Research in
AGRICULTURE, LIVESTOCK and FISHERIES
ISSN : P-2409-0603, E-2409-9325
An Open Access Peer-Reviewed Journal

Open Access **Res. Agric. Livest. Fish.**
Research Article **Vol. 6, No. 1, April 2019 : 79-90.**

SOCIO-ECONOMIC STATUS AND RATIONALE OF MANGO CULTIVATION BASED ON SOME SELECTED AREAS IN RAJSHAHI DISTRICT OF BANGLADESH

Asma Yeasmin Sampa[1]*, Md. Ariful Alam[2], Md. Abdul Latif[3] and Md. Masbaul Islam[2]

[1]Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka-1207;
[2]Department of Agribusiness and Marketing, Sher-e-Bangla Agricultural University, Dhaka-1207;
[3]Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

***Corresponding author:** Asma Yeasmin Sampa; E-mail: sampa92agec@gmail.com

ARTICLE INFO

Received
27 February, 2019

Accepted
24 April, 2019

Online
30 April, 2019

Key words:
Profitability
Demographic
Socio-economic condition
Problem confrontation index
Northern region

A B S T R A C T

The study was conducted among 104 mango producer through primary data collection to assess the profitability in mango production, demographic and socio-economic condition of farmers in four villages of Northern region of Bangladesh. The study encompasses the comparison of cost and profit of other crop with mango cultivation. Most farmers depend on mango production because the climate is unfavorable for field crop production but very conducive for mango cultivation in Barind ecosystem. Problem Confrontation Index (PCI) was used to measure the problems of mango production. On the basis of PCI formula, out of the 16 problems, insects and diseases infestation was identified as the major problem with PCI 429 followed by dropping of fruits and flowers with PCI 409. Lack of better varieties/ Seedling/ grafts, modern technology and climate change was also three major problems with PCI 387, 193 and 276 respectively. Cost and return analysis of mango production revealed that 10 mango varieties are founds as profitable with the higher working investment and human labor development. Cultivator had to spend 106659 taka for one hectors of land or 120 mango trees and average profit was 299010. Average profit from mango cultivation (299010Tk/ha) was higher than Average profit from onion cultivation (260412Tk/ha).Most farmers (about 87%) practiced intercropping with mango. the cost incurred by Harvesting, Sorting and Grading of mango cultivation was more than other crops. Although respondents certified that Rajshahi district is profitable in respect of mango production further study should be taken place with other variables and characteristics.

To cite this article: Sampa A. Y., M. A. Alam, M. A. Latif and M. M. Islam, 2019. Socio-economic status and rationale of mango cultivation based on some selected areas in Rajshahi district of Bangladesh. Res. Agric. Livest. Fish. 6 (1): 79-90.

INTRODUCTION

Bangladesh is situated between latitude 20°34N and 26°38N and longitude 88°01E and 92°41E, with a total land area of 1,47,610 square km. The country of mostly flat topography is characterized by highly variable amounts of rainfall. Bangladesh is Agro based country which is divided with 30 AEZ (Agro Economical Zone) on the basis of topography and climate conducive to different crop cultivation. Rajshahi belongs to AEZ-25 (Barind Tract). Socio-economic condition of Bangladesh fully depends on production of Agricultural goods. Fruit contributes 10% income of the national economy and 1-2% land covered of the total cultivable land in Bangladeh (Mondal et al., 2011). Per capita per day fruit intake is 44.7 gram at national level and that of 42.6 gram for rural areas (HIES, 2010) as compared to the minimum requirement of 100 g/capita (FAO/WHO, 2003; BAN-HRDB, 2007). The national production and area of fruits were 5067798 million ton and 388857 acres, respectively (BBS, 2017). The cultivation of mango has gaining momentum among the farmers in the Rajshahi region (especially in Barind area) due to its low water requirement, favorable agro-ecological conditions, ready market and profitability. In Bangladesh, mango ranks 2nd in terms of area followed by banana and 1st in terms of production. Bangladesh produces 1288315 metric tons of mangoes annually from 102939 acres of land (BBS, 2017). Mango (*Mangifera indica L*.) belongs to the family Anacardiaceous, is an important and popular fruit of Bangladesh. It has a unique position in respect of nutritional quality, taste, consumer's preference etc., among the fifty kinds of fruits grown in Bangladesh (Ahmad, 1985).Mango grows well in all types of soil with suitable pH range from 5.5 to 7.0 (Whiley, 1984), but it can be grown commercially up to pH 8.5 with proper nutritional management. It can grow well within the temperature ranging 24-30°C (Corbineau et al., 1986).The fruit has really of immense value in respect of money and prosperity. In Bangladesh it is called as "King of the fruit" (Ahmed, 1994).

