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Economics of shifting land from field crops to hog plum (*Spondias mombin* L.) cultivation in southern Bangladesh

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A B S T R A C T

The study was carried out to analyse the economics of shifting land from field crops to hog plum cultivation in southern Bangladesh during July to September 2018. A total of 120 farmers were selected by using multistage stratified random sampling technique to collect primary data. Result of the study shows that the per hectare average total cost of hog plum cultivation was Tk. 94,126. The average yield of hog plum was 7.97 t ha^{-1}. Net return from hog plum cultivation was Tk. 126,921 per hectare. By cultivating hog plum, farmers obtained 56 to 93% higher net return than the other existing cropping patterns. Since the BCR (2.94), NPV (Tk. 2215,000) and IRR (59%) were very high, the land shifting decision towards hog plum cultivation was sensible. However, BCR was very low in the initial stages of hog plum plantation. Initial investment support from public or private sector could facilitate the growth of this cultivation practice.

Keywords: Influencing factors, Land shifting, Multiple regression, Profitability, Project analysis.

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Introduction

Per capita income, food production and GDP of Bangladesh has been increasing over the time (BBS, 2019). With the social and economic development of the country, food consumption pattern has changed in favour of high value crops such as fruits and vegetables from staple food crops (Joshi, 2005). In recent years, demand for fruits has grown much faster than the demand of food grains. Production and distribution of fruits have opened up a great opportunity for achieving food, nutritional and financial security of the country (Khandoker *et al.*, 2017). The consumption pattern of the people depicts that there has been a constant increase in demand for fruits as compared to other crops in recent years. The total cultivable land under fruits production raised from 0.86% in fiscal year (FY) 2014-15 to 2.80% in FY 2018-19 (BBS, 2019). In 2019, national fruits production was about 4.95 million metric tons and around 11.06 lakh acres of land were used for that purpose (BBS, 2019). Among the various fruits; banana, mango, jackfruit, litchi and guava are mostly important as these are being commercially cultivated in Bangladesh. Besides these, the cultivation of hog plum is gaining popularity among farmers due to its promising higher profitability (Islam and Sujan, 2016). Amaechi (2015) found that hog plum farmers would have both economic and aesthetic benefit if they cultivate it on their fallow or cultivable lands. Hog plum is grown well throughout the southern parts of the country (Rahman, 2015). The soil and climatic conditions of Bangladesh, especially southern regions, are suitable for hog plum cultivation. In 2018-2019, the area under hog plum production was about 18,437 acres and the total production was about 40,623 metric tons (BBS, 2019). Moreover, huge portions of lands in southern parts of the country are now substituting to hog plum cultivation. The growth rates of yield, production and area of hog plum are increasing year after year. Hog plum has emerged as an important option for crop diversification in the southern parts of the country (Islam and Sujan, 2016). With this option, people of those parts of the country ensure a continuous source of income even without their conventional agricultural practices. The land alteration decisions are generally investigated at the macro level by using distributive lag model, which capture the role of different economic and non-economic factors of

decision making process. However, research works related to land shifting behaviour from field crops to fruits cultivation are very rare. Khandoker *et al.* (2014) attempted to analyse the impact of shifting land from cereal crops to Jujube cultivation in northern region of Bangladesh. Sarker *et al.* (2014) and Khandoker *et al.* (2017) investigated the profitability of shifting land from field crops to mango cultivation in northern Bangladesh. However, there was a serious dearth of literature on the production and distribution of hog plum fruits in southern Bangladesh. Therefore, an attempt was taken to analyse the economics of shifting land from field crops to hog plum cultivation in southern Bangladesh.

Methodology

A micro-level study based on primary cross-section data was designed to attain the objectives of this study. The methodology of the study was mainly about the sampling procedure, collection of data and analytical framework.

Area selection: The study was conducted in two major hog plum (*amra*) growing districts of Bangladesh, namely Jhalokathi and Pirojpur. Jhalokathi sadar upazila and Pirojpur sadar upazila under Jhalokathi and Pirojpur district, respectively, were selected purposively for administering questionnaire survey. For this study, primary data were collected by using pre-tested questionnaire during the month of July to September, 2018.

