Cost and Return Analysis for Sandbar Pumpkin cultivation in Rangpur and Kurigram districts during 2018-19 winter season

Md. Harun-Ar-Rashid, Ph.D
Executive Director, AAS

Prepared by:

Agricultural Advisory Society (AAS)
House # 13/14 (1st Floor), Salimullah Road, Block-D
Mohammadpur, Dhaka-1207
Phone: 880-2-58152151
Email: harunaas@gmail.com
www.aas-bd.org

10 April 2020

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Acronyms and Abbreviations

AAS	Agricultural Advisory Society
BBS	Bangladesh Bureau of Statistics
CCB	Cash cost basis
ED	Executive Director
FCB	Full cost basis
FGD	Focus Group Discussion
GDP	Gross Domestic Product
IT	Information technology
Kg/ha	Kilogram/ hectare
MS Excel	Microsoft Excel
MT	Metric Ton
NGO	Non-Government Organization
No.	Number
PAB	Practical Action Bangladesh
SPSS	Statistical Package for Social Science
Tk/ha	Taka/ hectare
Tk/Kg	Taka/ Kilogram
USAID	United States Agency for International Development

Acknowledgement

Author expresses his gratefulness to the five respondent farmers: Abdul Khaleque, Md. Ershadul, Toyeb Ali, Chad Miah and Rezaun Hossain in Rangpur and Kurigram districts for their generous support and help in providing useful data and information along with the attended farmer participants at the informal five FGDs during data collection at five villages during 20-26 October 2019. Without their inputs, support and follow-up feedbacks over cell phonic discussion it would not be possible to complete this study successfully.

I specially acknowledge to Mr. Nirmal Chandra Bepary, Project Coordination, Practical Action Bangladesh (PAB), Rangpur and Mr. Rezaul Karim, IT, AAS for their generous support during relevant data and information collection from the respondent Sandbar Pumkin farmers. Author would like to thanks all those who directly or indirectly helped in executing the study.

Author also grateful to Mr. Ibrahim Hossain of AAS for his great support in data entry, analysis, summary tables preparation and report preparation.

Executive Summary

Bangladesh predominantly is an agricultural country. Most inhabitants of the country are involved directly in agricultural activities for their livelihood. The sector dominants the economy 13.07% of the country's GDP in 2018 and it is the single largest manpower engaged in the sector. Various types of crops are produced in this country. The pumpkin is an important vegetable crop in Bangladesh, due to its great importance as well as nutritional value and high availability in all the year round. Pumpkin are rich in carbohydrate and minerals and cheaper source of vitamins, especially carotenoid pigments, which have a major role in nutrition inform of pro-vitamin-A, antioxidants, when used at ripening stage. The ripe fruits are typically orange or yellow in color and they have a thick shell on the outside. Pumpkins are warm weather crops and they require a temperature range of 10^0c to 27^0C for growth, ideal being 18^0C to 20.5^0C. Most pumpkins reach maturity at 3 months to 5 months after seed sowings. Bangladesh pumpkin production stood at 661,832 MT from 48,985 ha of lands with 648,737 households with average yield 13,511 kg/ha in 2014.

Bangladesh is a deltaic country formed by flood plains of the three major rivers, Ganges, Brahmaputra and Meghna. Frequent river erosion is occurred and in drought season a large amount of silted-up. The river side sand and silt landmass is known as "char" in Bengali. The char lands of three main rivers cover some 8,450 km^2 (6% of the total land area) with the current char population is about 12 million in 2011. These area are highly vulnerable to river erosion which causes loss of land and makes living in the chars both risks and uncertain. Most char dwellers are extreme poor, landless and marginal farmer. They fight to produce or manage food to eat. To solve this problem, any sustainable tactics is needed that will help the poor households to make optimum use of their available resources and cope with extreme weather. The Practical Action Bangladesh (PAB), a UK-based international NGO, has been assisting the extreme poor families in promoting sandbar cropping, mainly for pumpkin cultivation, in barren char lands (Sandbars) under its several projects from 2004. PAB introduced a cultivation method named sandbar cropping to produce winter vegetable, especially pumpkin in char lands. Sandbar cropping is a method in which farmers dig large pits in sandy land fill them with manure, compost and sow pumpkin seeds on those. Initially, PAB introduced to use Jute sacks in pits. PAB assists farmers by giving all agricultural inputs and technical help. At the end of rainy season in mid-October to mid-November, when water level in the river recedes, sandbars start to emerge in char lands. These sandbars usually disappear after six months and thus crops cannot be cultivated year round. These sandbars are brought under cultivation using sandbar cropping technique. The technique has experienced widespread adoption in five north western districts of the country. AAS was undertaken a study for cost and return analysis for sandbar Pumpkin cultivation with five farmers at five villages like as FGDs in Kaunia and Gangachara upazilas of Rangpur district and ulipur upazila of Kurigram district during 20-26 October 2019.

Average gross return was calculated Tk.164,840/ha counter to the average total cost of Tk.208,903/ha and Tk.110,996/ha on full cost and cash cost basis respectively for sandbar

pumpkin cultivation in Rangpur and Kurigram districts during 2018-19 winter season. The average net-returns were calculated as negative (-Tk.44,063/ha) on full cost basis and Tk.53,844/ha as positive on cash cost basis for sandbar pumpkin cultivation in Rangpur and Kurigram districts during 2018-19 winter season. The average higher benefit-cost ratio was calculated on cash cost basis (1:1.49) than full cost basis as negative benefit-cost ratio (1:0.79). Average about 13.78 ton/ha pumpkin yield was observed for sandbar pumpkin cultivation for Pumpkin hybrids with range yield from 10.00 t/ha to 17.00 t/ha in Rangpur and Kurigram districts during 2018-19 winter season. The average per kg production cost of pumpkin was found higher for full cost basis (Tk.15.16/kg) than cash cost basis (Tk.8.06/kg). Average about Tk.12.00/kg sale price of pumpkin was observed in Rangpur and Kurigram districts during 2018-19 winter season.

Among the eight cost items for sandbar pumpkin cultivation, the highest proportion of cost of the total cost on full cost basis (Tk.208,903/ha) was calculated for labor used (45.12%) followed by fertilizer used (21.83%), irrigation used (11.71%), interest on working capital used on full cost basis (8.26%), seed used (4.93%) and carrying cost (1.84%). Of the total 21.83% fertilizers cost of the total cost, of which 4.73% cost for organic fertilizer and 17.08% for chemical fertilizers.