Research on Mango production is not adequate particularly in Bangladesh. (Alam et al., 2017) estimated Production Performance of Mango in Dinajpur District of Bangladesh. Climate Change Adaptation and Economic Profitability (Sarker et al., 2014), Comparative profitability analysis (Khandoker et al., 2017) of shifting land from field crops to mango cultivation; Trend and Output Growth Analysis (Uddin et al., 2016), Scenario of Major Fruits Production and Marketing System (Dewan et al., 2015) of Major Fruits in Chittagong Region; analysis of Mango Marketing System (Matin et al., 2008); in Chittagong Hill Tracts of Bangladesh were reviewed. The present study was undertaken with a view to have an understanding about the status of mango production, mango varieties produced, problems confronted by the grower and to explore their relationship with some selected characteristics. However, the present study was conducted to identify the socio demographic status of the Mango cultivators and to identify the problems facing in production and marketing of mango. In addition, the overall costing and return benefit of mango production was also measured.

MATERIALS AND METHODS

This study was conducted at Northern region of Bangladesh. Keeping in mind the objectives of the study and considering the adjacent limitations data were collected from four upazila eg. Bagha, Charghat, Puthia, Durgapur upazilas under Rajshahi district. Data required for the present study were collected from primary and secondary sources. Primary data were obtained from Mango farmers. Secondary data were collected from various published sources e.g. Bangladesh Bureau of Statistics (BBS), Ministry of Environment, Bangladesh Bank (BB) and other related agencies in Bangladesh. Simple random sampling technique was used in sampling Mango producer from the population. Survey was conducted from January to March, 2018 based on a semi-structured questionnaire designed for mango producers. Data were entered into computer through MS Excel and the analysis was performed using SPSS (Statistical Package for Social Sciences) computer package. Descriptive analysis such as range, number, percentage, mean, and rank order were used whenever possible.

Descriptive Analysis

Tabular and Graphical techniques of analysis were generally used to find out the socio demographic profile of the respondent, to determine the cost, returns and profitability of mango farmers. It was used to get the simple measures like average, percentage etc.

Problem confrontation in mango production

The respondents were asked about the problems they faced during the cultivation on mango. An item was prepared in the interview schedule. The problems obtained from them were categorized into 6 types viz. very severe, severe, moderately severe, moderate, negligible, not at all. Problem Confrontation Index (PCI) was measured for each problem-item with help of the following formula:

$$PCI = Pvs \times 5 + Ps \times 4 + Pms \times 3 + Pm \times 2 + Png \times 1 + Pn \times 0$$

Where,

PCI = Problem Confrontation Index
Pvs = No. of respondents confronted very severe problem
Ps = No. of respondents confronted severe problem
Pms = No. of respondents confronted moderately severe problem
Pm = No. of respondents confronted moderate problem
Png = No. of respondents confronted negligible problem
Pn = No. of respondents confronted no problem at all

RESULT AND DISCUSSION

Respondents education status

Most of the farmer were literate,but accurate percentage were calculated among them.The observed education of the respondents ranged from primary to ssc and above. On the basis of general education, the respondent were classified into four categories. The majority (33.65 %) of respondents were in the SSC level followed by SSC & Above (28.84 %) and illiterate (19.23 %). The lowest proportions of respondents (18.26 %) were primary level. The literacy percentage of the study area is under national average. But the trend of literacy percentage is becoming higher as the Secondary level indicates the second highest percentage.

Status of recognized mango varieties

Thirteen (13) recognized mango varieties were cultivated by the growers of the selected study area. Table 1 indicated the status of the varieties. Lokna ranked 1st as it occupied the highest percentage (20 %) out of total mango varieties which was followed by Kirsapat(Himsagor) (19 %) which ranked 2nd, Langra (17 %) which ranked 3rd.the occupied percentage for Fazli (13 %), Ashwina (11 %), Amrapali(10%), Gopalbhog (3 %), Arajam (2%), Dudhsor(1.5%), Tutapori(1.2%), Harivanga(1%), Mohonbhog(0.8%) and Kachamitha (0.5%) which ranked 4th ,5th ,6th ,7th ,8th ,9th ,10th ,11th .12th and 13th, respectively.