Sampling technique and sample size: A multistage stratified random sampling technique was followed to select sample farmers for the study. At first, two districts were selected purposively considering their higher quantities of hog plum (*amra*) production. In the second stage, one upazila from each district and two villages from each upazila were selected accordingly. Finally, sixty farmers were selected randomly from each district amassing a total of 120 farmers from the total study areas. Population stratification was necessitated for common heterogeneity among agricultural household (Nyariki, 2009). Special attention was given to ensure the representativeness of different aged plantation of hog plum. Collected data were rearranged based on the span of hog plum cultivation. The respondents were categorized according to their stage of hog plum cultivation as 1st year, 2nd-3rd year, 4th-5th year, 6th-10th year, 11th-15th year and 16th-20th year.

Analytical techniques

a) Tabular technique: Collected data were edited, summarized, tabulated and analysed to fulfill the purpose of this study. Descriptive statistics like averages, percentages and ratios were used in presenting the results in a tabular form. The profitability of hog plum cultivation was examined on the basis of gross return (GR), gross margin (GM), net return (NR) and benefit cost ratio (BCR) analysis. Besides, the imputed value of family labour was taken into account in the time of total cost approximation. Per year lease value of land was considered for determining the land use cost. Project analysis and sensitivity analysis were also included on the paper. Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR) were calculated (at 5% discount rate) with the following formulas used by Sarker *et al.* (2014) and Khandoker *et al.* (2017):

Net Present Value (NPV): The net present value (NPV) of an investment is the discounted value of all cash inflows and cash outflows of the project during its lifetime. It can be computed as:

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t}$$

Benefit Cost Ratio (BCR): The benefit cost ratio (BCR) of an investment is the ratio of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of the project. It can be estimated using the following formula:

$$BCR = \sum_{t=1}^{n} \frac{\frac{B_t}{(1+r)^t}}{\frac{C_t}{(1+r)^t}}$$

Internal Rate of Return (IRR): Internal rate of return (IRR) is the rate of return at which the NPV of a stream of incomes is nullified. The IRR is computed as:

$$r = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t} = 0$$

Where, B_t = Total benefit (Tk. ha^{-1}) in time t
C_t = Total cost (Tk. ha^{-1}) in time t
r = Rate of interest (discount rate)
t = Number of years (t = 1, 2, 3 … … 20)

The IRR was calculated with the following formula:

$$\text{Internal Rate of Return (IRR)} = \text{Lower discount rate} + \text{Difference between two discount rates} \times \frac{\text{Present worth of cash flows at lower discount rate}}{\text{Absolute difference between the present worth of the cash flows}}$$

b) Statistical technique

Multiple regression model

The OLS regression model was used to analyse the factors influencing the extent of land shifting behaviour, where both the economic and non-economic factors were considered as explanatory variable. The relative income was included as explanatory variable to test its extent of influence. The following multiple linear regression function was fitted for present study-

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U_i$$

Where, Y = Shift of area from field crops to hog plum cultivation (decimal)

X_1 = Relative income ('1000 Tk. ha^{-1} $year^{-1}$)
X_2 = Yield (t ha^{-1})
X_3 = Education (years of schooling)
X_4 = Farm size (decimal)
X_5 = Age of the farmers (year)
X_6 = Hog plum farming experience (year)
X_7 = Non-farm income ('1000 Tk. ha^{-1} $year^{-1}$)
X_8 = Food crop (wheat/rice) requirement at home ('1000 Tk.)
α = Intercept
$\beta_1, \beta_2, \ldots \ldots \ldots \beta_8$ = Coefficients of the respective variables to be estimated
U_i = Random error

Results and Discussion

Intercropping with hog plum

A portion of the sample farmers practice intercropping with hog plum. Among the intercrops, majority of the farmers (23.33%) preferred intercropping with potato & arum followed by bitter gourd & cauliflower (20.83%), snake/water gourd & cabbage (18.33%), sweet gourd & tomato (17.50%), papaya (15.0%), Indian spinach & red amaranth (13.33%), chili (11.67%) and brinjal (10.83%) (Table 1). The study also found that 14.17% of the farmers did not adopt any intercrops with hog plum cultivation. Reason behind that no intercropping might be the extra care for hog plum saplings.

