PROFITABILITY ANALYSIS OF DATE PALM MOLASSES COMMERCIALIZATION IN SELECTED PLACES OF JASHORE, BANGLADESH

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*This is to certify that thesis entitled, "**PROFITABILITY ANALYSIS OF DATE PALM MOLASSES COMMERCIALIZATION IN SELECTED PLACES OF JASHORE, BANGLADESH**" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE** in **AGRICULTURAL STATISTICS**, embodies the result of a piece of bona fide research work carried out by **MD. RAKIBUL HASAN**, Registration No. **13-05699** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

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Gratitude to my parents, siblings

and those beloved people

who are continue to mean so much to me

LIST OF ACRONYMS AND ABBREVIATIONS

AEZ	Agro-Ecological Zone
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BCR	Benefit Cost Ratio
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
HVAPs	High value Agricultural Products
SPSS	Statistical Package for Social Science
UN	United Nations

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Md. Rakibul Hasan

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PROFITABILITY ANALYSIS OF DATE PALM MOLASSES COMMERCIALIZATION IN SELECTED PLACES OF JASHORE, BANGLADESH

ABSTRACT

The objectives of this paper were to explore socio-economic profile and measure profitability analysis of date palm molasses producing households. Primary data collection was carried out at three upazila of Jashore district along with fifteen key queries. This research was based on field data purveyed from 75 households following purposive sampling technique. Cobb-Douglas production function was applied to determine the effects of premediated cost factors on molasses commercialization. Tapping tree contract, earthen sap pot, labor wage, firewood and marketing cost factors had significant impact on molasses turnover. Large scale production (BCR 2.21) was explored more profitable than marginal scale (BCR 1.88). The average market prices were attained BDT 232.93/kg (large scale) and BDT 219.90/kg (marginal scale). Almost 98% respondents privileged with nutritious food intake and had over 80% significant impact on livelihood and societal security. Finally, some perplexities were distinguished including adultrated molasses presence in market, lack of efficient artisans, theft plausibility and quality date palm saps shortage along with compatible suggestions to reincarnate such signature.

CHAPTER 01

INTRODUCTION

1.1. **Background of the study**

With the advent of winter, in Bangladesh, the land of cultural festive and foodie hospitality, date palm molasses appeared as blessing to all the classes in society. Molasses is an amorphous form of unrefined and non-distilled sugar prepared from the sap or the juice of plants that contains a considerable amount of sucrose or sugar. Moreover, it is immense sources vit B, Mg, K and Fe that relieves common ailments like cold and cough, boosts energy, restores healthy digestion (Rangaswami 1977, Parvin *et al.,* 2015). Khejur Gur (liquid date palm jaggery/molasses - made from boiling the sap from date palms) is one of the best delicious food items in Bengal during the wintertime (Purkait, 2019).

Every winter, gachis (date juice extractors) collect date juice, condense the juice by heating it and make date molasses (Hossen, 2021). Later, they sell that in the nearest markets or direct to final desired customers. It changes lots of households by making them solvent, bringing smiles on their faces. There are lot of date trees at the agrarian fields and roadsides in most of the southern region. Nowadays, many people nurture date trees commercially to meet the anticipated upward demand (Zaman, 2021).

Phoenix sylvestris also identified as silver date palm, sugar date palm or wild date palm, is a species of flowering plant in the palm family native to most of India, Sri Lanka, Myanmar and Bangladesh (USDA, 2020). ranges from 4 to 15 m in height and 40 cm in diameter and soil requirement pH 6-8 (Riffle and Craft, 2003)

A date tree gives juice, cooking materials, molasses and other products mostly at 7-14 years (Halim *et al.,* 2008). Male trees give more saps than female trees. A household may meet its annual family needs with getting profit doing the seasonal

molasses business. Hajong *et al.* (2016) found that 100 liters of saps could produce 16.67 kg of molasses or 15 kg of patali. In addition, Khatun *et al.* (2011) explored several places and found BCR 3.00 on average with no need of extra care of the trees (Zaman, 2021). Therefore, a decent profit margin was observed in molasses manufacturing (Sanoy, 2009).

Due to such a promising economic point of assessment, households are more enthusing in this heritage decision based on the several economic as well as nutritional livelihood factors (Hajong *et al.*, 2016; Halim *et al.*, 2008; Khatun *et al*., 2011; Sanjoy, 2009; Zaman, 2021). Thus, an effort has been made to study some of key economic factors such tapping tree contract cost, firewood and inflaming accessories cost, artisans cost, earthen pot/pitcher cost and marketing cost that stimulate the household revenue in detail. However, this signature task confronts some perplexities that interrupt to attain a broad range and sustainable conclusion (Dharmaraj and Selvamariammal, 2019; Pareek, 2015; Seraj, 2017)

1.2. **Research questions**

A good research question locates the entire research task focused, relevant and feasible. Following explicit and rational questions are demonstrated to conduct the current study.

a. What living standard do the study area molasses producers belong to?

b. Which factors influence up to what level in the producer revenue generation?

c. Which perplexities appear more and how enhance production range?

This paper is structured with a chronological step to depict the current queries with pertinent and rational scenarios.

1.3. **Objectives of the study**

Keeping view above viewpoints, the current study makes an effort to illustrate the ensuing objectives in accordance with the study queries:

a. To explore the socio-economic profile of molasses producer households;
b. To observe the factor's influence on producers' revenue;
c. To find out the perplexities and applicable suggestions at the root level.

1.4. **Justification of the study**

Diversified seasons and multi facet festivals make Bangladesh to experience varietal sweet and cake at household level all the year round. Additionally, different roadside stall and well-decorated restaurant had been aroused to keep pace with escalating customer demand. Due to traditional flavor preference and health concern issues, rural signature date saps molasses has obtained a level of luster again. This entails date palm tree hub households are making effort to meet the demand fruitfully. However, several production and marketing level constraint make situation worsen. Moreover, molasses production cannot match up the minimum cost with the maximum revenue and this leads adverse condition for the marginal level. This notion procreates the current research theme to explore the cabalistic factors associated with producer revenue so that overall expenditure depiction can be plausible along with profit margin measurement. Furthermore, such profitability analysis was hardly found that interpret the socio-economic content of this signature substance. Finally, the outcomes outlined from this exploration are anticipated to be expedient to the academic researchers and extension policy makers to promote strategies and approaches for effective expansion actions.