Family income earner

The highest proportion of family members had no income earner except only one person and the percentage of their number was about 41% .Other members were dependent on that person. About 40% family had another income earner who helped the head of family and remaining 19% family had another two income earners with the head.

Amount of land under mango cultivation

The observed range of total cultivable land size for mango production of the respondents was from 20-600 decimal. On the basis of total cultivable land size, the respondents were classified into ten categories.

Land ownership and utilization pattern

Analysis showed highest percentage of farmers that is about 95.2 percent of mango farmers used only their own land for mango cultivation. About 2.9 percent used their own and rented land, about 2 percent used their own &leased in land for mango production. Table 2 shows oownership of cultivable land and experience of farmers in mango cultivation.

Table 1. Ranking Status of Mango Varieties of the sample farmer

Mango Varieties	Percentage	Ranking Status
Lokna	20	1st
Kirsapat(Himsagor)	19	2nd
Langra	17	3rd
Fazli	13	4th
Ashwina	11	5th
Amrapali	10	6th
Gopalbhog	3	7th
Arajam	2	8th
Dudhsor	1.5	9th
Tutapori	1.2	10th
Harivanga	1	11th
Mohonbhog	0.8	12th
Kachamitha	0.5	13th
Chusa	0.3	14th
Asari	0.3	15th
Vadri	0.2	16th
Athi amm	0.2	17th

Source:Field survey 2018

Table 2. Land ownership and experience in mango production

Land ownership	Respondents	Percentage
Own land	99	95.2
Own and Rented in	3	2.9
Own and leased in	2	1.9
Experience in mango production(years)		
Low (<10)	15	14.30
Medium (10-20)	67	63.80
High (>20)	22	21.90

Source: Field survey 2018

Experience in mango production

The observed experience in mango production of the respondents ranged from 4 to 32 years. On the basis of experience in mango production, the respondents were classified into three categories as shown in table 2. Data shown in the table 2 indicated that the highest percent of respondents about 63.80 % had medium experience (10-20 years) followed by the respondents about 21.90 % having high (>20 years) experience. Rest about 14.30 % of respondents had low experience (<10 years).

Problems in mango production

On the basis of Problem Confrontation Index (PCI) formula, out of the 16 problems, insects and diseases infestation was identified as the major problem followed by dropping of fruits and flowers. Scarcity of better varieties/ Seedling/ grafts, Climate change and Lack of modern technology were also three major problems faced by mango farmers in case of mango production. The observed problem confrontation index of the problems ranged from 50 to 429. 1st, 2nd, 3rd, 4th and 5thranked problems with their PCI are shown below.

Table 3. Ranking of Problems in Mango Production

SL. No.	Problem items	PCI	Rank order
1	Insect and disease infestation	429	1st
2	Dropping of fruits and flowers	409	2nd
3	Scarcity of better varieties/ Seedling/ grafts etc	387	3rd
4	Climate change	276	4th
5	Lack of modern technology	193	5th

Source: Field survey 2018

Average dose of fertilizer

After establishing a mango garden cultivator should use different types of fertilizer for better fruiting and profit. Respondents used mainly MoP, TSP, and Urea fertilizer. Their fertilizer use ratios were as like Urea: TSP: MoP=1.5: 2: 1. The highest amount of fertilizer used by mango farmers was TSP and they used 21kg/decimal or 21kg/16 mango trees followed by Urea which was used about 16 kg/decimal or 16kg/16 mango trees. Lowest amount indicated the use of MoP and they used 9kg/decimal or 9kg/16 mango trees.