Table 1. Types of crops cultivated in hog plum field as intercrop.

Types of crop	% farmers responded		Average
	Pirojpur	Jhalokathi	
Potato & Arum	25.00	21.67	23.33
Bitter gourd & Cauliflower	21.67	20.00	20.83
Snake/Water gourd & Cabbage	20.00	16.67	18.33
Sweet gourd & Tomato	16.67	18.33	17.50
Papaya	16.67	13.33	15.00
Indian spinach & Red amaranth	15.00	11.67	13.33
Chili	13.33	10.00	11.67
Brinjal	11.67	10.00	10.83
No intercrops	15.00	13.33	14.17

Cost of hog plum cultivation (including intercrops)

For estimating the cost of production, all the variable cost i.e. land preparation, human labour, sapling, manures, fertilizer, insecticides, etc. were calculated per hectare basis. Both cash cost and imputed value of family supplied inputs were included in the calculation. Interest on operating capital (IOC) was also considered for determining the cost of hog plum cultivation. The cost of land use was calculated on the basis of per hectare lease value of land. Table 2 represents the cost of hog plum cultivation in different years. The average total cost of hog plum cultivation in all years was Tk. 94,126 per hectare of which 65% were variable cost. Land use cost comprised the largest share (33%) of the total cost. On an average, labour cost contributed 27% of the total cost. Fertilizers cost shared only 6% of the total cost. Farmers in the study areas spent on an average Tk. 14,787 (16% of total cost) per hectare for cultivating intercrops. The cost for saplings and supporting sticks were Tk. 20,232 and Tk. 4,130 per hectare, respectively and incurred on the first year only. Land preparation cost was Tk. 14,165 and incurred at the beginning of the project. Most of the cases, in the first year, farmers took extra care of hog plum saplings. For this reason, the cost and benefits from intercropping in the first year were comparatively low.

Table 2. Cost of hog plum cultivation including intercrops (figured in Tk. ha^{-1}).

Particulars	1st year	2nd-3rd year	4-5th year	6-10th year	11-15th year	16-20th year	All years
Observations	20	20	20	20	20	20	120
A. Variable Cost	91506	49521	56229	60445	59029	51108	61306 (65)
Hired labour	11876	9873	16794	22197	24679	19737	17526 (19)
Family labour	10917	7246	7386	6376	5310	5194	7072 (8)
Land preparation	14165	0	0	0	0	0	2361 (3)
Saplings	20232	0	0	0	0	0	3372 (4)
Manures	7398	2122	1511	495	1100	2538	2527 (3)
Fertilizers							
Urea	1628	1420	1524	1361	1137	1257	1388 (1)
TSP	3980	3730	2573	1976	2365	1886	2752 (3)
MoP	1824	1129	1047	986	1328	1205	1253 (1)
Gypsum	220	192	147	171	0	124	142 (0)
Insecticides	3492	2758	3869	3578	4036	3579	3552 (4)
Irrigation	4268	3683	4587	3921	3890	2968	3886 (4)
Stick	4130	0	0	0	0	0	688 (1)
Intercrop	7376	17368	16791	19384	15184	12620	14787 (16)
B. Fixed cost	33575	32525	32693	32798	32763	32565	32820 (35)
Interest on operating capital	2288	1238	1406	1511	1476	1278	1533 (2)
Land use cost	31287	31287	31287	31287	31287	31287	31287 (33)
Total Cost (A+B)	125081	82046	88922	93243	91792	83673	94126 (100)

Note: Figures in the parentheses indicate the percentage of total cost.