Among the seven labor used types for sandbar pumpkin cultivation, the highest proportion of labor used of the total average labor used (245/ha) was calculated for irrigation (43.02%) followed by cow dung/compost collection, loading, unloading/carrying, drying, application etc (17.06%), Pit/canal digging (12.57%), Pit preparation and seed sowing (8.90%), fertilizer top-dressing (7.51%), Pumpkin harvesting/carrying (7.18%) and pesticide spraying (3.76%). Among the five respondent farmers, the highest number of total labor used with seven type activities for sandbar pumpkin cultivation was calculated for Toyeb Ali (292) followed in order by Abdul Khaleque (274), Md. Ershadul (258), Rezaun Hossain (222) and Chad Miah (169).

Background

Bangladesh predominantly is an agricultural country. Most inhabitants of the country are involved directly in agricultural activities for their livelihood. The sector dominants the economy 13.07% of the country's Gross Domestic Product (GDP). In earlier decades, the sector contributed more than 50% of GDP. Due to gradual transformation of the economy from agriculture to industry and service sector, this sector has fallen from around 50% in the 1970 to 13.07% in recent year 2018 but still it is the single largest manpower engaged in the sector. It is also the source of raw materials of different industries, such as jute and jute products, food and food products and so on.

Bangladesh by birth possesses very fertile land in which diversified crops grow very easily. Various types of crops are produced in this country. The pumpkin is an important vegetable crop in Bangladesh, due to its great importance as well as nutritional value and high availability in all the year round vegetables play a vital role in the overall economic performance of Bangladesh. Pumpkin is very popular and one of the most important vegetable crops grown extensively throughout the country. Due to its high nutritional content and lucrative market price, pumpkin may be considered as a high value crop. Both mature and immature vegetable are used as a

vital ingredient for several culinary preparation in Bangladesh. Pumpkin are rich in carbohydrate and minerals and cheaper source of vitamins, especially carotenoid pigments, which have a major role in nutrition in form of pro-vitamin-A, antioxidants, when used at ripening stage. Thus, this vegetable can contribute to improve nutritional status of the people of Bangladesh, particularly the vulnerable group in respect of vitamin-A requirement. Pumpkin are very versatile in their uses for cooking and have an advantage over other vegetables as the fruit can be stored for up to 6 months before being consumed and hence can play an important role in maintaining nutritional levels during long dry seasons.

The ripe fruits are typically orange or yellow in color and they have a thick shell on the outside. The main nutrients are lute in and both alpha and beta carotene, the latter of which generates vitamin A in the human body. The production of vegetables including pumpkin is increasing day by day in Bangladesh. Among all the vegetables produced in the country, pumpkin major area covered of total cropping area and production. It grows in all districts of Bangladesh but plenty of pumpkins are produced in the region of Jashore, Kushtia, Chittagong, Dhaka and Rangpur.

Pumpkins are warm weather crops that are damaged easily by light frosts. They require a temperature range of 18^0C to 24^0C for growth, ideal being 18^0C to 20.5^0C. Therefore, a prolonged warm season is essential to obtain quality pumpkin. Pumpkins prefer a generous water supply. Over watering is often harmful. Pumpkins grow well and produce excellent quality fruit in rich, high-textured soils. Sandy loam or well drained loamy fertile soils, ideally deeper than 25cm are ideal for pumpkin cultivation. Pumpkins are propagated by seed sown directly in field where plant will mature. Seeds may be sown from October to December for winter crop and February to May for summer crop. Most pumpkins reach maturity at 3 months to 5 months after sowing. The fruit is harvested when the skin becomes hard and loses its shiny appearance. However, gathering the pumpkins should be delayed until the vines have completely dried off, retaining the stem. Young, fresh leaves are used as vegetables, the same way as spinach. Pumpkin seeds can be roasted and eaten as a snack.

According to BBS, Bangladesh's pumpkin production stood at 661,832 tons from 48,985 hectares of lands with 648,737 households with average yield 13,511 kg/ha. Of the total 48,985 ha land, of which 29,798 ha lands cultivated during 2014 winter season (60.83%) and 19,187 ha lands cultivated during 2014 summer season (39.17%). Out of a total of 661,832 MT of pumpkins produced, of which 402,581 MT of pumpkins produced during 2014 summer season and 259,251 MT of pumpkins produced during 2014 winter season. Of the total 648,737 households cultivated pumpkins, of which 387,382 households cultivated pumpkins during 2014 summer season (59.71%) and 275,896 households cultivated pumpkins during 2014 winter season (42.53%). Out of a total of 48,985 ha land calculated under pumpkin cultivation, of which 28,633 ha land cultivated during 2014 summer season (58.45%) and 20,352 ha land cultivated during 2014 wither season (41.55%).

Bangladesh is a deltaic country formed by flood plains of the three major rivers, Ganges, Brahmaputra and Meghna. These rivers drain into the Bay of Bengal, although only 7% of the catchment is lies with the country's boundaries. Frequent river erosion is occurred and in drought season a large amount of silted-up. The riverside sand and silt land masses is known as "Char" in Bengali. The char-lands of the three main rivers the Jamuna-Brahmaputra, Ganges-Padma and Meghna cover some 8,450 km^2 (6% of the total land area) with the current char population is about 12 million in 2011. These areas are highly vulnerable to river erosion which causes loss of land and makes living in the chars both risky and uncertain. Most char dwellers are extreme poor, landless and marginal farmers. They fight to produce or manage food to eat. To solve this problem, any sustainable tactics is needed that will help the poor

households to make optimum use of their available resources and cope with extreme weather. The practical Action Bangladesh (PAB), a UK-based internationally reputed NGO, has been assisting the extreme poor families in promoting sandbar cropping, mainly for Pumpkin cultivation, in the barren char lands under its pathway from poverty project in 2009 and follow-up projects from UKAID, Dexis/USAID etc). They introduced a cultivation method named sandbar cropping to produce winter vegetable especially Pumpkin in char lands. Sandbar cropping is a method in which farmers dig holes in sandy land fill them with manure/compost and sow pumpkin seeds. PAB assists farmers by giving all agricultural inputs and technical help. They have also managed storage facilities for the farmers to store pumpkin for getting better price from off-season selling.

The sandbar cropping technique is a pit cultivation approach, adapted to the sandbars of char lands to grow pumpkin, squash and watermelon. Pits are dug in the sandbars and lined with manure and compost. Jute sacks are used in locations where ground water is very poor and soil is sandy. Seeds are placed in the pits and are carefully monitored for the next few months with frequent irrigation and nursing as required. At the end of rainy season in mid October to mid-November when water level in the river recedes, sandbars start to emerge in char lands. These sandbars are brought under cultivation using the sandbar cropping technique.

Sandbars cropping is an innovative, cost-effective technology that transforms silted barren sandy lands created by following into arable farmland. This has helped thousands of families in Bangladesh that are displaced from land degradation and suffer from poverty, hunger and malnourishment. The technique has experienced widespread adoption in five northwestern districts of the county.