1.5. **Research framework**

This study comprises five major chapters. At first, Chapter 1 demonstrates the elementary info on current study. Next, previous study and exploration outcome as well as deficiencies are portrayed in the chapter 2 section. Following that materials and methods (chapter 3) leads pathway of the entire study comprising with sampling and data collection techniques, regression model installation, study reliability and ethics. Chapter 4 depicts the result and discussion of present exploration. Finally, chapter 5, the conclusion and summary will cover up the entire research and depict the key findings. Furthermore, compatible suggestions, study limitations and scope for farther research will be delineated.

CHAPTER 02

REVIEW OF LITERATURE

Attempts had been furnished to compile secondary data for constructing an inclusive literature review from several sources keeping apposite with study purposes.

2.1. **Signature heritage of Date Palm plant and molasses**

Winter in Bengal generally appeared as foggy quiescent morning. In village, people from all ages gather together to ignited firewood having rural cake on to their platelet. A bit on the cake containing raw saps or molasses made by the mothers' hand in the parky morning is amusing.

From ancient time period, Bengal province was glorified with date palm juice or molasses for diurnal consumption (Purkait, 2019). Famous philologist Panini was astonished at molasses tradition and Bengal hospitalities and his writings '*Gurasha auang desho goura'* was the first black and white clue of molasses heritage at 4th century BC (Bhowmik, 2020). However, date palm plant and molasses were popularized on early 19th centuries when British empire this to the outer nations (Banerjee and Khan, 2021).

Phoenix sylvestris also known as silver date palm, Indian date, sugar date palm or wild date palm, is a species of flowering plant in the palm family native to southern Pakistan, most of India, Sri Lanka, Nepal, Bhutan, Myanmar and Bangladesh (USDA, 2020). ranges from 4 to 15 m in height and 40 cm in diameter and soil requirement pH 6-8 (Riffle and Craft, 2003).

In Bangladesh, date plants are easily found at river or canal embankment, road side, agrarian land corner, homestead yard or someone's orchard (Halim et al., 2008). Tapping of the palms for sap production starts from mid-October and continues to

mid-March (Halim *et al.*, 2008). Usually palms of more than 5 years are selected for tapping and tapping initiated with a skillful operation. Soften portion was cut by sharpen knife and earthen pot/pitcher was placed for containing exudate. After harvesting saps, this juice was further processed and entailed in lucrative molasses.

According to the type of molasses, this molasses is divided into Jhola molasses, Danagur, Pataligur and Chitagur (Hossen, 2021). This molasses is used to make a variety of traditional cakes or dishes in our country which are incomparable in taste and smell. Some of the foods are vapa pitha, payes, kheer, dudhchitui pitha, dudhpuli pitha, palm pitha, molasses jilapi, semai, shorbat, molasses tea. However, the best food made with this molasses in Bangladesh is steamed cake (Hossen, 2021). In addition, in the winter, a small bhapa pitha shop is set up in the alleys of the city from where the people of the city also satisfy their cravings.

With rapid population growth and significant health concern issue arouse, date palm molasses superseded the concurrent sugarcane molasses (Khatun *et al*, 2011). Molasses date palm (1 g) contains 660 milligram of sugar, 10 milligram of protein, 10 milligram of fat and 790 milligrams of carbohydrate (Alanazi, 2010). Furthermore, natural sugar content has nutritional value than industrial processed sugar.

Therefore, traditional flavor preference and health concern issues arose, rural signature date saps molasses had obtained a new level of luster & commercialization of date palm plant as well as molasses incarnated (Alanazi, 2010; Halim *et al.,* 2008; Hossen, 2021; Khatun *et al*, 2011; Riffle and Craft, 2003)

2.2. **Date palm molasses commercialization**

To meet the market demand traditional molasses producing pattern has turned into commercial form. Several traditional marginal scale producers were submerged and distinguished large scale household exposed. As urban dwellers enlisted such signature substance in their diurnal winter consumption, commercialization of date palm saps as well as molasses had acquired the vanquished throne again. A seven steps molasses production and marketing are portrayed underneath:

Step 1: At first molasses producer came into agreement with the date palm tree. Agreement may be on direct advanced seasonal payment, or dividing the harvested raw saps in premediated proportional rate, or providing finished molasses up to a predetermined figure to the tree owner. However, molasses producing households got privileged if they have own date palm orchard. Agreement had done before the month of winter season appeared.

Step 2: The leaves and stalks at the very top of the tree stem are cleaned towards the end of Agrahayan before collecting the sap (Hossen, 2021). In the cleaned part, small holes are made and bamboo pipes are buried hoping the saps can come out in the tube. Then, hanging earthen pot/pitchers were placed to contain the exuded saps overnight at daybreak (Salam, 2019).

Step 3: Saps collectors, locally known as Gachi (artisans) were employed to harvest raw saps and bring that signature juice towards molasses producing household yard (Rana *et al.* 2009). Meanwhile, household initiated their activities (including washing boiling and condensing substances, firewood ignition) since early morning.