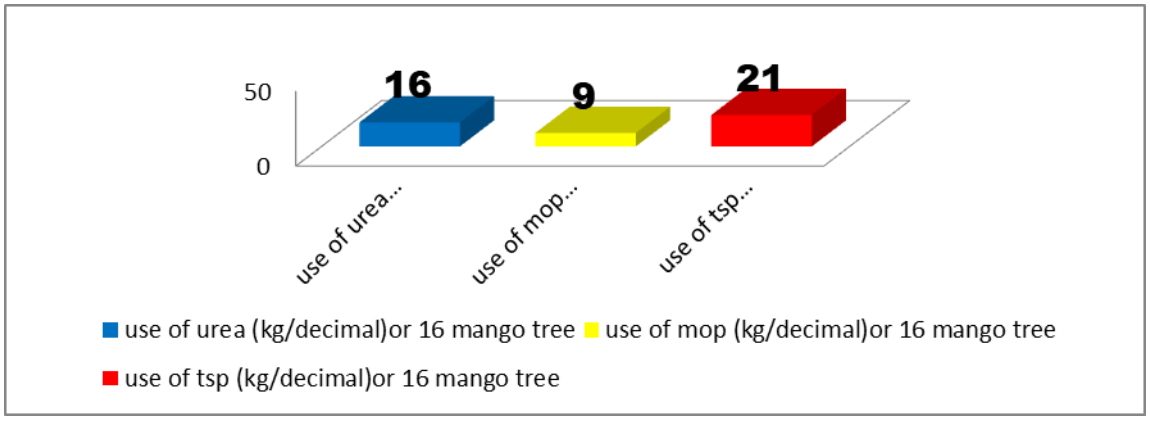

Figure 1. Use of fertilizer dose, Source: Field survey 2018

Fertilizer usage

It was observed that all of the respondents about 100% used cow dung and compost to the mango trees while about 95% of used the respondents Urea and TSP individually. MP was used by 94% of the respondents respectively according to the collected data.

Average Cost and Profit

Data represented that every cultivator had to spend 106659 taka for one hectors of land or 120 mango trees. Maximum part of the cost incurred for fertilizer labor cost, pesticides. But it had less impact on profitability of the farm. More than 30 respondents spent tk 50000-80000 followed by 110000-140000 taka was spent by about 30 respondents. Highest cost about tk140000-180000 was spent by 25 respondents. Average cost of mango cultivation is 106659.

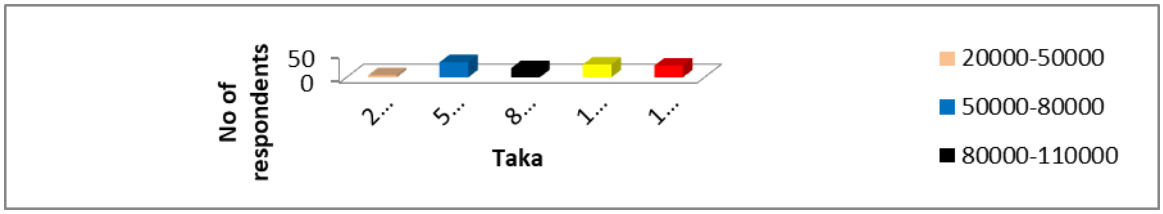

Figure 2. Average cost without considering land rent.
Source: Field survey 2018

On the other hand average profit was 299010 taka but it varies from 299010 to 300000 taka on the basis of respondents from 120 mango trees or from one hector. Only 1 respondent earned profit of 450000-500000 Tk. and maximum number of respondents earned a profit of 200000-250000 tk followed by 250000-300000tk by 26 respondents from 120 mango trees or from one hector.

Profit comparison between mango and onion cultivation

As farmers in the study areas were much interested in mango cultivation, it was common perception that it was highly profitable crop. Although profitability of mango cultivation was measured in this study, farmers' perception about comparative profitability was also revealed .Farmers also cultivated onion in their land. They felt better by cultivating onion in their land as they thought it kept their land good. Though cultivation of mango provided them more profit they didn't accept it easily. Causes were many like they didn't want to change their lands sizes and shapes. It also needed money costing for preparing land for cultivating Mango. As Mango provided them more profit even more than cultivation of Guava farmer changed their mind and also changed their Land shapes. A lot of fixed cost incurred at the beginning of the project. Average profit from mango cultivation was higher than Average profit from onion cultivation which amount was Tk. 299010 per hectare and 260412 per hectare respectively. As a result farmer thought twice about their decision. The results were shown on a Table 4.

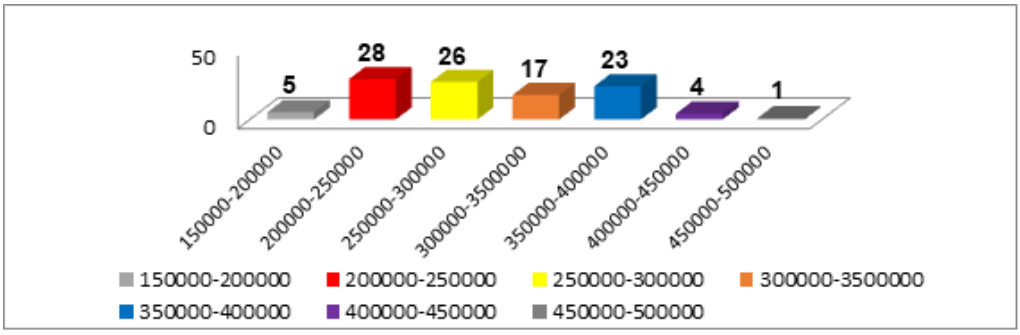

Figure 3. Average profit without considering land rent.
Source: Field survey 2018

Table 4. Average profit from mango and onion cultivation; Intercropping.