After the raining season ends each year in Bangladesh, large barren sandy islands appear in the main rivers. These attached or detached sandbars usually disappear after six months and thus cannot be crops cultivated year-round. However, during the dry season, these lands can be used by extreme poor farmers to grow high nutrition crops. PAB's sandbar cropping technique enables landless families in Bangladesh to diversify their incomes by growing pumpkins and other crops on previously barren land. Farmers can overcome seasonal food shortages and reduce risks that threaten their livelihoods with sandbar cropping. PAB teaches farmers how to identify suitable sandbar cropping space, dig pits, fill them with manure/compost and add pumpkin seeds.

The sandbar cropping project first began in 2004 as part of PAB work to help tsunami-affected communities in northwest Bangladesh rebuild their communities and protect them from the effect of river erosion, flooding and other natural disasters. In 2005, the disappearing lands projects, starting in the Gaibandha district, PAB encourage community members venture onto transitional sandbars to sow pumpkin seeds. After each rainy season, large sand islands (char lands) appear in the main rivers of northwest Bangladesh. Cropping on the sandbars involves digging small pits in the sand and lining the pits with compost/manure to grow pumpkin, squash, and other high value crops and vegetables. Sandbar cropping has given displaced peoples a way to transform barren landscapes and mini deserts into productive croplands. Sandbar cropping has brought food security, nutritional security, improved livelihoods for extreme poor in northwest Bangladesh.

The study revealed that farmers in the char land were highly dependent on agriculture for their livelihood. They were not much educated. Their livelihood status was low but they are improving their livelihood by cultivating pumpkin on sandbar.

Purpose

Recently pumpkin is grown on sandbar on commercial basis in Tista river in northwest districts due to intervention of Practical Action Bangladesh, the latest information from farmers on yield, cost and return, price of pumpkin during harvesting should be available for the benefit of extensionists, specialists, project staff, policymakers, traders, exporters and relevant other users. Accordingly, AAS was undertaken an initiative to collect the relevant primary data for cost and return analysis of pumpkin in Rangpur and Kurigram districts during 20-26 October 2019.

Study area and respondents

Total of five villages were selected under three upazilas, of which three villages were selected in Gangachara upazila (Salapar, Mohipur Senpara and Chalapak Purbopar villages) in Rangpur district, one village was selected in Kaunia upazila (Talukshabaz Balapara villages) in Rangpur district and one village was selected in Ulipur upazila (Korpura Busunia para village) in Kurigram district by the study team for conducting the study on cost and return analysis for sandbar pumpkin cultivation (Table.1). The primary field data was collected from 5 successful and knowledgeable pumpkin farmers at five FGDs at five villages in Rangpur and Kurigram districts. The study area (Rangpur & Kurigram districts) is illustrated in Figure.1.

Table.1: List of five respondents at five villages in Gangachara and Kaunia upazilas of Rangpur district and Ulipur upazila of Kurigram district.

SL #	Farmer	Village	Upazila	District	Pumpkin variety
1	Md. Abdul Khaleque	Talukshabaz Balapara	Kaunia	Rangpur	Bangkok1 (F_1)
2	Md. Md. Ershadul	Salapar	Gangachara	Rangpur	Shera (F_1)
3	Md. Toyeb Ali	Mohipur Senpara	Gangachara	Rangpur	Shera (F_1)
4	Md. Chad Mia	Chalapak Purbopar	Gangachara	Rangpur	Shera (F_1)
5	Md. Rezaun Hossain	Korpura Bosunia Para	Ulipur	Kurigram	Bangkok1 (F_1)

Data collection, analysis and report preparation

Primary data for cost and return analysis for sandbar pumpkin cultivation was collected by Dr. Harun-Ar-Rashid, ED, AAS in collaboration with Mr. Rezaul Karim, IT, AAS from the five successful and knowledgeable farmers (Md. Abdul Khaleque, Md. Md. Ershadul, Md. Toyeb Ali, Md. Chad Miah and Md. Rezaun Hossain) using one page structured questionnaire developed by AAS. Thus, primary data was collected from the selected five successful and knowledgeable farmers at five villages in Gangachara and Kaunia upazilas of Rangpur district and in Ulipur upazila of Kurigram district. Of the total of five successful and knowledgeable farmers

interviewed, of which four farmers interviewed in Rangpur district and one farmer interviewed in Kurigram district (Table.1).

Collected primary data was finalized through validation with the opinion from the participated farmers at each of five locations (like as FGDs) in five villages in Rangpur and Kurigram districts. Collected data were cleaned for analysis and entered in MS Excel spread sheet and analysis was done using MS Excel and SPSS. Cleaned data of five farmers were presented in Appendix: I-V.

Report summarizing costs and returns analysis for sandbar pumpkin cultivation with interviewed five selected farmers along with other participated farmers at five locations through using the following data categories and definitions:

(a) Cost of production (Tk./ha) for sandbar pumpkin cultivation includes for labor for pit/canal preparation, labor for other cultivation practices, seed, organic fertilizer, chemical fertilizer, pesticide, irrigation uses, carrying, land rent and interest on working capital. The total cost is calculated on full cost basis (FCB) and cash cost basis (CCB) in taka per hectare.

(i) Full cost including: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer**,** 4**.** Chemical fertilizer, 5. Pesticide, 6. Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

(iI) Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5. Irrigation, 6. Carrying, 7. Land rent, 9. Interest on working

(b) Gross return (Tk/ha) is calculated by valuing harvested pumpkin at local market price.

(c) Net-return (Tk./ha) is calculated through subtracting the total cost from the gross return on full cost basis and cash cost basis.

(d) Benefit-cost ratios are calculated through dividing the gross return by the total cost on full cost basis and cash cost basis.

(e) Yields (T/ha) are calculated from the respondent farmers for pumpkin

(f) Crop produces (pumpkins) cost (Tk./kg) is calculated through dividing the total cost by the harvested yield in taka per kg on full cost basis cash cost basis.

(g) Crop produces sale price (Tk./kg) is calculated or recorded from the respondent farmers for pumpkin.

Findings

I. Cost and return of pumpkin

Table.2 presents the summary cost and return, benefit-cost ratio, pumpkin production cost and pumpkin sale price and Annex. I provides item-wise summary cost & return of sandbar pumpkin cultivation during 2018-19 winter season in Rangpur and Kurigram districts. Average gross-return was calculated Tk.164,840/ha counter to the average total cost of Tk. 208,903/ha and Tk.110,996/ha on full cost basis and cash cost basis respectively for sandbar pumpkin

cultivation. Among the five farmers, the highest gross return was calculated for Md. Ershadul (Tk.204,000/ha) followed by Toyeb Ali (Tk.186,000/ha), Abdul Khaleque (Tk.184,000/ha), Chad Miah (Tk.135,200/ha) and Rezaun Hossain (Tk.115,000/ha). Among the five farmers, the highest total cost was calculated for Rezaun Hossain (Tk.223,592/ha) followed by Toyeb Ali (Tk.220,496/ha), Md. Ershadul (Tk.210,915/ha), Abdul Khaleque (Tk.200,047/ha) and Chad Miah (Tk.189,464/ha) on full cost basis. Among the five farmers, the highest total cost was calculated for Rezaun Hossain (Tk.129,922/ha) followed by Chad Miah (Tk.128,162/ha), Toyeb Ali (Tk.112,592/ha), Md. Ershadul (Tk.96,596/ha) and Abdul Khaleque (Tk.87,657/ha) on cash cost basis.