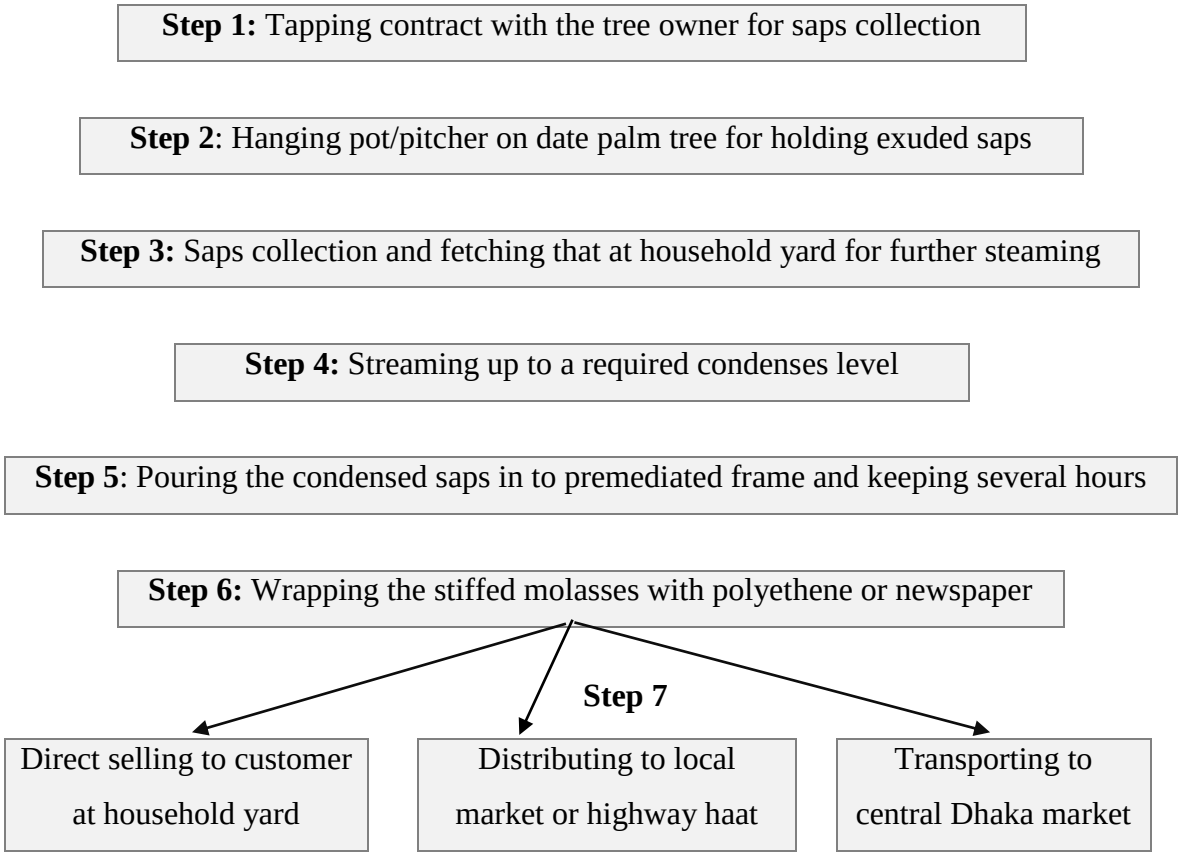

Figure 01: Flowchart of molasses commercialization inside national border (researchers own portrait) (Sources: Hossen, 2021; Purkait, 2019; Salam, 2019)

Step 4: Steaming activities were done up to late morning. Water colored raw saps turned into golden reddish condensed item. Sometimes, additional aroma flavor ingredients such as cardamom, sesame, cattle milk, bay leaves powder). For achieving more stiffed molasses, crumble sugar was mixed.

Step 5: After aforementioned boiling, condensed juice was churned and poured into several frame/molds and kept aside for at least 4-5 hours. Entire frame/molds were covered with thin cotton cloth to prevent undesired dust entrance.

Step 6: Wrapping the stiffed molasses with polyethene or newspaper depending on marketing nature. Otherwise, produced molasses were preserved into clay vessels with a traditional method for several days before marketing.

Step 7: Three major ways for molasses marketing done by household. They had to distribute their molasses to the local market but preferred to transport central Dhaka market for earning more value. Sometimes, visitors from several distinguished places often arrived at household yard and purchased to their desired requirements.

These are the common scenarios of every winter morning in the explored area. As more promotion expanded, the sale range enriched.

2.3. **Profitability of Date palm molasses**

Producing molasses with date juice has become a fortune changer for many households and also a significantly infusing dynamism in the rural economy. It created income opportunities for numerous households during the lean period of agriculture in this country.

Antecedently, **Hajong *et al.* (2016**) found that 100 liters of juice could produce 16.67 kg of molasses or 15 kg of patali in Magura and Jashore. Saps harvest was highest 250 liters in a season and at least BDT 150 per kg finished molasses could be earned at grass root level **(Islam and Miah, 2004**). This study also portrayed four key agents including farmer, processor, bepari and retailer in processing and marketing of date palm juice and molasses (Hajong *et al.* 2016).

Additionally, **Halim *et al*. (2008)** explored that palms 7-14 years old growing in the agricultural fields and ails produced most sap (2.5 liter, on average each night). The large-scale producer earned the highest average seasonal income (over 38 thousand BDT) from the date palm products, however the relative contribution to income from palm products was the highest (78%) among the marginal producers.

Meanwhile, **Khatun *et al.* (2011)** connoted that about 6.5 liters raw saps contributed 1 kg molasses. Date palm molasses production entailed 88% IRR with undiscounted benefit-cost ratio 3.00.

Besides, **Sanjoy (2009)** found selling price over BDT 135 per kilogram molasses at producer level whereby it costed about BDT 90 per kilogram. A good profit margin was observed in molasses manufacturing.

Furthermore, **Zaman (2021)** explored that country produced around 20,000 tons of date molasses in each year. Household could produce 20 to 25 kg of molasses from a single date tree in a season and earn BDT 2,000-3,000 from a tree with no need of extra care of the trees.

Therefore, aforementioned studies established that the seasonal income of the producers from date palm husbandry was a significant portion of their mean annual income and played an important role in the livelihoods in southwestern rural Bangladesh (Hajong *et al.,* 2016; Halim *et al.,* 2008; Khatun *et al.,* 2011; Sanjoy, 2009; Zaman, 2021)

2.4. **Major perplexities in molasses production and marketing**

Major barriers were identified including stealing outbreak, lack of quality saps, lack of gachi and efficient artisan, plausible contamination of dust and bat saliva (Pareek, 2015). Seraj (2017) explored two additional problems of adulterated molasses presence at market and lack of respective authority supervision. Furthermore, Dharmaraj and Selvamariammal (2019) put more emphasis on promotional as well as feasible advanced training deficiency and environmental stress aspects.

2.5. **Earlier study gaps**

Frequent comprehensive evidence and significant researches had been observed to estimate date palm molasses profitability in response to vicinity. However, cumulative studies were found absent that expressed the aforementioned contextual factors behind molasses revenue generation. Therefore, an effort has been made to study the predominant factors that influence the molasses household revenue. On the contrary, concurrent restraints need to be depicted with time compatible actions to reach on effective resource utilization.

CHAPTER 03

MATERIALS AND METHODS

Methodology is the blood vein and artery of any study. Therefore, methodology along with facile informative questionnaire (including most of the quantitative data) has performed the role of pathway for this inclusive study. The methods and materials tracked in pointing this research are being described underneath:

3.1. **Contextual framework of the Study**

In methodological study, selection and reckon of variables is a key task. The contextual framework of Rosenberg and Hoveland (1960) was trailed while establishing layout for the dependent and independent variables which is exposed in Figure 02. This present study is attempted to focus on two scenarios: the first, the exclusive factors influencing producer revenue and benefits as well as constraints confronted due to such cultivation.