Particulars	**Taka/Hector**
Average profit from mango cultivation	299010
Average profit from onion cultivation	260412
Items	**Percentage of respondents**
Intercropping with mango	87
Not intercropping	13

Source: Field survey 2018

Intercropping with mango

Most farmers (87%) in the study areas practiced intercropping with mango (Table 5).Only about 13% farmers was not interested in intercropping with mango. It was found that a large number of crops were grown as intercrops in the mango field. Among the intercrops, majority of the farmers (22%) preferred intercropping with sweet gourd followed by Turmeric (20%) and Black gram (20%) respectively in the selected areas. Farmers were not used to cultivate Papaya in that area. Only about 12% farmers preferred Brinjal and Bitter gourd respectively in intercropping with mango. Minority of the farmers (6%) preferred intercropping with Guava followed by Lentil (20%) (Table 4).

Comparison of cost of plant materials of mango and other crops when planting

The study found out farmers perception about cost of mango plant materials compared to other crops cultivation. The highest percentage of farmers more than (53%) mentioned that cost of mango plant materials was lower than other crops. On the other hand, about 47% farmers responded negatively and said that cost of mango plant materials was higher than other crops.

Table 5. Comparison of mango with other crops

Topic	**Respondents**	
Comparison with other cops	Less (%)	More (%)
Cost of plant materials	53	47
Cost of planting	62	38
Necessities of fertilization and Irrigation	89	11
Necessities of Pesticide use	69	31
Harvesting, Sorting, Grading cost of mango	79	21
Labor cost	5	95
Analysis of weather condition	32	68
Yield	11	89

Source:Field survey 2018

Comparison of cost of planting of mango with other crops

The study found out farmers perception about cost of mango cultivation compared to other crops cultivation. The highest percentage of farmers more than (62%) mentioned that cost of mango cultivation was lower than other crops. On the other hand, about 38% farmers responded negatively and said that planting cost of mango was higher than other crops.

Comparison of necessities of fertilization and Irrigation

In case of analysis of the necessities of fertilizer and Irrigation about 89% of the respondents agree that Mango cultivation required less fertilization and irrigation than any other crops. On the other hand only about 11% told that cultivation of Mango required more fertilization and irrigation than other crops (Table 5).

Comparison of necessities of Pesticide use

The study found out farmers perception about the necessities of use of pesticides. The highest percentage of farmers that was about (69%) respondents was agreed that mango cultivation required more use of pesticides than other crops. On the other hand only about 31% farmers response negatively and said that cultivation of mango required less pesticides than other crops (Table 5).

Comparison of Harvesting, Sorting and Grading cost of mango and other crops

The study found out farmers perception about the necessities of Harvesting, Sorting and Grading of mango. The highest percentage of farmers that was about (79%) respondents was agreed that the cost incurred by Harvesting, Sorting and Grading of mango cultivation was more than other crops. On the other hand only about 21% farmers response negatively and said that cultivation of mango required less cost of Harvesting, Sorting and Grading than other crops(Table 5).

Comparison of labor cost in Mango cultivation and other crop cultivation

On the basis of Comparison of labor cost in Mango cultivation and other crop cultivation, the answers of the respondents were classified into three categories as shown in table. An alarming data were founded here about 98% of the respondents agreed that the labor cost incurred by mango cultivation was higher than any other crops. About 4% of them answered negatively and told that cultivation of mango required less labor cost than other crops and only about 1% of them told that it required same labor cost as other crops (Table 5).

Comparison of weather condition for Mango cultivation

The study found out farmers perception about weather condition for mango cultivation compared to other crops cultivation. The highest percentage of farmers more than (68%) mentioned that weather is favorable factor for cultivation of Mango than other crops. On the other hand, about 32% farmers responded negatively and said that weather is not favorable factor for mango cultivation (Table 5).