The average negative net-return was calculated on full cost basis (-Tk.44,063/ha) and average positive net-return was calculated on cash cost basis (Tk.53,844/ha) for sandbar pumpkin cultivation. Among the five farmers, the highest negative net-return was calculated for Rezaun Hossain (-Tk.108,592/ha) followed by Chad Miah (-Tk.54,264/ha), Toyeb Ali (-Tk.34,496), Abdul Khaleque (-Tk.16,047/ha) and Md. Ershadul (-Tk.6,915/ha) on full cost basis. Among the five farmers, the highest net-return was calculated for Md. Ershadul (Tk.107,404/ha) followed by Abdul Khaleque (Tk.96,343/ha), Toyeb Ali (Tk.73,408/ha), Chad Miah (Tk.7,038/ha) and negative net-return was calculated for Rezaun Hossain (-Tk.14,972/ha) on cash cost basis.

The average higher benefit-cost ratio was calculated on cash cost basis (1:1.49) than full cost basis as negative benefit-cost ratio (1:0.79). Among the five respondent farmers, the lowest negative benefit-cost ratio was calculated for Rezaun Hossain (1:0:51) followed by Chad Miah (1:0.71), Toyeb Ali (1:0.84), Abdul Khaleque (1:0.92) and Md. Ershadul (1:.0.97) on full cost basis. Among the five respondent farmers, the highest benefit-cost ratio was calculated for Md. Ershadul (1:2.11) followed by Abdul Khaleque (1:2.10), Toyeb Ali (1:1.65), Chad Miah (1:1.06) and negative benefit-cost ratio was calculated for Rezaun Hossain (1:0.89) on cash cost basis.

Average about 13.78 t/ha pumpkin yield was observed for sandbar pumpkin cultivation for pumpkin hybrids in Rangpur and Kurigram districts during 2018-19 winter season. Among the five respondent farmers, the highest pumpkin yield was observed for Md. Ershadul (17.00 t/ha) followed by Abdul Khaleque (16.00 t/ha), Toyeb Ali (15.50 t/ha), Chad Miah (10.40 t/ha) and Rezaun Hossain (10.00 t/ha). The low yield of pumpkin per hectare was observed with five farmers in Rangpur and Kurigram districts mainly due to disease infection on crop during 2018-19 cropping season.

The average per kg production cost of pumpkin was found higher for full cost basis (Tk.15.16/kg) than cash cost basis (Tk.8.06/kg). Among the five respondent farmers, the highest per kg pumpkin production cost was found for Rezaun Hossain (Tk.22.36/kg) followed by Chand Miah (Tk.18.22/kg), Toyeb Ali (Tk.14.23/kg), Abdul Khaleque (Tk.12.50/kg) and Md. Ershadul (Tk.12.40/kg) on full cost basis. Among the five respondent farmers, the highest per kg pumpkin production cost was found for Rezaun Hossain (Tk.13.00/kg) followed by Chad Miah (Tk.12.32/kg), Toyeb Ali (Tk.7.26/kg), Md. Ershadul (Tk.5.68/kg) and Abdul Khaleque (Tk.5.48/kg) on cash cost basis.

Average about Tk.12.00/kg sale price of pumpkin was observed in Rangpur and Kurigram districts during 2018-19 winter season. Among the five respondent farmers, the highest per kg pumpkin sale price was observed for Chad Miah (Tk.13/kg) followed by Md. Ershadul/Toyeb Ali (Tk.12/kg) and Abdul Khaleque/Rezaun Hossain (Tk.11.50/kg). Low gross return and net-returns were observed due to low pumpkin yield per hectare and low pumpkin sale price per kg along with high production costs in Rangpur and Kurigram districts during 2018-19 winter season.

Table.2: Summary cost and return analysis for sandbar pumpkin cultivation with five farmers in Rangpur and Kurigram districts during 2018-19 winter season.

Item	Abdul Khaleque, Rangpur	Md. Ershadul, Rangpur	Toyeb Ali, Rangpur	Chad Miah, Rangpur	Rezaun Hossain, Kurigram	Average
Gross return (Tk/ha)	184,000	204,000	186,000	135,200	115,000	164,840
Total Cost (Tk/ha)						
(i) Full cost basis	200,047	210,915	220,496	189,464	223,592	208,903
(ii) Cash cost basis	87,657	96,596	112,592	128,162	129,922	110,996
Net-return (Tk/ha)						
(i) Full cost basis	(16,047)	(6,915)	(34,496)	(54,264)	(108,592)	(44,063)
(ii) Cash cost basis	96,343	107,404	73,408	7,038	(14,972)	53,844
Benefit-cost ratio						
(i) Full cost basis	0.92	0.97	0.84	0.71	0.51	0.79
(ii) Cash cost basis	2.10	2.11	1.65	1.06	0.89	1.49
Yield, Cost & Price						
(a) Yield (Kg/ha)	16,000	17,000	15,500	10,400	10,000	13,780
(b) Cost of Production (Tk./Kg)						
(i) Full cost basis	12.50	12.40	14.23	18.22	22.36	15.16
(ii) Cash cost basis	5.48	5.68	7.26	12.32	13.00	8.06
(c) Sale Price (Tk./Kg)	11.50	12.00	12.00	13.00	11.50	12.00

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer, 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

