pattern, yield of individual crop,

per unit prices of relevant input and output were collected through focus group discussion (FGD) with 30 farmers including small, medium and large farm household, school teacher, village leader by using pre design check list and structure schedule for May 2007 considering Rabi season of 2006-2007. Descriptive statistics method was used for analyzing the data.

Results and Discussion

Cropping patterns

It was found from the Table 1 that there was a number of cropping patterns at Sanuhar village. Among the cropping patterns, four cropping patterns, such as Boro rice – Fallow – T.Aman, Grass pea – Fallow/Jute/Vegetable/Sesbania – T.Aman rice, Mungbean – Aus rice/ Fallow – T.Aman rice and Wheat –Aus rice/Jute/Fallow – T.Aman rice were practiced pattern at Sanuhar village. The area coverage by the dominant cropping pattern Boro rice – Fallow – T.Aman was 75% alone (Table 1).

Table 1. Cropping patterns at Sanuhar village.

	Rabi	Kharif I	Kharif 11	Coverage
CP-$P_{1:}$	Boro rice	Fallow	T Aman	75
CP-$P_{2:}$	Mungbean	Aus rice/Fallow	T.Aman	7
CP-$P_{3:}$	Grass pea	Fallow/Jute/SesbaniaNegetable	T Aman	6
CP-$P_{4:}$	Wheat	Aus/ Jute/Fallow	T.Aman	3
CP-$P_{5:}$	Lentil	Jute/Fallow	T.Aman	
CP-$P_{6:}$	Pea	Ausl Jute/Fallow	T.Aman	
CP-$P_{7:}$	Sunflower	Ausl Jute/Fallow	T.Aman	
CP-$P_{8:}$	Chiou	Ausl Jute/Fallow	T.Aman	7
CP-$P_{9:}$	Pea	Ausl Jute/Fallow	T.Aman	
CP-$P_{10:}$	Vegetables	Ausl Jute/Fallow	T.Aman	
CP-$P_{11:}$	Chilies	Ausl Jute/Fallow	T.Aman	
CP-$P_{12:}$	Water melon	Ausl Jute/Fallow	T.Aman	
CP-$P1_{3:}$	Vegetable	Vegetable	Vegetable	
CP-$P_{14:}$	Fallow	Fallow	T.Aman	2

CP = Cropping Pattern

Sowing and harvesting time of crops

Time of sowing is an important factor for getting good yield, especially for all Rabi crops. It was found from the Table 2 that usually farmers of the village could not sow their crops within the optimum time. BRRI recommended

optimum time of transplanting T. Aman rice, and Aus rice are mid July to mid August and mid March to mid April, respectively, whereas farmers transplanted these crops up to end of August and third week of April to second week of May, respectively. Farmers transplanted T.Aman rice in late due to inundation of land. They transplanted Aus rice in late because they were to wait for rain. Farmers sowed grass pea and mungbean seed within optimum time. BARI recommended optimum time of sowing mustard, lentil, wheat, and chickpea are mid-October to mid-November, last week of October to first week of November, mid-November to end November and 20 November to 10 December, respectively, while farmers sowed seed of mustard, lentil, wheat, and chickpea in late because of land unsuitability for seeding and long duration T. Aman rice, which was harvested late (Table 2).

Table 2. Sowing and harvesting time of different crops at Shanuhar village.

Name of crops	Variety	Sowing/transplanting time	Harvesting time	Coverage (%)
T. Aman rice	HYV	Second week of July to second week of August	Third week of November to Second week of December	55
T. Aman rice	Local	During August	During December	45
Aus rice	Local/ HYV	Third week of April to second week of May	Third week of July to second week of August	-
Boro rice	HYV	Third week of January to second week of February	First to third week of May	100
Grass pea		Last week of October to First week on November	Second to third week of March	-
Mungbean	HYV	Third week of January to second week of February	Second week of April to second week of May	100
Mustard	HYV	Fourth week of November to second week of December	Fourth week of February to second week of March	100
Lentil		Fourth week of November to second week of December	Fourth week of February to second week of March	100
Wheat		Fourth week of November to second week of December	Fourth week of February to second week of March	100
Chick pea		Third week of December to second week of January	First week of March to third week of March	100

Cost and returns of individual crops under dominant cropping patterns

The focus of this part is to determine the costs and returns for different crops under the dominant cropping patterns. For determination of relative profitability of different crops and cropping patterns, it was necessary to compute all cost items for each of the individual crops. Costs of production of individual crops under the dominant cropping patterns are mentioned below:

Human labour cost

Human labour was one of the most important cost items of enterprises under the dominant cropping patterns. Per hectare total human labour used for the cropping pattern P_1, (Boro rice - Fallow - T. Aman rice) were 117 and 108 man-days where per hectare cost for the respective crops were Tk.14079 and Tk.12968, respectively. The per hectare total human labour used for producing crops in the pattern P_2 (Mungbean-Aus rice -T. Aman rice) were 130, 117, and 108 man-days, while their corresponding costs were Tk.15561, Tk.14079 and Tk.12968, respectively. For producing Grass pea, Aus rice and T. Aman rice under the cropping pattern P_3 per hectare total human labour costs were Tk. 5187, Tk. 14079 and Tk.12968, respectively. In case of the cropping pattern P_4 (Wheat – Aus rice – T. Aman rice) per hectare total human labour costs were Tk.10374, Tk.14079, and Tk.12968, respectively (Table 3)

Table 3. Per hectare labour cost of individual crops under the dominant cropping pattern at Sanuhar village.

Cropping pattern	Man-days/ha	Labour cost (Tk./ha)
Pattern-1 (P_1): Boro rice	117	14079
Fallow	-	-
T. Aman rice	108	12968
Total	**225**	**27047**
Pattern-2 (P_2): Mungbean	130	15561
Aus rice	117	14079
T. Aman rice	108	12968
Total	**355**	**42608**
Pattern-3 (P_3): Grass pea	43	5187
Aus rice	117	14079
T. Aman rice	108	12968
Total	**268**	**32234**
Pattern-4 (P_4): Wheat	86	10374
Aus rice	117	14079
T. Aman rice	108	12968
Total	**311**	**37421**

Ploughing cost

Animal power and power tiller both were used for tillage operation in the Sanuhar village. The per hectare costs of tillage operation for Boro rice-Fallow - T. Aman rice under cropping pattern P_1, were Tk. 3705, and Tk. 3705, respectively, whereas for pattern P_2 was Tk. 3088, Tk. 3705, and Tk. 3705 for Mungbean, Aus rice, and T. Aman rice, respectively. The cost of pattern P_3 the costs were Tk.3705 and Tk. 3705 for Grass pea, Aus rice, and T. Aman rice, respectively. On the other hand, the pattern P_4 tillage costs were Tk. 4940, Tk. 3705 and Tk. 3705 for Wheat, Aus rice and T. Aman rice, respectively (Table 4).

Table 4. Per hectare ploughing cost of individual crops under the dominant cropping pattern at Sanuhar Village.

Cropping pattern	Ploughing no.	Ploughing cost (Tk./ha)
Pattern-1 (P_1): Boro rice	3	3705
Fallow	-	-
T. Aman rice	3	3705
Total	**6**	**7410**
Pattern-2 (P_2): Mungbean	2.5	3088
Aus rice	3	3705
T. Aman rice	3	3705
Total	**8.5**	**10498**
Pattern-3 (P_3): Grass pea	-	-
Aus rice	3	3705
T. Aman rice	3	3705
Total	**6**	**7410**
Pattern-4 (P_4): Wheat	4	4940
Aus rice	3	3705
T. Aman rice	3	3705
Total	**10**	**12350**

Cost of seeds

Per hectare seeds used for Boro rice, Fallow, and T. Aman rice under the cropping pattern P_1 were 59 kg and 62 kg, respectively. The corresponding per hectare costs of these crops were Tk. 1173 and Tk.1235, respectively, whereas In case of cropping pattern P_4 (Mungbean–Aus rice-T. Aman rice) corresponding per hectare seed costs were Tk.1482, Tk.1235 and Tk. 1235, respectively. For P_3 (Grass pea - Aus rice-T. Aman rice) seed costs were Tk. 716, Tk. 1235, and Tk. 1235, respectively, whereas cropping pattern P_4 (Wheat-Aus rice-T. Aman rice) per hectare seed costs were Tk. 5899, Tk.1235, and Tk. 1235, respectively (Table 5).

Cost of irrigation

In the Sanuhar village, farmers used irrigation water for crops like Boro rice and wheat, while T. Aman rice, Aus rice, Grass pea, and Mungbean were grown under the rainfed condition. It was evident from Table that per hectare irrigation cost for Boro rice and wheat were Tk.7410 and Tk.3952, respectively (Table 5).

Cost of insecticides

Farmers applied insecticides for almost all crops except wheat and grass pea. Cost of insecticides was found to be the highest for mungbean under the cropping pattern P_2 which was Tk. 2161 (Table 5).

Table 5. Per hectare material input cost of individual crops under the dominant cropping patterns at Sanuhar village.