Comparison of yield of mango and other crops

On the basis of Comparison of yield of mango and other crops, the answers of the respondents were classified into two categories e.g. same to other crops and more than othercrops as shown in table In case of analyze the yield comparison of mango and other crops the highest percentage of farmers about 89% responded that yield of Mango was far greater than the yield of other crops. On the other hand only about 11% of them told that the yield was same to the yield of other crops (Table 5).

Reasons for shifting land to mango cultivation

Farmers in the study areas were asked to mention the reasons behind mango cultivation in the crops land. Respondent farmers mentioned that higher profit compared to other crops (71%) was the main reason for cultivating mango (Table10). About 57% farmers mentioned the lower price of other crops as an important factor of shifting. Easy cultivation process (49%) was opined to be the third reasons. As Rajshahi was in Barind region, farmers of this district reported that lack of irrigation facility for rice was the main reason to about 58% respondents. Some farmers (37%) preferred mango because they could cultivate more than one crop in mango field (intercropping) which also influenced them to cultivate mango. Suitability of land for mango rather than other crops (43%), not requiring extra care (31%), and the lower yield of other crops (26%) were mentioned as the reasons for cultivating mango.

Table 6. Reasons for shifting to mango cultivation

Reasons	Percentage of respondents
Higher profit	71
Lower price of other crops	57
Easy cultivation process	49
Lack of irrigation facility for rice	58
Non-suitable land for other crops	43
Lower yield of other crops	26
Not required extra care	31
Can cultivate two crops at a time(Intercropping)	37

Source: Field survey 2018

Fellow land used for mango cultivation

The study found out farmers perception about Fellow land used for mango cultivation. The highest percentage of farmers more than (60%) mentioned that they can use fellow land for Mango cultivation but on the other hand about 39% of them told fellow land could not be used for commercial mango cultivation (Table 6).

Share cropping with Mango and other crop cultivation

The study found out farmers perception about the cropping pattern of Mango and other crop cultivated in this region. The highest percentage of farmers more than (56%) told that they would like to practice share cropping with Mango cultivation even its possible in case of commercial cultivation. Share cropping practice is an important alternative source of earnings for Mango cultivator in the earlier period as they don't get any benefit even for the first 3-4 years. They earn money that time from other shared crop. On the other hand about 43% respondent answered in negative and said that they could not use share cropping with mango (Table 6).

Disease infection as a constraint for Mango cultivation

In case of analysis of the disease infection as a constraint for mango cultivation the study found out farmers perception related to Mango and other crop cultivated in this region and the highest percentage of farmers about 91% responded that it was a major constraint for mango cultivation on the other hand only about 9% of them told it was not a major problem faced by them in case of mango cultivation (Table 6).

Return at the earlier period of Mango cultivation

The study found out farmers perception about the return at the earlier period of cultivation. Result found that the highest percentage of farmers about 83% of the respondents argued that in case of mango cultivation return at the earlier period in first 3-4 years after mango cultivation was very lower amount than other crops. On the other hand, only about 21% of the respondents told that cultivation of Mango can produce low amount of return at the earlier period (Table 6).

Marketing channels

Marketing channels are the alternative roots of products flow from producers to consumers (Kohls and Uhl, 1980). In the study areas, the mango moved from the producer seller to the consumers through some market intermediaries, such as Bairals, Beparis, Aratdars (both local and urban) and retailers (both local and urban). According to the volume of mango handled and participation of the intermediaries in the channel, six channels were identified as dominant in the study areas as shown in Table 7.

Table 7. Mango runs through the major channels in selected areas

Marketing Channels	Percent of product run	Rank
Owner/ Producer - Bepari- Aratdar- Wholesaler- Retailer- Consumers	25	1st
Owner/ Producer - Bepari- Aratdar- Wholesaler- Consumers	15	2nd
Owner/ Producer - Faria- Bepari- Aratdar- Wholesaler- Consumers	14	3rd
Owner/ Producer - Faria- Bepari- Aratdar- Wholesaler- Retailer -Consumers	10	5th
Owner/ Producer - Processing unit-Consumers	12	4th
Owner/ Producer - Retailer -Consumers	8	6th