II. Proportion of cost item

Table.3 presents item-wise cost proportion of the total cost (Tk.208,903/ha) on full cost basis for sandbar pumpkin cultivation in Rangpur and Kurigram districts during 2018-19 cropping season. Among the eight cost items for sandbar pumpkin cultivation, the highest proportion of cost of the total cost on full cost basis (Tk.208,903/ha) was calculated for labor used (45.12%) followed in order by fertilizer used (21.83%), irrigation used (11.71%), interest on working capital used on full cost basis (8.26%), seed used (4.93%), land rent for six months (4.41%), pesticide used (1.89%) and carrying cost (1.84%). Of the total 21.83% fertilizer cost, of which 4.73% cost for organic fertilizer and 17.08% cost for chemical fertilizer. Among the five respondent farmers, the highest proportion of cost for labor was observed for Md. Ershadul (50.83%) followed by Abdul Khaleque (47.92%), Toyeb Ali (47.48%), Rezaun Hossain (43.69%) and Chad Miah (35.68%). Among the five respondent farmers, the highest proportion of cost for seed was observed for Abdul Khaleque (6.25%) followed by Chad Miah (5.54%), Toyeb Ali (4.76%), Md. Ershadul (4.48%) and Rezaun Hossain (3.53%). Among the five respondent farmers, the highest proportion of cost for fertilizers (organic and chemical fertilizers) was observed for Chad Miah (26.52%) followed by Rezaun Hossain (23.57%), Abdul Khaleque (21.06%), Toyeb Ali (20.45%) and Md. Ershadul (17.57%). Among the five respondent farmers, the highest proportion of cost for pesticide was observed for Md. Ershadul (2.37%) followed by Rezaun Hossain (2.15%), Chad Miah (2.11%), Toyeb Ali (1.81%) and Abdul Khaleque (1.00%). Among the five respondent farmers, the highest proportion of cost for irrigation was observed for Chad Miah (14.78%) followed by Rezaun Hossain (13.42%), Toyeb Ali (11.34%), Abdul Khaleque (10.50%) and Md. Ershadul (8.53%). Among the four respondent farmers, the highest proportion of cost for carrying was observed for Md. Ershadul (4.41%) followed by Rezaun Hossain (3.08%), Chad Miah (1.32%), Toyeb Ali (0.45%) and abdul Khaleque did not pay for carrying. Among five respondent farmers, the highest proportion of cost for land rent was observed for Chad Miah (5.81%) followed Toyeb Ali (5.44%), Abdul Khaleque (5.00%), Md. Ershadul (3.56%) and Rezaun Hossain (2.24%). The cost proportion for interest on working capital on full cost basis was observed at 8.26% for the five involved respondent farmers.

Table.3: Item-wise proportion of costs of the total cost on full cost basis of sandbar pumpkin cultivation with five farmers in Rangpur and Kurigram districts during 2018-19 winter season.

SL #	Cost Item	Abdul Khaleque, Rangpur		Md. Ershadul, Rangpur		Toyeb Ali, Rangpur		Chad Miah, Rangpur		Rezaun Hossain, Kurigram		Average	
		Amount (Tk./ha)	%	Amount (Tk./ha)	%	Amount (Tk./ha)	%	Amount (Tk./ha)	%	Amount (Tk./ha)	%	Amount (Tk./ha)	%
1	Labor	95,900	47.94	107,200	50.83	104,700	47.48	67,600	35.68	97,700	43.69	94,620	45.12
2	Seed	12,500	6.25	9,450	4.48	10,500	4.76	10,500	5.54	8,125	3.63	10,215	4.93
3	Fertilizer total	42,129	21.06	37,050	17.57	45,090	20.45	50,220	26.52	52,705	23.57	45,439	21.83
(a)	Organic fertilizer	16,800	8.40	8,400	3.98	10,000	4.54	2,160	1.14	12,500	5.59	9,972	4.73
(b)	Chemical fertilizer	25,329	12.56	28,650	13.58	35,090	15.91	48,060	25.37	40,205	17.98	35,467	17.08
4	Pesticide	2,000	1.00	5,000	2.37	4,000	1.81	4,000	2.11	4,800	2.15	3,960	1.89
5	Irrigation	21,000	10.50	18,000	8.53	25,000	11.34	28,000	14.78	30,000	13.42	24,400	11.71
6	Carrying	0	0	9,300	4.41	1,000	0.45	2,500	1.32	6,800	3.04	3,920	1.84
7	Land rent	10,000	5.00	7,500	3.56	12,000	5.44	11,000	5.81	5,000	2.24	9,100	4.41
8	Interest on working capital (FCB)	16,518	8.26	17,415	8.26	18,206	8.26	15,644	8.26	18,462	8.26	17,249	8.26
Total Cost		**200,047**	**100**	**210,915**	**100**	**220,496**	**100**	**189,464**	**100**	**223,592**	**100**	**208,903**	**100**

III. Proportion of labor use

Table.4 provides labor use type-wise proportion of the total number of labor use for sandbar pumpkin cultivation with five respondent farmers in Rangpur and Kurigram districts during 2018-19 winter seasons. Among the seven labor types used for sandbar pumpkin cultivation, the highest proportion of labor used of the total average labor used (245/ha) was calculated for irrigation (43.02%) followed by cow dung/compost collection, loading, unloading/carrying, drying, application etc (17.06%), Pit/Canal digging (12.57%), Pit preparation and seed sowing (8.90%), fertilizer top-dressing (7.51%), Pumpkin harvesting/carrying (7.18%), and pesticide spraying (3.76%). Among the five respondents farmers, the highest number of total labor used with seven types of activities for sandbar cultivation of Pumpkin was calculated for Toyeb Ali (292) followed by Abdul Khaleque (274), Md. Ershadul (258), Rezaun Hossain (222) and Chad Miah (169). Among the five respondent farmers, the highest proportion of labor used for pit/canal digging was observed for Chad Miah (26.63%) followed by Toyeb Ali (17.12%), Rezaun Hossain (9.01%), Md. Ershadul (8.58%) and Abdul Khaleque (6.20%). Among the five respondent farmers, the highest proportion of labor used for cow dung collection, loading, uploading/carrying, drying, application etc was observed for Md. Ershadul (21.71%) followed by Toyeb Ali (20.55%), Rezaun Hossain (18.05%), Abdul Khaleque (14.96%) and Chad Miah (7.10%). Among the five respondent farmers, the highest proportion of labor used for pit preparation and seed sowing was observed for Md. Ershadul (12.02%) followed by Toyeb Ali (10.27%), Chad Miah (8.88%), Rezaun Hossain (7.21%) and Abdul Khaleque (6.20). Among the five respondent farmers, the highest proportion of labor used for irrigation application was observed for Rezaun Hossain (50.45%) followed by Abdul Khaleque (47.45%), Md. Ershadul (44.57%), Toyeb Ali (37.67%) and Chad Miah (35.50%). Among the five respondent farmers, the highest proportion of labor used for fertilizer top-dressing was observed for Md. Ershadul (10.08%) followed by, Toyeb Ali (8.90%), Abdul Khaleque (7.66%), Chad Miah (5.92%) and Rezaun Hossain (4.05%). Among the five respondent farmers, the highest proportion of labor used for pesticide spraying was observed for Chad Miah (8.88%) followed by Rezaun Hossain (4.05%), Abdul Khaleque (2.92%), Toyeb Ali (2.74%) and Md. Ershadul (2.33%). Among the five respondent farmers, the highest proportion of labor used for pumpkin harvesting/carrying was observed for Abdul Khaleque (14.60%) followed by Rezaun Hossain (7.21%), Chad Miah (7.10%), Md. Ershadul (4.65%) and Toyeb Ali (2.74%).