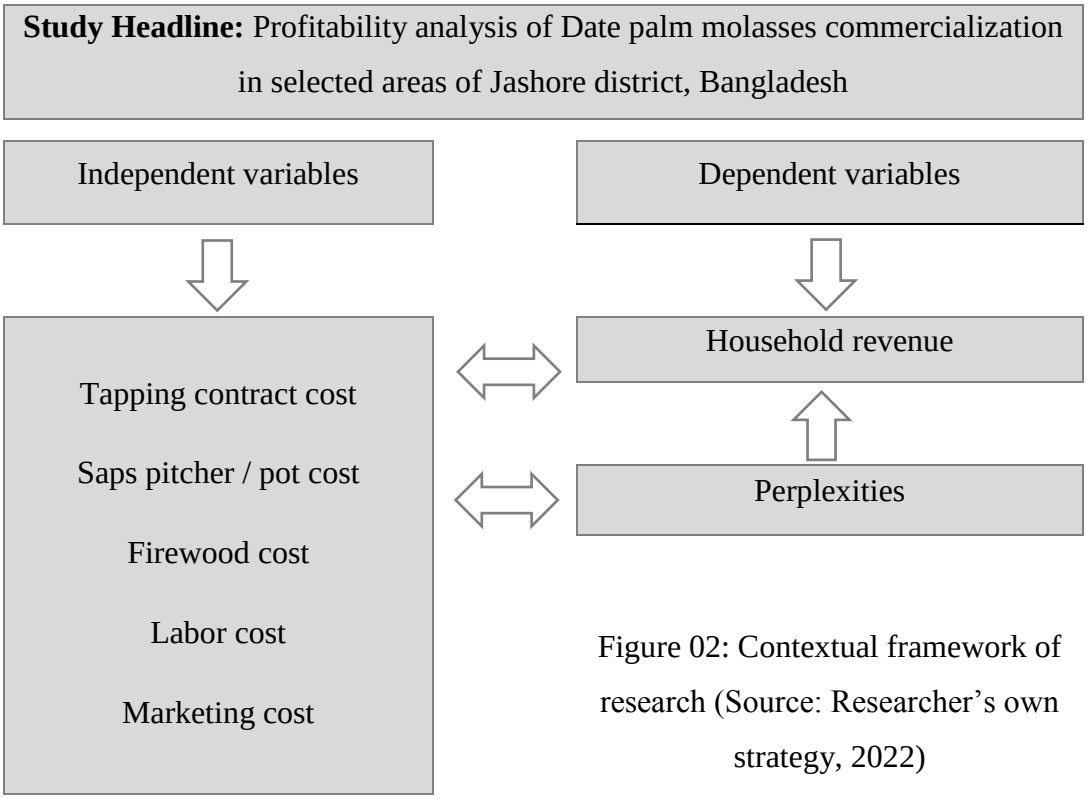

Figure 02: Contextual framework of research (Source: Researcher's own strategy, 2022)

3.2. **Study locations**

The study was operated in three several upazila of Jashore district. The explored areas belong to the AEZ of 'High Ganges River Floodplain'. This district is located at 88°40′ to 89°50′ E and 22°47′ to 23°47′ N (Siddiqui, 2011). In this study region almost 40% of the working population is involved in agriculture (BBS 2020).

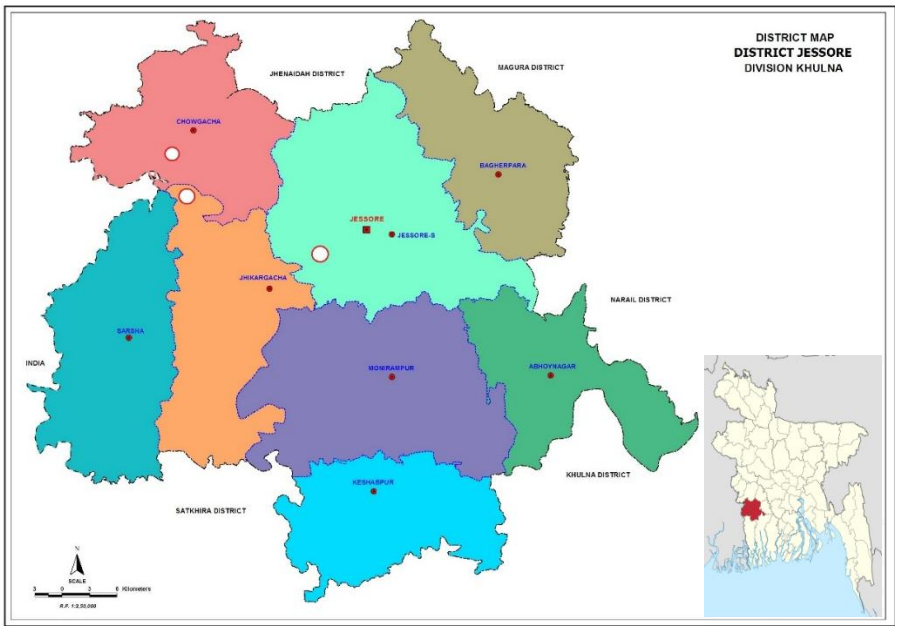

Figure 03: Survey locations at Jashore districts (Signified with inner white and bold red colored circumference)

Antecendently, Das *et al*. (2010) conducted research work on past and present scenario of date palm cultivation, its profitability and socio-economic characteristics of date palm's farmer in Jessore district. Therefore, this survey area is selected for exploring present situation after a long decade.

3.3. **Sampling Module and Sample Size**

A two-stage purposive sampling design was trailed to accumulate sample respondents for this study. At the initiative stage, three adjacent upazila (including Jhikorgacha, Sadar, Chougacha) were carefully chosen.

After that, one union was selected from each upazila for detailed data collection. Ganganandapur from Jhikorgacha, Chanchra from Sadar and Hakimpur from Chougacha. Finally, a total of 35 households including at least 10 from each union were purposively chosen for interview in terms of data convenience as well as expediency and logistic facilitation.