Source: Field survey 2018

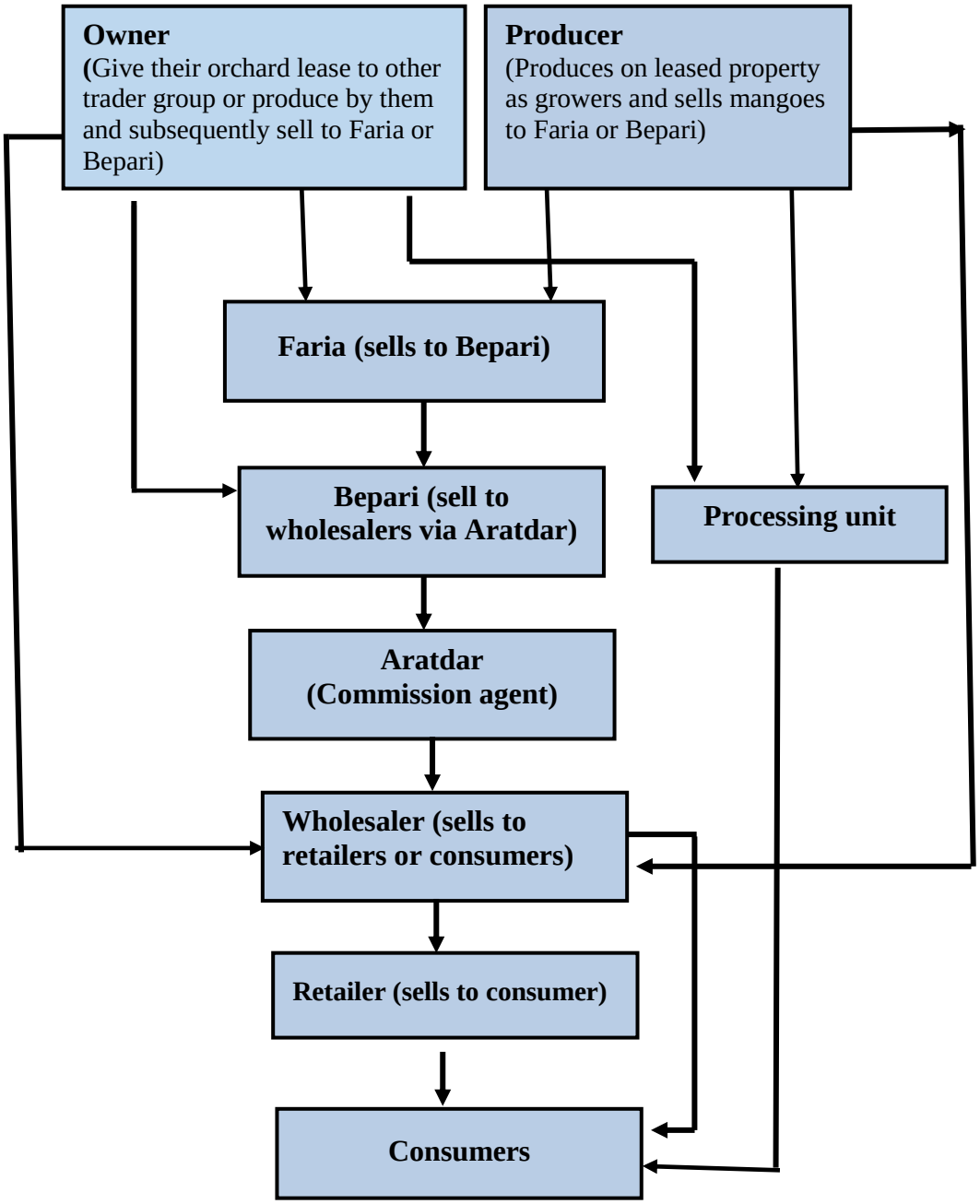

Figure 4. Typical marketing channel of mango

Source: Field survey of 2018

Problems faced by the farmers

Table 8. Problems faced by the farmers, traders

Production Problems of farmers	**Problem level(%) according to farmers**		
	Acute	**Tolerable**	**General**
Lack of knowledge	90	10	
Non-availability of credit	22	4	74
Insufficiency of credit	26	6	68
Low prices of output	72	26	2
High prices of inputs	65	35	4
Lack of human labor	75	17	8
Lack of quality variety /cultivar	50	30	20
High prices of fertilizer and insecticides	87	9	4
Lack of storage facilities	53	36	11
Problem of theft	55	32	13
Inadequate extension service	60		
Marketing Problems of Farmers	**Rank of Problems**		
Inadequate transport facility	1		
Higher cost of transportation	2		
Preservation problem	3		
Lack of feeder roads	4		
Lack of shed in the market	5		
Post-Harvest loss	6		
Strike / Political unrest	7		
Marketing Problems of Traders	**Rank of Problems**		
Unstable price	1		
Selling on credit	2		
Lack of capital	3		
Lack of market place	4		
High transport cost	5		
Lack of market information	6		
Lack of processing center	7		
Lack of processing plant	8		