Cropping pattern	Seed		Insecticide cost (Tk./ha)	Irrigation cost (Tk./ha)	Total cost (Tk./ha)
	Quantity (kg/ha)	Cost (Tk./ha)			
Pattern-1 (P_1): Boro rice	59	1173	1853	7410	10436
Fallow-		-	-	-	-
T. Aman rice	62	1235	865	-	2100
Total					**12536**
Pattern-2 (P_2): Mungbean	25	1482	2161	-	3643
Aus rice	62	1235	618	-	1853
T. Aman rice	62	1235	865	-	2100
Total					**7596**
Pattern-3 (P_3): Grass pea	36	716	-	-	716
Aus rice	62	1235	865	-	2100
T. Aman rice	62	1235	865	-	2100
Total					**4916**
Pattern-4 (P_4): Wheat	117	5866	-	-	5866
Aus rice	62	1235	865	-	2100
T. Aman rice	62	1235	865	-	2100
Total					**10066**

Cost of fertilizer

The fertilizer costs for different crops under the dominant cropping patterns are presented in Table 6. The Table shows that for cropping patterns P_1, P_2, P_3, and P_4 per hectare total costs of fertilizer were Tk. 7224, Tk.6101, Tk.5338, and Tk. 8932, respectively. Total fertilizer cost for the pattern P_4 was the highest followed by pattern P_1, P_2, and P_3,

Table 6. Per hectare manure and fertilizer cost of individual crops under the dominant cropping pattern at Sanuhar village.

Cropping pattern	Urea		TSP		MP		Gypsum		Total cost (Tk./ha)
	Qty. (kg/ha)	Cost (Tk./ha)	Qty. (kg/ha)	Cost (Tk./ha)	Qty. (kg/ha)	Cost (Tk./ha)	Qty. (kg/ha)	Cost (Tk./ha)	
Pattern-1:									
Boro rice	185	1204	93	1760	49	840	75	450	4254
Fallow	-	-	-	-	-	-	-		
T. Aman	111	722	74	1408	49	840	-	-	2970
Total									**7224**
Pattern-2:									
Mungbean	31	201	19	352	12	210	-	-	763
Aus rice	105	682	56	1056	37	630	-	-	2368
T. Aman	111	722	74	1408	49	840	-	-	2970
Total									**6101**
Pattern-3:									
Grasspea	-	-	-	-	-	-	-	-	0
Aus rice	105	682	56	1056	37	630	-	-	2368
T. Aman	111	722	74	1408	49	840	-	-	2970
Total									**5338**
Pattern-4:									
Wheat	148	963	80	1525	43	735	62	371	3594
Aus rice	105	682	56	1056	37	630	-	-	2368
T. Aman	111	722	74	1408	49	840			2970
Total									**8932**

Profitability analysis of the dominant cropping patterns

Per hectare yield, gross return, gross margin of the major cropping patterns are presented in Table 7. Under the cropping P_1, *(*Boro rice - Fallow - *T.* Aman rice) per hectare total gross return was estimated at Tk. 65918 per year. In this cropping pattern P_1, the total variable costs and gross margin were Tk. 55784 and Tk.10134, respectively. For cropping pattern P_2 (Mungbean - Aus rice - T. Aman rice) per hectare total gross return was estimated Tk. 86790 per year where total variable costs and gross margin were Tk. 69610 and Tk. 17180, respectively. The per hectare gross return of the cropping pattern P_3 (Grass pea -Aus rice - T. Aman rice) was estimated Tk. 68805 whereas total variable costs and gross margin were Tk. 52608 and Tk. 16198, respectively. In case of cropping pattern P_4 (Wheat - Aus rice- T. Aman rice) per hectare gross return was estimated Tk. 98646 while total variable costs and the gross margin were Tk. 75282 and Tk. 22870, respectively.

Table 7. Per hectare yield, gross return, gross margin of the major cropping patterns at Sonuhar village.

Pattern-1	Quantity (kg/ha)	Value (Tk./ha)	Gross return Tk./ha)	total variable cost (Tk./ha)	Gross margin (Tk./ha)
Boro rice	3458	34580	34580	32474	2106
Fallow	-	-	-	-	-
T. Aman rice	3582	31338	31338	23310	8028
Total		**65918**	**65918**	**55784**	**10134**
Pattern-2					
Mungbean	766	30628	30628	23054	7574
Aus rice	3310	24824	24824	23246	1578
T. Aman rice	3582	31338	31338	23310	8028
Total		**86790**	**86790**	**69610**	**17180**
Pattern-3					
Grass pea	778	12643	12643	6052	6592
Aus rice	3310	24824	24824	23246	1578
T. Aman rice	3582	31338	31338	23310	8028
Total		**68805**	**68805**	**52608**	**16197**
Pattern-4					
Wheat	2124	42484	42484	28726	13264
Aus rice	3310	24824	24824	23246	1578
T. Aman	3582	31338	31338	23310	8028
Total		**98646**	**98646**	**75282**	**23444**