Table 01: Sampling structure of molasses households in the study area

Upazila	Union	No of each type producers		In total
		Large scale	Marginal scale	
Chougacha	Hakimpur	12	13	25
Jhikorgacha	Ganganandapur	10	15	25
Sadar	Chanchra	8	17	25

(Source: Field study, 2022)

3.4. **Period of Study**

Precise time management allows the researcher to attain the research efficiency (Chase *et al.* 2012). Thus, a specific time schedule was considered to accumulate the pertinent info. The data collection period was December 2021 to January 2022.

3.5. **Preparation of Survey questionnaire**

A set of multi-dimensional premeditated sample survey was composed to collect fixed schemed information following with the objectives of the study. Close-ended enquiries were enquired according to the survey strategy. The necessary alterations were well-appointed for a decisive survey nature.

3.6. **Collection of Data**

The elementary data were assembled by face-to-face interviewing the respondents according to survey nature. It was troublesome to gather detailed data since most of the growers did not retain any annals of their diurnal activities in black and white. Some refused to expose all the hidden fact as well as overstated about own selves. To overcome such tangles, all practical efforts were applied by the researcher to settle info collection accuracy. Before the interview initiation, each respondent was clarified about the purpose of researchers' Master's study project.

3.7. **Processing of Data**

Activities were applied during the data collection period to lessen the plausible errors. The composed data were manually reviewed. Data were transferred into tabular form to meet the study's objectives. After that, data was provided and analyzed in computer with the help of Statistical Package for Social Science (SPSS) software. After obligatory checking data was converted into international standard worldwide units including kilogram, BDT.

3.8. **Analytical Technique**

3.8.1. **Descriptive analysis**

Tabular and graphical approaches were often used to depict socio-economic profile of the household and to depict the profitability of molasses along with incurred cost.

Technique and strategies were followed with SPSS software inputting the revenue, cost, gross margin and net farm profit for the estimation of profitability of molasses production. The gross margin model is expressed as:

GM = TR – TVC

Where, GM = Gross Margin; TR = Total Return; and TVC = Total Variable Cost.

After this, the BCR was assessed as a ratio of gross revenue and gross variable cost. The formula of calculating BCR (undiscounted) is shown below:

Benefit Cost Ratio = Total return / Total variable cost

3.8.2. **Functional technique**

3.8.2.1. **Hypothesis narration**

Research need to have hypothesis for conceding the significance.

Null hypothesis, H_o = Multi-dimensional incurred cost had no influence on molasses gross return/output,

Alternative hypothesis, H_1 = Multi-dimensional incurred cost had significant level influence on molasses gross return.

3.8.2.2. **Regression model fitting**

A technical concept of Cobb-Douglas production function may be applied to weigh the factors affecting the level of revenue outcome. The specification of the Cobb-Douglas production arrangement for molasses production was as follows:

$$\mathbf{Y = \alpha X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5}}$$

By taking natural log in every sides, the Cobb-Douglas production function was transformed into the undermentioned form since it would be solved by the ordinary least squares (OLS) method.

$$\ln Y = \ln \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + e$$

Where, **Y** = Gross income (BDT per kilogram molasses)

$\mathbf{X_1}$ = Cost of tapping tree contract (BDT per kilogram molasses)

$\mathbf{X_2}$ = Cost of saps pitcher / pot (BDT per kilogram molasses)

$\mathbf{X_3}$ = Cost of human labor (BDT per kilogram molasses)

$\mathbf{X_4}$ = Cost of firewood (BDT per kilogram molasses)

$\mathbf{X_5}$ = Cost of marketing (BDT per kilogram molasses)

$\boldsymbol{\alpha}$ = Intercept

$\boldsymbol{\beta_1}$, $\boldsymbol{\beta_2}$ --------- $\boldsymbol{\beta_5}$ = Regression coefficients of the respective variables to be estimated

e = Random error

3.9. **Measurement of independent variables**

Independent variables under this study were five selected factors, featuring by cost of tapping tree contract, cost of pitcher / pot, cost of firewood, cost of human labor and cost of marketing.

3.9.1. **Cost of tapping tree contract**

Tapping tree contract may be done in four major ways including direct contracted money, proportional distribution of saps, pre-defined molasses contract and tapping saps from own tree. First one requires advanced cash money, following twos depend on the production level and final one need no obligatory money. All the aforementioned methods transactions will be converted into existed market value in Bangladeshi Taka for facile calculation.

3.9.2. **Cost of saps pitcher / pot**

It mainly depends on the number of tapping date palm trees. At the first sight, such type cost seems fixed cost but it acts as variable for sometimes. Due to prevalence of steal, breakdown of clay pitcher or some unavoidable reasons, household requires to arrange new ones in the middle of that saps collecting season. Pot/pitcher price needs to be symmetrical with the existed market price.

3.9.3. **Cost of human labor**

Human labor is consisted of two major division including gachi (saps collector from tree) cost and condensing, mold &wrapping labor cost. Total daily labor cost dividing by daily production level will generate the human labor cost per unit produced molasses.

3.9.4. **Cost of firewood**

Depending on the degree on production bulkiness, firewood including dry date palm leaves, jute sticks, chopping wood mainly. Firewood price per kg molasses can be reckoned with total required firewood dividing by total molasses produced per day.

3.9.5. **Cost of marketing**

It is the entire package of sorting and wrapping labor cost, polyethene or paper cost, transportation or delivery cost, promotional activity cost and finally communication (mobile) cost. Summation of aforementioned costs will be further divided by the marketed / sold molasses per day to compute per kilogram molasses marketing cost.

3.10. **Study reliability and variability**

This exploration was 75 farmers oriented; twenty-five from each three upazila. Market survey as well as discussion with community dwellers were made for precise assessment. Information purveyed from these later two sources were 90% similar the collected data from farmers. Therefore, data accuracy and reliability can be legitimately ensured.

3.11. **Ethical alertness of research survey**

Appointments were done before farmer interviews and each respondent was well informed about the nature and purpose of the study. No overstated or misleading questions were inquired which might disrupt the confidentiality or privacy aspects. Transparent replies were chronicled and producers' consent were occupied.

3.12. **Limitations in data collection**

The primary constraints were the time boundary. Additionally, ceaseless exploration was not plausible during Covid-19 pandemic situation. Furthermore, unexpected interference from the side-talkers while collecting data from the target entities.