Table.4: Labor use type-wise proportion of the total labor use for sandbar pumpkin cultivation with five farmers in Rangpur and Kurigram districts during 2018-19 winter season.

SL #	Labor use type	Abdul Khaleque		Md. Ershadul		Toyeb Ali		Chad Miah		Rezaun Hossain		Average	
		Labor (No./ha)	%	Labor (No./ha)	%	Labor (No./ha)	%	Labor (No./ha)	%	Labor (No./ha)	%	Labor (No./ha)	%
1	Pit/Canal digging	17	6.20	22	8.53	50	17.12	45	26.63	20	9.01	30.80	12.57
2	Cow dung collection, loading, unloading/carrying, drying, application, etc	41	14.96	56	21.71	60	20.55	12	7.10	40	18.02	41.80	17.06
3	Pit preparation & seed sowing	17	6.20	31	12.02	30	10.27	15	8.88	16	7.21	21.80	8.90
4	Irrigation application	130	47.45	115	44.57	110	37.67	60	35.50	112	50.45	105.40	43.02
5	Fertilizer top dressing	21	7.66	26	10.08	26	8.90	10	5.92	9	4.05	18.40	7.51
6	Pesticide spraying	8	2.92	6	2.33	8	2.74	15	8.88	9	4.05	9.20	3.76
7	Pumpkin harvesting / Carrying	40	14.60	12	4.65	8	2.74	12	7.10	16	7.21	17.60	7.18
Total Cost		**274**	**100**	**258**	**100**	**292**	**100**	**169**	**100**	**222**	**100**	**245**	**100**

Conclusions and recommendations

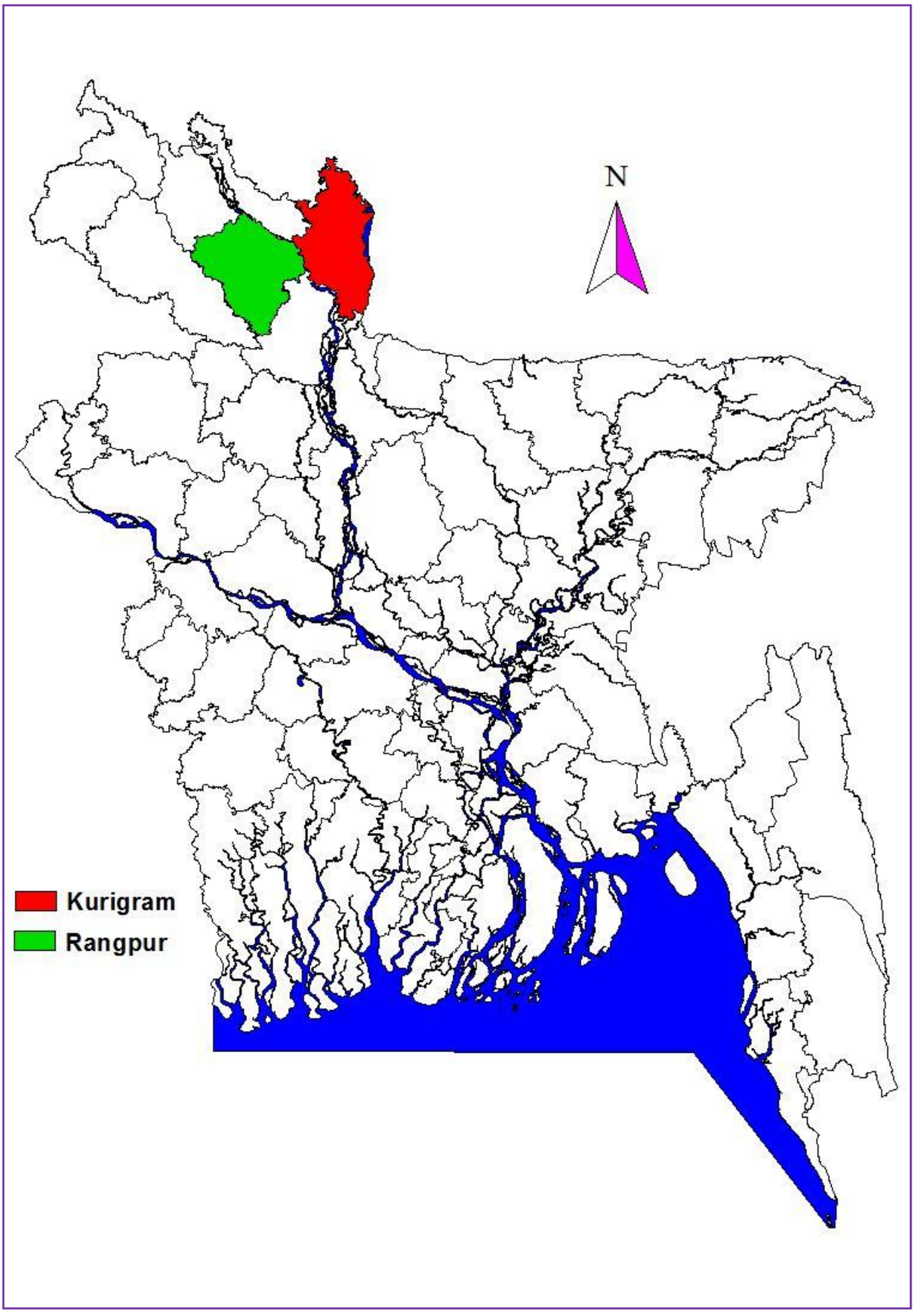
Conclusions

Cost and return of sandbar pumpkin cultivation in Rangpur and Kurigram districts during 2018-19 winter season is revealed as low gross return along with the negative net-return on full cost basis and low net-return on cash cost basis and these might be due to low pumpkin yield (mainly due to various diseases infection), low price of harvested pumpkin and high production cost. Accordingly, sandbar pumpkin cultivation is found as a low value vegetable crop with high production cost and this might be due to mainly use of higher number of labor man-day per hectare, higher cost of fertilizers per hectare and higher irrigation cost per hectare. Sandbar pumpkin cultivation is found as highly labor intensive cultivation method and as very hard work in general and women in particular.