Profitability of hog plum cultivation

In the study areas, average yield of hog plum was 7.97 t ha^{-1} year^{-1}. Farmers did not get any yield from hog plum cultivation in the first year. They started getting yield from 3rd years of plantation. On 4th year, yield was 5.32 t ha^{-1}. The highest amount of yield (15.15 t ha^{-1}) obtained from 11 to 15 years old hog plum garden. After 15 years, yield rate had decreased. Returns from hog plum cultivation in different years are presented in Table 3. Average gross return per hectare was Tk. 221,047 per year. The average gross return from intercrops was Tk. 29,867 per hectare. The highest net return was also found in the 11th-15th year (Tk. 297,825 ha^{-1} year^{-1}) followed by 6th-10th year (Tk. 286,904 ha^{-1} year^{-1}). Average gross margin and net margin of hog plum cultivation were Tk. 159,741 and Tk. 126,921 per hectare, respectively. In the study areas, farmers have to spend on an average Tk. 12 for producing 1 kg hog plum. The average undiscounted BCR on total cost was 2.47. Higher cost incurred in the first couple of years for hired labour, land preparation, sapling, manures and sticking with no return from hog plum influenced the BCR to be lowest in the initial years of plantation.

Table 3. Profitability of hog plum cultivation with intercrops.

Particulars	1st year	2 -3rd year	4 -5th year	6 -10th year	11 -15th year	16 -20th year	Average
Sample	20	20	20	20	20	20	-
A. Total cost (Tk. ha^{-1})	125081	82046	88922	93243	91792	83673	94126
Variable cost	91506	49521	56229	60445	59029	51108	61306
Fixed cost	33575	32525	32693	32798	32763	32565	32820
Cost of intercrops	7376	17368	16791	19384	15184	12620	14787
B. Yield of hog plum (kg ha^{-1})	0	1830	5320	14250	15150	11245	7966
C. Price (Tk. kg^{-1})	24	24	24	24	24	24	24
D. Gross return of hog plum (Tk. ha^{-1})	0	43920	127680	342000	363600	269880	191180
E. Gross return of intercrop (Tk. ha^{-1})	20381	35194	39505	38147	26017	19958	29867
F. Total gross return (Tk. ha^{-1})	20381	79114	167185	380147	389617	289838	221047
G. Gross margin (Tk. ha^{-1})	-71125	29593	110956	319702	330588	238730	159741
H. Net return (Tk. ha^{-1})	-104700	-2932	78263	286904	297825	206165	126921
I. BCR on TC (undiscounted)	0.16	0.96	1.88	4.08	4.24	3.46	2.47
J. Per unit production cost (Tk. kg^{-1})	-	51	18	7	6	8	12

Returns on investment in hog plum cultivation

Most of the cases, opportunity cost of capital is considered as the discount rate for project analysis. The results of this calculation presented on Table 4 and Table 5. For assessing benefit-cost ratio (BCR) and net present value (NPV), the costs and returns were discounted at 5% rate of interest.

Table 4. Financial analysis of hog plum cultivation project in the study areas.

Year	Gross cost (Tk.)	Gross benefit (Tk.)	Discount factor at 5%	PW of cost at 5%	PW of benefit at 5%
1	125081	20381	0.952	119125	19410
2	82046	79114	0.907	74418	71759
3	82046	79114	0.864	70874	68342
4	88922	167185	0.823	73156	137544
5	88922	167185	0.784	69673	130994
6	93243	380147	0.746	69579	283672
7	93243	380147	0.711	66266	270163
8	93243	380147	0.677	63111	257298
9	93243	380147	0.645	60105	245046
10	93243	380147	0.614	57243	233377
11	91792	389617	0.585	53669	227801
12	91792	389617	0.557	51113	216953
13	91792	389617	0.530	48679	206622
14	91792	389617	0.505	46361	196783
15	91792	389617	0.481	44154	187412
16	83673	289838	0.458	38332	132778
17	83673	289838	0.436	36506	126455
18	83673	289838	0.416	34768	120434
19	83673	289838	0.396	33112	114699
20	83673	289838	0.377	31535	109237
Total				1141780	3356780
Net present worth		(PW of benefit at 5%)−(PW of cost at 5%)			2215000
BCR		(PW of benefit at 5%)÷(PW of cost at 5%)			2.94

Table 5. Financial analysis of hog plum cultivation project in the study areas.