CHAPTER 04

RESULTS AND DISCUSSION

This chapter consists of the socio-economic context, existing production status comparing with previous time period, impact on respondents' socio-economic position, benefit cost analysis of molasses, opportunities as well as constraints behind this crop cultivation pattern.

4.1. **Socio-economic context**

The socio-economic outline is crucial to have an inclusive idea about the existing household performances. Therefore, info concerning respondents age structure, occupation nature, family size with family labor support, degree of women participation, marketing range were recorded as deliberated below:

4.1.1 **Age distribution**

Head of the households (61.3%) were in the age group between 31 to 50 years followed by the age group above 50 years (26.7). Very tiny percent was 12% under the age group less than 30 years (Table 02). Apathy of young generation may extinguish such seasonal signature in future.

Table 02: Age distribution of respondents in study area

Categories (years)	Responded household heads				
	Chougacha	Jhikorgacha	Sadar	Total	% in total
Young aged (up to 30)	3	3	3	9	12
Middle aged (31-50)	14	17	15	46	61.3
Old (above 50)	8	5	7	20	26.7

(Source: Field study, 2022)

4.1.2. **Occupation nature**

Considering their household revenue sources, the respondents were classified into several sorts: agriculture, grocery store, day labor, transport service provider, remittance privileged, desk job (public/private), apprentice and other earning sources. Table data revealed that the highest proportion of the respondent (34.7%) were attached with grocery or stationary or petty business while second highest respondents (32%) had income from agriculture solely. However, remaining one third had relevance with day labor ship, transport service, remittance privilege, official job and institutional apprentice.

Table 03: Earning source of responded participants in study area

Categories	Responded households				
	Chougacha	Jhikorgacha	Sadar	Total	% in Total
Agriculture	5	7	12	24	32.0
Grocery or stationary store	10	9	7	26	34.7
Day labor ship	3	0	2	5	6.7
Transport service provider	2	3	2	7	9.3
Remittance privileged	2	2	1	5	6.7
Desk official job (public/private)	1	3	1	5	6.7
Institutional apprentice	2	1	0	3	4.0

(Source: Field survey, 2022)

4.1.3. **Family size and family labor availability**

The normal family size comprises 5.13 members per family, which is higher than national statistics (4.7) (BBS, 2020). More than half of the household members assisted in this molasses production directly or indirectly.

Table 04: Respondents household members and family labor sources

Categories	Responded households				% in labor respect to family members
	Chougacha	Jhikorgacha	Sadar	Mean	
Family members	4.9	5.3	5.2	5.13	53
Active earning member	2.5	2.16	2.2	2.28	
Available family labor for molasses	2.84	2.76	2.64	2.75	

(Source: Field study, 2022)

4.1.4. **Women participation/assistance**

Females participation was found significantly in labor sources under the survey zones. Overall medium level participation rate was higher (42.7%) in this area. High women assistance feasibility depicted less labor cost in other sense and met up SDG target five (gender proportionality) ultimately. As family women were good at household chores, they could support the male by inflaming and condensing syrups, packetizing. Due to village social as well as religious value, a little presence of women was explored in the market. Household women participations made a handsome turnover by minimizing the artisan's expenditure.

Table 05: Women participation at molasses production activities

Categories (score)	Responded households				
	Chougacha	Jhikorgacha	Sadar	Total	% in total
Low participation (< 3)	3	4	4	11	14.7
Medium participation (3-4)	11	10	11	32	42.7
High participation (> 4)	11	11	10	32	42.7

(Source: Field survey, 2022)

4.1.5. **Marketing range**

It signifies the marketing feasibility of molasses sale. Households followed several ways to reach the market.

Table 06: Ways of marketing molasses

Marketing locations	Responded producers				
	Chougacha	Jhikorgacha	Sadar	Total	% in total
Household yard	6	2	5	13	17.3
Contractual production	3	12	4	19	25.3
Local market	9	7	8	24	32
Haat / highway market	3	3	5	11	14.7
Direct to central Dhaka market	4	1	3	8	10.7

(Source: Field survey, 2022)

Most of the productions (about one-third time) were sold through local markets. However, currently contractual sale (pre-order) is more popular (25.3%) and cashes out more. ICT cognizant household now moved onto Dhaka market delivery.

4.2. **Impact on responded participants socio-economic position**

Date palm molasses has made notable impact to many of the respondent households in this explored area. Survey outcomes exposed that 98.7% respondent household consumed some extent on nutritious food consumption (Table 07) during molasses production time period. More than 80% households attained infrastructure development. Moreover, 85.3% respondents had their recreation and societal security conveniences. Meanwhile, over fifty percent of entire respondents were engaged with social influential or voluntary community/organization.

Table 07: Impact on food consumption, household and social security

Categories	% of household responded			All areas
	Chougacha	Jhikorgacha	Sadar	
Nutritious food intake increase	100	96	100	98.7
Infrastructure upgrading	76	80	88	81.3
Recreation and societal security	92	74	90	85.3
Social community engagement	64	40	56	53.3

(Source: Field survey, 2022)

4.3. **Comparative profitability analysis**

Participants were enquired about their variable as well as fixed cost and gross return. Both cost and return are brought under consideration to measure the BCR.

The cost of molasses commercialization varies depending on plant contract nature, availability of firewood, efficient artisans and marketing feasibility mainly. Tables showed the rational cost distribution at different household level along with revenue.

Table 08: Comparative analysis of costs and returns of molasses production

Particulars (per kilogram)		Large scale producer	Marginal scale producer
A.	**Gross return** (Marketable molasses)	232.93	219.90
B.	**Fixed cost**		
	Saps tapping contract	33.57	36.77
	Saps pitcher / pot	1.62	1.46
	Saps condensing materials, mold and accessories, weight machine	4.95	8.41
	Total =	40.14	46.64
C.	**Variable cost**		
C.1.	Production cost		
	Firewood	26.06	27.37

Particulars (per kilogram)		Large scale producer	Marginal scale producer
	Labor cost	36.45	39.82
C.2.	Marketing cost	2.83	3.91
	Total (C.1. + C.2.)	65.34	71.7
D.	Total cost	105.48	117.74
E.	**Gross margin** (A-C)	167.59	148.2
F.	**Net profit** (A-D)	127.48	102.16
G.	**BCR** (total cost)	2.21	1.88

(Source: Field survey, 2022)

Pointedly, both large and marginal scale household confronted profit margin. However, first one superseded later in terms of BCR measurement.