Recommendations

1. Seed of disease resistant and high yielding hybrid pumpkin varieties need to make available through informal field demonstration on the sandbars in Tista River.
2. Quality seed of the accepted hybrid pumpkin varieties need to make available among the farmers in the pumpkin growing charland areas in northwest districts of the country.
3. Practical training for the lead and progress farmers involved for sandbar pumpkin cultivation on the important diseases and pests of pumpkin need to be provided through community approaches through involving local pesticide dealers. Factsheets/leaflets on each of the plant health problem need to be distributed among the trained and motivated lead and progressive farmers in charlands under the leadership of the pesticide dealers.
4. To ensure the highest sale price of the harvested pumpkins, the better markets linkages along with the embroiling other acceptable marketing approaches need to be ascertained in the pumpkin growing charland areas.
5. Government need to ensure the tax free working capital for the poor sandbar pumpkin growers
6. Short term or long-term land right need to be established for the farmers for sandbar pumpkin cultivation in sandbars of Tista river areas in northwest districts of the country.

Figure.1: Location Map of Rangpur and Kurigram districts



Annex. I: Item-wise summary cost and return analysis of Sandbar pumpkin cultivation of five farmers during 2018-19 winter season in Rangpur and Kurigram districts

SL #	Item	Average Cost-return (Tk/ha)
1	Labor	94,620
2	Seed	10,215
3	Fertilizer	45,439
4	Crop Protection	3,960
5	Irrigation	24,400
6	Carrying	3,920
7	Land rent	9,100
8	Interest on working capital	
	a) Full cost basis	17,249
	b) Cash cost basis	14,472
A. Total Cost		
	a) Full cost basis	208,903
	b) Cash cost basis	110,996
B. Gross and Net return:		
	Gross return (Tk./ha)	
	a) Main product (Pumpkin)	164,840
	Net return (Tk./ha)	
	a) Full cost basis	(44,063)
	b) Cash cost basis	53,844
C. Benefit-Cost Ratio		
	a) Full cost basis	0.97
	b) Cash cost basis	1.49
D. Yield, cost & price		
	(a) Pumpkin Yield (Kg/ha)	13,780
	(b) Pumpkin Production Cost (Tk./kg)	
	a) Full cost basis	15.16
	b) Cash cost basis	8.06
	(c) Pumpkin Sale Price (Tk/kg)	12.00

A. Cash cost basis: 1. Labor (10%), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer, 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

Appendix. I: Cost and return for sandbar pumpkin cultivation

Farmer Name: Md. Abdul Khaleque Village: Talukshabaz Balapara Upazla: Kaunia

District: Rangpur Variety: Bangkok 1 (F_1) Cell: 01984809126

SL #	Item	Quantity/ ha	Price (Tk.)	Cost-Income (Tk./ha)
A. Cost				
1	Labor use (No.):			
	(a) Pit/canal digging	17	350	5,950
	(b) Cow dung collection, loading, un-loading, carrying, drying, application etc	41	350	14,350
	(c) Pit preparation & seed sowing	17	350	5,950
	(d) Irrigation	130	350	45,500
	(e) Fertilizer top-dressing	21	350	7,350
	(f) Pesticides spraying	8	350	2,800
	(g) Pumpkin harvesting & carrying	40	350	14,000
	Total (a-g) (No.)	274	-	95,900
2	Seed use (gm)	1000	12.50	12,500
3	Fertilizer use			
	(i) Organic fertilizer:			
	(a) Cow dung/ Compost (Trolley)	24	700	16,800
	(ii) Chemical fertilizer			
	(b) Urea (kg)	370	16	5,920
	(c) TSP (kg)	495	27	13,365
	(d) MOP (kg)	165	16	2,640
	(e) Gypsum (kg)	124	6	744
	(f) Zinc Sulphate (kg)	7	180	1,260
	(g) Borox (kg)	4	200	800
	(h) Magnesium Sulphate (kg)	-	-	600
	Total fertilizer cost (i+ii)			42,129
4	Disease & Insect Control	-	-	2,000
5	Irrigation	-	-	21,000
6	Carrying			-
7	Land Rent			10,000
8	Total Cost (1-7)			183,529
9	Interest on working capital (9%)			16,518
10	Total Cost (8+9)			
	(a) Full cost basis			200,047
	(b) Cash cost basis			87,657
B. Gross return & net return				
	Gross return			
	(a) Main product (Kg)	16,000	11.50	184,000
	Net return			
	(a) Full cost basis			(16,047)
	(b) Cash cost basis			96,343
C. Benefit-Cost Ratio				
	(a) Full cost basis			0.92
	b) Cash cost basis			2.10

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer , 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

Appendix. II: Cost and return for sandbar pumpkin cultivation

Farmer Name: Md. Md. Ershadul Village: Salapar Upazla: Gangachara

District: Rangpur Variety: Shera (F_1) Cell: 01930325622

SL #	Item	Quantity/ ha	Price (Tk.)	Cost-Income (Tk./ha)
A. Cost				
1	Labor use (No.):			
	(a) Pit/canal digging	22	400	8,800
	(b) Cow dung collection, loading, un-loading, carrying, drying, application etc	56	400	22,400
	(c) Pit preparation & seed sowing	31	400	12,400
	(d) Irrigation	115	400	46,000
	(e) Fertilizer top-dressing	26	400	10,400
	(f) Pesticides spraying	6	400	2,400
	(g) Pumpkin harvesting	12	400	4,800
	Total (a-g) (No.)	258	400	107,200
2	Seed use (gm)	900	10.5	9,450
3	Fertilizer use			
	(i) Organic fertilizer:			
	(a) Cow dung/ Compost (Kg)	21,000	0.40	8,400
	(ii) Chemical fertilizer			
	(b) Urea (kg)	450	17	7,650
	(c) TSP (kg)	400	27	10,800
	(d) MOP (kg)	300	16	4,800
	(e) Gypsum (kg)	-	-	-
	(f) Zinc Sulphate (kg)	30	180	5,400
	(g) Borox (kg)			
	(h) Magnesium Sulphate (kg)			
	Total fertilizer cost (i+ii)			37,050
4	Disease & Insect Control	-	-	5,000
5	Irrigation	-	-	18,000
6	Carrying (Trolley) for Cow dung)	10	300	9,300
7	Land Rent			7,500
8	Total Cost (1-7)			193,500
9	Interest on working capital (9%)			17,415
10	Total Cost (8+9)			
	(a) Full cost basis			210,915
	(b) Cash cost basis			96,596
B. Gross return & net return				
	Gross return			
	(a) Main product (Kg)	17,000	12.00	204,000
	Net return			
	(a) Full cost basis			(6,915)
	(b) Cash cost basis			107,404
C. Benefit-Cost Ratio				
	(a) Full cost basis			0.97
	b) Cash cost basis			2.11

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer , 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