Year	Incremental benefit	Discount factor at 55%	PW of benefit at 55%	Discount factor at 60%	PW of benefit at 60%
1	-104700	0.645161	-67548.39	0.625000	-65437.50
2	-2932	0.416233	-1220.40	0.390625	-1145.31
3	-2932	0.268537	-787.35	0.244141	-715.82
4	78263	0.173250	13559.06	0.152588	11941.99
5	78263	0.111774	8747.78	0.095367	7463.74
6	286904	0.072112	20689.33	0.059605	17100.81
7	286904	0.046524	13347.95	0.037253	10688.01
8	286904	0.030016	8611.58	0.023283	6680.00
9	286904	0.019365	5555.86	0.014552	4175.00
10	286904	0.012493	3584.43	0.009095	2609.38
11	297825	0.008060	2400.56	0.005684	1692.94
12	297825	0.005200	1548.75	0.003553	1058.09
13	297825	0.003355	999.19	0.002220	661.30
14	297825	0.002164	644.64	0.001388	413.32
15	297825	0.001396	415.90	0.000867	258.32
16	206165	0.000901	185.74	0.000542	111.76
17	206165	0.000581	119.83	0.000339	69.85
18	206165	0.000375	77.31	0.000212	43.66
19	206165	0.000242	49.88	0.000132	27.29
20	206165	0.000156	32.18	0.000083	17.05
Total			11013.85		-2286.13

The benefit cost ratio (BCR) was calculated by dividing the present worth of the gross benefit by the present worth of the gross cost. BCR was 2.94 at 5% discount rate, which implies that the project was profitable. The simplest discounted cash flow measures of the project worth is the net present worth (Khandoker *et al.*, 2017) which is determined by subtracting present worth of costs from present worth of benefits. The estimated net present worth of the project was Tk. 2215,000 per hectare.

Average earning capacity of capital used in a project over the project life is represented by internal rate of returns (IRR). It refers to that discount rate which negates the present worth of cash inflows and outflows. In the project of hog plum cultivation, IRR was 59%. This opportunity was highly acceptable because it was much higher than the opportunity cost of capital.

Sensitivity analysis

The effects of adverse changes in the project are estimated by sensitivity analysis. Three adverse situations are assessed for the project under this study. The first situation is constant return but cost increased by 10%. The second situation is constant cost but return decreased by 10%. The third situation is both cost increased and return decreased by 10%. The results of sensitivity analysis are presented in Table 6. At 5% discount rate, greater than one BCR, positive NPV and higher IRR than opportunity cost of capital imply that investment in hog plum cultivation was remunerative for 10% increased cost with constant return, 10% decreased return with constant cost, even at the worst situation of 10% increased cost with 10% decreased return.

Table 6. Result of sensitivity analysis of hog plum cultivation.

Situation	BCR at 5%	NPV at 5% (Tk.)	IRR (%)
Current situation	2.94	2215000	59
Cost increased by 10% but return constant	2.67	2100822	53
Cost constant but return decreased by 10%	2.65	1879322	52
Cost increased and return decreased by 10%	2.41	1765144	46

Profitability of existing cropping patterns other than hog plum

Cropping patterns followed by farmers before shifting land to hog plum cultivation

Farmers of the study areas follow various types of cropping pattern. Most of them cultivate two crops in a year. Some of them cultivate three crops also. Before starting hog plum cultivation, they cultivated mainly Boro, T. Aman, T. Aus, Pulse crops (mostly Kheshari), Potato and some short duration vegetables. A total of 18 types of cropping patterns were found. Mostly followed 8 cropping patterns are presented in Table 7. The highest percentage (22.50%) of farmers mentioned that they followed Fallow-T. Aus-T. Aman cropping pattern followed by Boro-Fallow-T. Aman (20.00%), Pulse-Fallow-T. Aman (12.50%), Potato-Fallow-T. Aman (10.00%) and Boro-Fallow-Fallow (8.33%) in their field before starting hog plum cultivation.

Table 7. Cropping patterns followed by the farmers before starting hog plum cultivation.