A comparison among dominant cropping patterns

It was observed that the farmers earned the highest gross return (Tk. 98646/ha) and gross margin (Tk. 23444/ha) from the pattern P_4 (Wheat -Aus rice -T. Aman rice) followed by P_2 (gross return Tk. 86790/ha and gross margin Tk. 17180/ha), P_3 (gross return Tk. 68805/ha and gross margin Tk.16197/ha) and P_1, (gross return Tk. 65918/ha and gross margin Tk. 10134/ha) (Table 7). Based on the summary results concluded that the cropping pattern P_I (i.e., Boro rice - Fallow -T. Aman rice) could earn the lowest per hectare gross return (Tk.65918) and gross margin (Tk. 10134). Since, the cost of production of Boro rice was high and remains fallow in Kharif 1, the pattern was less profitable. Pattern P_4 was most profitable because of comparatively less production cost and high price of wheat grain.

Problems of wheat cultivation

Problems of wheat cultivation at Sanuhar village are presented in Table 8. Growing wheat and Boro rice in the side by side plot create problems for wheat

cultivation ranked as number one problem because irrigation water from the Boro rice field was percolated to the wheat filed and sometimes wheat crop has been damaged due to excess moisture. Old variety of wheat Kanchan gives low yield ranked as number two problem followed by scarcity of wheat seeds of new varieties and lack of knowledge about production technology of wheat. Some problems are solved by increasing knowledge and awareness on comparative advantages of wheat among the villagers by the DAE. BADC can increase availability of seeds of new varieties of wheat.

Table 8. Problems of wheat cultivation and rank at Sanuhar village.

Problems	Rank
Growing wheat and Boro rice in the same plot (side by side plot) create problems for wheat cultivation	I
Old variety of wheat Kanchan gives low yield	2
Scarcity of wheat seeds of new varieties	3
Lack of knowledge about production technology	4
Long duration T. Aman rice	5
Lack of irrigation facilities	6
Land preparation delayed (Joe)	7
Financial problems	8

Prospects of wheat at Shanuhar village

There were medium high land with limited irrigation facilities from canal and ponds, about 20-25% land become suitable for seeding wheat by first week of December after harvesting MV of T. Aman rice. Some of the farmers have started to grow wheat which indicated that there was bright prospect to cultivate wheat at Shanuhar village.

Measures to be taken for wheat adoption at Shanuhar village

1. Arrange training for farmers on modern wheat cultivation practices;
2. Make available seeds of new varieties of wheat;
3. Make available loan for wheat cultivation;
4. Digging cannel for developing irrigation facilities.

Conclusion

Boro rice was cultivated in about 75 percent land of Rabi season by using scarce supplementary irrigation in this village. Farmers could apply 5 to 7 irrigations for Boro rice, but number of irrigations was not sufficient for yield. Wheat needs two to three irrigations only, which are more profitable than Boro rice. It is essential

to create awareness on comparative advantages of wheat over Boro rice among the villagers for adoption of wheat at this village. Lack of supplementary irrigation facilities was a major problem for Rabi crops at Sanuhar village. Without supplementary irrigation, mungbean and grass pea give better yield than wheat. Initial investment for wheat cultivation was high due to high price of seeds of modern varieties. Farmers do not have enough money for buying seeds and fertilizers for wheat. For that reason, marginal farmers sometimes can not afford it. Wheat Research Centre (WRC), Department of Agricultural Extension (DAE), and Bangladesh Agricultural Development Corporation (BADC) can play important role for seed availability in the village. Wheat is comparatively profitable and labour intensive Rabi crops than others crops like grass pea, mustard, lentil. Farmers earned the highest per hectare gross return (Tk. 98646) and gross margin (Tk. 22870) from the pattern P_4 (Wheat –Aus rice -T. Aman rice) followed by P_2 (Per hectare gross return Tk. 86790 and gross margin Tk.17180), P_3 (Per hectare gross return Tk. 68805 and gross margin Tk.16798) and P_1 (Per hectare gross return Tk.65918 and gross margin Tk.10134). Higher benefit was achieved from the pattern P_4 (Wheat –Aus rice -T. Aman rice) due to less production cost and high price of wheat grain. But three cereal crops could exhaust soil nutrient so that Mungbean-Aus rice-T. Aman pattern may be alternate options to sustain soil health as well as productivity of the selected area.

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