Appendix. III: Cost and return for sandbar pumpkin cultivation

Farmer Name: Md. Toyeb Ali Village: Mohipur Senpara Upazla: Gangachara

District: Rangpur Variety: Shera (F_1) Cell: 01815588293

SL #	Item	Quantity/ ha	Price (Tk.)	Cost-Income (Tk./ha)
A. Cost				
1	Labor use (No.):			
	(a) Pit/canal digging	50	400	20,000
	(b) Cow dung collection, loading, un-loading, carrying, drying, application etc	60	350	21,000
	(c) Pit preparation & seed sowing	30	350	10,500
	(d) Irrigation	110	350	38,500
	(e) Fertilizer top-dressing	26	350	9,100
	(f) Pesticides spraying	8	350	2,800
	(g) Pumpkin harvesting	8	350	2,800
	Total (a-g) (No.)	292	369	104,700
2	Seed use (gm)	1000	10.50	10,500
3	Fertilizer use			
	(i) Organic fertilizer:			
	(a) Cow dung/ Compost	-	-	10,000
	(ii) Chemical fertilizer			
	(b) Urea (kg)	450	17	7,650
	(c) TSP (kg)	560	27	15,120
	(d) MOP (kg)	545	16	8,720
	(e) Gypsum (kg)	-	-	-
	(f) Zinc Sulphate (kg)	20	180	3,600
	(g) Borox (kg)			
	(h) Magnesium Sulphate (kg)			
	Total fertilizer cost (i+ii)			45,090
4	Disease & Insect Control	-	-	4,000
5	Irrigation	-	-	25,000
6	Carrying (Trolley for pumpkin)	-	-	1,000
7	Land Rent			12,000
8	Total Cost (1-7)			202,290
9	Interest on working capital (9%)			18,206
10	Total Cost (8+9)			
	(a) Full cost basis			220,496
	(b) Cash cost basis			112,592
B. Gross return & net return				
	Gross return			
	(a) Main product (Kg)	15,500	12.00	186,000
	Net return			
	(a) Full cost basis			(34,496)
	(b) Cash cost basis			73,408
C. Benefit-Cost Ratio				
	(a) Full cost basis			0.84
	b) Cash cost basis			1.65

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer , 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

Appendix. IV: Cost and return for sandbar pumpkin cultivation

Farmer Name: Md. Chad Miah Village: Chalapak Purbopar Upazla: Gangachara

District: Rangpur Variety: Shera (F_1) Cell: 01775986020

SL #	Item	Quantity/ ha	Price (Tk.)	Cost-Income (Tk./ha)
A. Cost				
1	Labor use (No.):			
	(a) Pit/canal digging	45	400	18,000
	(b) Cow dung collection, loading, un-loading, carrying, drying, application etc	12	400	4,800
	(c) Pit preparation & seed sowing	15	400	6,000
	(d) Irrigation	60	400	24,000
	(e) Fertilizer top-dressing	10	400	4,000
	(f) Pesticides spraying	15	400	6,000
	(g) Pumpkin harvesting	12	400	4,800
	Total (a-g) (No.)	169	-	67,600
2	Seed use (gm)	1000	10.50	10,500
3	Fertilizer use			
	(i) Organic fertilizer:			
	(a) Cow dung/ Compost (kg)	3,600	0.60	2,160
	(ii) Chemical fertilizer			
	(b) Urea (kg)	600	17	10,200
	(c) TSP (kg)	1,200	27	32,400
	(d) MOP (kg)	150	16	2,400
	(e) Gypsum (kg)	150	6	900
	(f) Zinc Sulphate (kg)	12	180	2,160
	(g) Borox (kg)	-	-	-
	(h) Magnesium Sulphate (kg)	-	-	-
	Total fertilizer cost (i+ii)			50,220
4	Disease & Insect Control	-	-	4,000
5	Irrigation	-	-	28,000
6	Carrying (Trolley for cowdung)	5	500	2,500
7	Land Rent			11,000
8	Total Cost (1-7)			173,820
9	Interest on working capital (9%)			15,644
10	Total Cost (8+9)			
	(a) Full cost basis			189,464
	(b) Cash cost basis			128,162
B. Gross return & net return				
	Gross return			
	(a) Main product (Kg)	10,400	13.00	135,200
	Net return			
	(a) Full cost basis			(54,264)
	(b) Cash cost basis			7,038
C. Benefit-Cost Ratio				
	(a) Full cost basis			0.71
	b) Cash cost basis			1.06

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer , 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital

Appendix. V: Cost and return for sandbar pumpkin cultivation

Farmer Name: Md. Rezaun Hossain Village: Korpura Bosunia Para Upazla: Ulipur

District: Kurigram Variety: Bangkok-1 (F_1) Cell: 01788270746

SL #	Item	Quantity/ ha	Price (Tk.)	Cost-Income (Tk./ha)
A. Cost				
1	Labor use (No.):			
	(a) Pit/canal digging	20	350	7,000
	(b) Cow dung collection, loading, un-loading, carrying, drying, application etc	40	350	14,000
	(c) Pit preparation & seed sowing	16	350	5,600
	(d) Irrigation	112	350	39,200
	(e) Fertilizer top-dressing	9	350	3,150
	(f) Pesticides spraying	9	350	3,150
	(g) Pumpkin harvesting	16	350	5,600
	Total (a-g) (No.)	222	-	97,700
2	Seed use (gm)	650	12.50	8,125
3	Fertilizer use			
	(i) Organic fertilizer:			
	(a) Cow dung/ Compost (kg)	17,860	0.70	12,500
	(ii) Chemical fertilizer			
	(b) Urea (kg)	750	17	12,750
	(c) TSP (kg)	685	27	18,495
	(d) MOP (kg)	560	16	8,960
	(e) Gypsum (kg)	-	-	-
	(f) Zinc Sulphate (kg)	-	-	-
	(g) Borox (kg)	-	-	-
	(h) Magnesium Sulphate (kg)	-	-	-
	Total fertilizer cost (i+ii)			52,705
4	Disease & Insect Control including trap	-	-	4,800
5	Irrigation	-	-	30,000
6	Carrying (Boat for cowdung)	-	-	6,800
7	Land Rent			5,000
8	Total Cost (1-7)			205,130
9	Interest on working capital (9%)			18,462
10	Total Cost (8+9)			
	(a) Full cost basis			223,592
	(b) Cash cost basis			129,972
B. Gross return & net return				
	Gross return			
	(a) Main product (Kg)	10,000	11.50	115,000
	Net return			
	(a) Full cost basis			(108,592)
	(b) Cash cost basis			(14,972)
C. Benefit-Cost Ratio				
	(a) Full cost basis			0.51
	b) Cash cost basis			0.89

A. Cash cost basis: 1. Labor (10 %), 2. Seed, 3. Chemical fertilizer, 4. Pesticide, 5.Irrigation, 6. Carrying, 7. Land rent, 8. Interest on working capital

B. Full cost basis: 1. Labor (100 %), 2. Seed, 3. Organic fertilizer , 4. Chemical fertilizer, 5. Pesticide, 6.Irrigation, 7. Carrying, 8. Land rent, 9. Interest on working capital