Types of Cropping pattern	% farmers responded		All
	Pirojpur	Jhalokathi	
Fallow-T. Aus-T. Aman	21.67	23.33	22.50
Boro-Fallow-T. Aman	23.33	16.67	20.00
Pulse-Fallow-T. Aman	11.67	13.33	12.50
Potato-Fallow-T. Aman	8.33	11.67	10.00
Boro-Fallow-Fallow	6.67	10.00	8.33
Wheat-Fallow-T. Aman	5.00	6.67	5.83
Boro-Fallow-Vegetables	3.33	5.00	4.17
Boro-T. Aus-Fallow	3.33	1.67	2.50
Others	16.67	11.67	14.17
Total	100.00	100.00	100.00

Profitability of cereal crops cultivation in the study areas

Potato-Fallow-T. Aman was the most profitable cropping pattern (BCR on TC was 1.37) before shifting land to hog plum cultivation. Details about the calculation are presented on Table 8. Total cost for Potato-Fallow-T. Aman pattern was Tk. 152,535 and net return was Tk. 56,438 per

hectare. Per hectare total cost for Pulse-Fallow-T. Aman pattern was Tk. 105,250 whereas it was Tk. 126,355 for Wheat-Fallow-T. Aman pattern. Boro- Fallow-T. Aman pattern required Tk. 91,783 as total cost, which was lower than that of Boro-T. Aus-Fallow (Tk. 93,237 ha^{-1}). The net return of different cropping pattern varies from Tk. 9,391 (Boro-Fallow-Fallow) to Tk. 56,438 (Potato-Fallow-T. Aman). Estimated BCR on total cost ranged from 1.16 to 1.37 along with different practiced pattern. On the other hand, it ranged from 1.49 to 1.84 based on variable cost.

Table 8. Profitability of cereal crops cultivation (figured in Tk. ha^{-1}).

Cropping pattern	Total Cost	Total Variable Cost	Gross Return	Gross Margin	Net Return	BCR on TC	BCR on TVC
Potato-Fallow-T. Aman	152535	113572	208973	95401	56438	1.37	1.84
Pulse-Fallow-T. Aman	105250	77050	137878	60828	32628	1.31	1.79
Wheat-Fallow-T. Aman	126355	91477	160470	68993	34115	1.27	1.76
Boro-Fallow-Vegetables	121208	89715	151510	61795	30302	1.25	1.69
Boro-T. Aus-Fallow	93237	61235	111682	50447	18445	1.20	1.82
Boro-Fallow-T. Aman	91783	61018	109222	48204	17439	1.19	1.79
Fallow-T. Aus-T. Aman	65785	48921	77626	28705	11841	1.18	1.59
Boro-Fallow-Fallow	58691	45627	68082	22455	9391	1.16	1.49

Relative profitability of hog plum cultivation in contrast to other prevailing crops

The costs and returns of different cropping pattern were compared with hog plum cultivation to analyse the comparative profitability. The cost of hog plum cultivation were higher than that of Boro-T. Aus-Fallow, Boro-Fallow-T. Aman, Fallow-T. Aus-T. Aman and Boro-Fallow-Fallow cropping pattern. On the other hand, for Potato-Fallow-T. Aman, Pulse-Fallow-T. Aman, Wheat-Fallow-T. Aman and Boro-Fallow-Vegetables cropping pattern, the production cost were higher than that of hog plum cultivation. Details information regarding relative profitability of hog plum cultivation are presented on Table 9 and Table 10. Total cost of Boro-Fallow-Fallow cropping pattern was 38% lower than that of hog plum cultivation whereas it was 62% and 34% higher for Potato-Fallow-T. Aman and Wheat-Fallow-T. Aman cropping pattern, respectively. However, in monetary term, per hectare total cost incurred for hog plum cultivation was Tk. 35,435 more than that of Boro-Fallow-Fallow cultivation whereas it was Tk. 58,409 less than that of Potato-Fallow-T. Aman cropping pattern.