4.4. **Factors affecting the molasses production**

Cobb-Douglas production function was recognized to evaluate the variable significance as well as relevance level.

The statistical significance of the test was found in the 'P-value' column in the model (Table-09).

Cost of saps tapping contract (X_1) was found positive association representing 1.101 at 1 percent significant level for molasses production. It implies that 1 percent increase in the cost of plant tapping, keeping other factors constant, would increase gross revenue by 1.101 percent.

Table 09: Estimated values of coefficient of Cobb-Douglas production model

Explanatory variables	Estimated coefficient	P-Value
Intercept	-2.066	.001
Cost of saps tapping contract (X_1)	1.101	.001
Cost of saps pitcher/pot (X_2)	-0.182	.001
Cost of human labor (X_3)	-0.288	.032
Cost of firewood (X_4)	.633	.003
Cost of marketing and promotion (X_5)	.155	.002
Adjusted R^2	0.953	
F-Value	278.852	

(Source: Field survey, 2022)

Meanwhile, earthen saps pot cost coefficient (X_2) was also found non-positive (-0.182). It depicts that 1% more cost addition would decline gross revenue by 18.2% keeping another factor cost constant.

In addition, the regression coefficient of labor cost (X_3 = - 0.288) was negative but significant for molasses revenue. It implies the 1 percent increase in the human labor cost, keeping other factors constant, would cut gross returns by 0.288 percent.

Cost of firewood (X_4) had a positive liaison with molasses output revenue. Estimated coefficient of firewood was 5 percent significant with value 0.633. It implies that 1 percent increase in the cost of labor as additional expenditure, remaining other factors constant, would increase gross returns by 0.633 percent.

Finally, marketing and promotion cost (X_5) was found positive impact on molasses output. Estimated co-efficient 0.155 indicated that 1 percent rise in the cost of

marketing and promotion for molasses commercialization, remaining other factors constant, would increase gross returns by 0.155 percent.

The adjusted R^2 for molasses commercialization was found to be 0.953 which indicated that about 95.3 percent of the variations of the output were described by the explanatory variables included in the model. Meanwhile, The F-value for the molasses production was measured at 278.852 which were highly significant at 1 percent level. It means that the explanatory variables included in the model were vital for interpreting the variation in gross revenue of molasses manufacturing.

4.5. **Perplexities confronted at molasses production and marketing**

Molasses production evidenced a spring for root level individuals, but this group people confront most of trauma. The crucial complications were adulterated molasses presence in market (92%) and lack of gachi / efficient labor (78.7%) and stealing plausibility (76%). Furthermore, asymmetrical cost & revenue (70%), lack of quality saps (37.3%) and market infeasibility (26.7%) were also cited at household levels.

Table 10: Perplexities confronted at molasses production and marketing activities

Particulars	% of participants responded			All areas
	Chougacha	Jhikorgacha	Sadar	
Lack of quality saps	36	36	40	37.3
Stealing possibility	72	68	88	76
Lack of gachi / efficient labor	80	84	72	78.7
Lack of marketing feasibility	20	40	20	26.7

Particulars	% of participants responded			All areas
	Chougacha	Jhikorgacha	Sadar	
Asymmetrical cost & revenue	64	78	68	70
Adulterated molasses presence in market	96	88	92	92

(Source: Field survey, 2022)

4.7. **Discussions**

4.7.1. **Socio-economic context of household and vicinity**

Study found active age group ranged 31-50 years majorly up to 61.3% followed by the age group over 50 years. Research also revealed that the highest proportion of the respondent (34.7%) were involved with grocery or stationary or petty business while subsequent highest respondents (32%) had income from agriculture solely. The average family size comprises 5.13 members per family in which more than half number of the household members assisted in this molasses production directly or indirectly.

Women participation was found medium level regularly about 42%. High women involvement feasibility depicted less labor cost and met up SDG target five ultimately.

Producer units under survey location had entrée to local market most of time (32%). One-fourth of entire producer community had pre-contractual scope. About 17.3% of household found convenience to sale their product at their house yard.

4.7.2. **Welfare progression molasses household**

After linked with molasses commercialization, almost 98% household confronted a significant nutrition advantage and most of them led a reformed life with three-time meals a day during molasses seasonal period. More than 81% farmers upgraded household and about 85% progressed in recreational as well as educational level. In addition, over 53% household were accustomed with societal organizations.

4.7.3. **Comparative profitability analysis between marginal and large-scale producer**

Human labor, tree tapping and firewood were the most expensive inputs in the production molasses. Together these formulate over 90% of entire expenditure. Sometimes, earthen sap pot was become crying need due to handling break down or stealing performances. Meanwhile, marketing cost varied depending on the way of selling the finished output.

Six cost items: plant tapping contract, human labor, earthen pot/pitcher, firewood, marketing and required accessories were considered as variable and fixed cost for estimating the total expenditure. For instance, large scale production, average paid for plant tapping contract, human labor, earthen pot/pitcher, firewood, marketing and required accessories were BDT 33.57/kg; BDT 36.45/kg; BDT 1.62/kg; BDT 26.06/kg; BDT 2.83/kg and BDT 4.95/kg by correspondingly (Table 2). Per kilogram of total variable cost, total fixed cost, total cost of molasses commercialization's were BDT 65.34; BDT 40.14 and BDT 105.48 individually. Meanwhile, in marginal scale molasses production, per kilogram molasses variable, fixed and total cost were BDT 71.7; BDT 46.64 and BDT 117.74 separately.

The average per kg gross return and net profit in large scale commercialization were BDT 167.59 and BDT 127.48 respectively (Table 2). Benefit cost ratio was estimated at 2.11. However, gross return and net profit in marginal scale manufacturing were little bit less than aforementioned. Average per kg gross return and net profit were BDT 148.2 and BDT 102.16 along with 1.88 BCR calculation.

Therefore, household were easily stirred with molasses commercialization and made this seasonal revenue generation on its peak point.

4.7.4. **Explanation of regression function estimated values**

After dealing out information, Cobb-Douglas production function was designed. The values of adjusted R^2 and F asserting 95.3%, and 278.852 specified the variance of explanation in the dependent variable with respect to independent ones and ultimately represented the suitable data fitness of model.