Source: Field survey 2018

CONCLUSION

In Bangladesh, mango ranks 2nd in terms of area followed by banana and 1st in terms of production. Bangladesh produces 1288315 metric tons of mangoes annually from 102939 acres of land (BBS, 2017).However; Bangladesh's potential for mango production is not yet fully exploited. To improve this situation, many issues along the whole mango value chain need to be addressed. Suitable, high quality planting material e.g. cultivar is a prerequisite for improving the mango value chain. Research on this issue is

urgently needed and should focus first on evaluation and characterization of available rootstock and scion varieties to select the most suitable ones for efficient dissemination to farmers in Barind track. Second, the number of mango varieties should be increased by importing material from advanced mango producing countries. Third, Supply of HYV's plant materials as a Solution for better yielding and better profitability should be enhanced. Fourth, training should be provided to the people as a Solution for better yielding and better profitability. Finally, the most promising mango varieties need to be further improved by systematic breeding programs for their better adaptation to present and future environmental and socioeconomic conditions in Bangladesh.

REFERENCE

1. Alam MJ, Momin MA, Ahmed A, Rahman R, Alam K, Islam AJ, Ali MM, 2017. Production Performance Of Mango In Dinajpur District Of Bangladesh (A case study at sadar Upazilla) European Journal of Agriculture and Forestry Research, 5: 16- 57.
2. Ahmed AKMA, 1994. Production Technology of Mango. Horticultural Research Centre, BARI, Joydebpur, Gazipur 1701, Bangladesh. pp. 122.
3. BBS, 2018. Year Book of Agricultural Statistics of Bangladesh 2017. Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh. www.bbs.gov.bd
4. Bangladesh Economic Review, 2018. Bangladesh Economic Review, Division of finance, Ministry of Finance, Government of the Peoples' Republic of Bangladesh, Bangladesh Secretariat, Dhaka.
5. BAN-HRDB, 2007. Bangladesh Applied Nutrition and Human Resource Development Board [Cited by Haque MA, 2010. Role of Indigenous Fruits in Food and Nutritional Securities in Bangladesh, Keynote speech presented at the National Workshop, BARC, Dhaka, Bangladesh, 16 June 2010].
6. Corbineau F, M Kante and D Come,1986. Seed germination and seedling development in the mango (*Mangifera indica* L.). Tree Physiology, 1 (2): 151-160.
7. Dewan B, Alam MN, Sarker F, 2013. Scenario of major fruits production and marketing system in chittagong hill tracts study based on Khagrachhari hill district, Bangladesh. International Journal of Economics, Commerce and Management, 3(5): 966-977.
8. Khandoker S, Miah MAM, Rashid MA, Khatun M and Kundu ND, 2017. Comparative profitability analysis of shifting land from field crops to mango cultivation in selected areas of Bangladesh. Bangladesh Journal Agricultural Research, 42(1): 137-158
9. Kohls RL and JN Uhl, 1980. Marketing of Agricultural Product. Fifth Edition: Macmillan Publishing Co., INC.
10. Matin MA, Baset MA, Alam QM, Karim MR and Hasan MR, 2008. Mango marketing system; In selected areas of Bangladesh. Bangladesh Journal of Agricultural Research, 33(3): 427-438.
11. Mondal MR, Islam MS, Islam MAJ, Bhuiyan MM, Rahman MS, Alam and Rahman MHH, 2011. Khrishi Projukti Hatboi (Hand Book of Agro-technology) (Part-2), 5th ed. Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. P. 1
12. Sarker F, Biswas JC, Maniruzzaman M, 2014. Climate Change Adaptation and Economic Profitability: Crop Land Shifting to Mango Orchard in Rajshahi Region. Bangladesh Rice Journal, 18(1&2): 8-17.
13. Uddin MJ, Dey SR, Taslim T, 2016. Trend and output growth analysis of major fruits in Chittagong region of Bangladesh. Bangladesh Journal of Agricultural Research, 41(1): 137-150.
14. Whiley AW, 1984. *In:* Tropical tree fruits for Australia (compiled by P. E. Page), Qd. Dept. Prim. Indus. Inform. Series Q183018. P. 25.