The gross return and net return from hog plum cultivation were higher than that of all the inspected cropping patterns. Hog plum cultivators secured 69% higher gross return than that of Boro-Fallow-Fallow cropping pattern. Farmers obtained 56 to 93% higher net return than the cropping patterns analysed in this study. BCR of hog plum cultivation was also higher than that of any other examined cropping patterns.

Table 9. Relative profitability of hog plum cultivation with other prevailing crops.

Comparing points	Boro-T. Aus-Fallow	Boro-Fallow-T. Aman	Fallow-T. Aus-T. Aman	Boro-Fallow-Fallow
Total cost lower than hog plum (Tk.)	889	2343	28341	35435
Total cost lower than hog plum (%)	1	2	30	38
Gross return lower than hog plum (Tk.)	109365	111825	143421	152965
Gross return lower than hog plum (%)	49	51	65	69
Net return lower than hog plum (Tk.)	108476	109482	115080	117530
Net return lower than hog plum (%)	85	86	91	93

Table 10. Relative profitability of hog plum cultivation with other prevailing crops.

Comparing points	Potato-Fallow-T. Aman	Pulse-Fallow-T. Aman	Wheat-Fallow-T. Aman	Boro-Fallow-Vegetables
Total cost higher than hog plum (Tk.)	58409	11124	32229	27082
Total cost higher than hog plum (%)	62	12	34	29
Gross return lower than hog plum (Tk.)	12074	83169	60577	69537
Gross return lower than hog plum (%)	5	38	27	31
Net return lower than hog plum (Tk.)	70483	94293	92806	96619
Net return lower than hog plum (%)	56	74	73	76

Factors influencing the land shifting decision towards hog plum cultivation

Multiple linear regression analysis was done for investigating the influence of different factors for shifting land from field crops to hog plum cultivation. Estimated results are presented on Table 11. The explanatory variables included in the model explained around 82.95% of variations in land shifting behaviour. The significant F-value (73.38) indicates that all the explanatory variables included in the regression model were important.

Estimated results indicate that the relative income from the crops had played a positive role for shifting land towards hog plum cultivation. Farm size also had a positive influence on land shifting decision. The variable age is negatively significant and indicates that older farmers were less interested for shifting their land. Food crop requirement had a negative impact on land shifting behaviour. It imply that higher the requirement of food crops, less likely to shift land towards hog plum cultivation and vice-versa.

Table 11. Factors influencing the land shifting decision of farmers towards hog plum cultivation.

Explanatory Variable	Parameters	Co-efficient	Sd. Error	P-values
Intercept	β_0	69.845***	25.834	0.008
Relative income (Tk. ha^{-1} year^{-1})	β_1	0.639*	0.354	0.074
Yield (t ha^{-1})	β_2	0.049	8.830	0.996
Education (years of schooling)	β_3	0.431	2.088	0.837
Farm size (decimal)	β_4	0.108*	0.063	0.091
Age of the farmers (year)	β_5	-0.818*	0.428	0.059
Hog plum farming experience (year)	β_6	0.245	1.491	0.870
Non-farm income (Tk. ha^{-1} year^{-1})	β_7	0.094	0.880	0.915
Food crop requirement (Tk.)	β_8	-0.696*	0.366	0.060
R^2		82.95%		
F-value		73.38		

***Note**: *** and * indicate significant at 1%, and 10% level, respectively.*

Conclusions

The study was conducted to analyse the economics of shifting land from field crops to hog plum cultivation. Results of the study show that lower cost of production and higher return from hog plum cultivation than that of any other cropping pattern influenced the farmers to shift their land from field crops to hog plum cultivation. Findings also reveal that BCR of hog plum cultivation was its lowest limit in the initial stage of production but it turned out to be higher onwards till fifteen years of plantation. Support from formal or informal sectors for initial investment might play a pivotal role to flourish this unorthodox cultivation practice. Relative income and farm size had positive effect whereas farmer's age and food crops requirement had negative effect on land shifting behavior towards hog plum cultivation. Production of hog plum in fallow land or land where other crops are not grown well would increase the relative income and secure available cultivable land for cereal crops. Motivation should be given to the farmers for cultivating hog plum in these lands.

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