4.7.4.1. Tree tapping contract and earthen pot cost

Tree tapping contract and earthen pot cost coefficients were significant at 1 percent level of significant. However, coefficient of saps tapping contract cost (X_1) was found positively associated while earthen pot cost coefficient (X_2) was found non-positive. Increasing 1 percent in the cost of plant tapping, keeping other factors constant, would increase gross revenue by 1.101 percent. It implied that bringing under more sap tree after a level, household revenue accelerated. Meanwhile, 1 percent more cost addition in earthen pot would decline gross revenue by 0.182% keeping another factor cost constant. It concerned that uncareful handling break down and theft problem would add additional expenditure which might be checked.

4.7.4.2. Human labor and firewood cost

Regression coefficient of labor cost (X_3 = - 0.288) was negative but significant at 5 percent for molasses revenue. It implies the 1 percent increase in the cost of human labor, keeping other factors constant, would decrease gross returns by 0.288 percent. It advocated that household might provide labor most of time to lessen the labor cost for having a good profit margin.

On the other hand, cost coefficient of firewood (X_4) had a positive liaison with molasses revenue. Estimated coefficient of firewood was 5 percent significant with value 0.633. It implied that 1 percent increase in the labor cost as additional expenditure, remaining other factors constant, would generate gross returns by 0.633 percent. It also depicted that more cost on firewood at sap boiling stage could generate proper condensed juice which procreate good quality molasses with better turnover ultimately.

4.7.4.3. Marketing cost

Marketing expenditure was positively as well as significantly associated for molasses revenue. Its coefficient (X_5 = 0.155) asserted that one percent extra addition on marketing activities would escalate the molasses profits 0.155 percent than before.

4.7.5. **Perplexities in molasses production and marketing**

Although molasses commercialization was rationally profitable, household confronted multi facet difficulties during production and marketing. Financial damage due to unrestrained spurious molasses presence in market, decreasing gachi or artisan's day by day, theft problem, good quality saps shortage and market complexity were found from alpha to omega in reincarnation of signature molasses.

A well-established management would minimize such perplexities and attain a promising economic turnover in all grass root level.

CHAPTER 05

SUMMARY AND CONCLUSION

This is the compacted chapter of the over whole paper. It is time to compact the exploration and the study's key findings. Section 5.1 portrays a summary of the exclusive study. Applicable suggestions, conclusion, limitations of the study and farther research pathways are chronologized in sections 5.2, 5.3, 5.4 and 5.5.

5.1. **Summary**

Naturally blessed territory and its foodie inhabitant's hospitality were cited initially. Afterwards, molasses was introduced with its signature dominance followed by its nutrition outline as well as natural plant source. Artisans were more enthused onto commercial production and made reasonably more turnover from domestic markets which was comparatively tough in case of ancestral pathways. Finally, influential factors that impacted onto molasses commercialization were asserted along with perplexities and this part welcomed the succeeding literature review section.

In literature review, antecedent explorations were evaluated and chronologized with respect to research enquiries. Signature clarification of Date Palm plant and molasses, steps of molasses commercialization process, molasses market profitability, molasses production and marketing perplexities were constructed by accumulating info from numerous sources.

In third chapter, pathway for the full thesis study named materials and methods was asserted with reliable process. A Cobb-Douglas production function was constructed with the corresponding factors. P-value test, adjusted R^2 and F tests were kept in the limelight and influential factors were categorized with proper labeling.

Finally, the results and discussion chapter were last but not the least that portrayed socio-economic context and impact analysis, molasses production changed over

time, comparative profitability analysis of two different household level, factors influencing molasses commercialization and prospect as well as challenges behind this production schedule with appropriate field survey outcomes. Stirring significant factors significance pertinent with molasses commercialization were described with aforementioned test outcomes mentioned at materials and methods part.

5.2. **Applicable suggestions**

On the basis of the findings of the study it is manifest that vegetable is profitable enterprises and this can generate more incentives and employment opportunity to the rural end. Therefore, undermentioned compatible strategies and tactics are put forwarded for ensuring more production willingness of vegetable in one hand and higher profit of the farmer on the other.

i. **Operating as a multiparty force to stimulate the production**

Research institutes, extension authorities and merchant associations should support producers as a joint dynamism. DAE may aggrandize service center for the outlying households with support of local government agency. In addition, the dimensions of DAM should be increased.

ii. **Enforcing more involvement of women than before**

Allowing women is not only beneficial for their own socio-economic well-being but also imperative for sustainable livelihoods of societies. The socializing concept of gender awareness by community leaders will influence rampantly.

iii. **Endorsing promising policy and accreditation**

The government should enact apposite strategy for the producers, traders and consumers. Authorities should provide competent authorization schemes to match standard qualifications.

5.3. **Conclusion**

On journey to national prosperity marked by sustainable program, date palm molasses can serve apposite winter healthful food item, strengthen rural economy, engrossing women participation and nationwide growth ultimately. Season based molasses commercialization raised the socio-economic status of the rural households and exposed optimistic results. Specifically, this exploration acknowledged the factors affecting the grass root level household revenue in three specified upazila of Jashore district. The results depicted that cost of plant tapping contract, earthen pot, artisans and marketing strategy significantly stirred the molasses production. In addition, this study asserted market scenario and commercialization perplexities with ensuing immense prospect that before. Furthermore, this exploration also suggested introducing advanced marketing facilities supervised by DAE and DAM, letting more women community engagement and formulating policies aimed at efficiently addressing producers would boost the date palm molasses at grass root level. Finally, minimizing the existed farming perplexities with effective measures could ease more venture as well as production and ultimately lead toward welfare procession.

5.4**. Limitation of the study**

Taking into account the money, time and other requisite resources accessible to the researcher, it was necessary to impute some margins as stated below:

i. The study was kept to twenty-five selected household of three specified upazila.

ii. Only five major expenditure features of were taken for survey in this study.

iii. The researcher relied on the data asserted by the respondent limited within the heads of households with their memory during interview.

iv. For some cases, the researcher confronted unexpected exaggerated interference. However, the researcher tried to handle this problem as far as possible with sufficient sagacity and skill.

v. Several perplexities during productions are likely to be faced by the grass root household. However, only six difficulties had been reflected in this exploration.

5.5. **Pathways for farther research**

Elementary motive behind this research was to expose some pre-asserted factors affecting the household revenue in molasses production. However, inadequacy of time, capital and other obligatory possessions, it was quite tough for the researcher to cover other south-western locations rather than Jashore district solely. Hence, only selected areas of three upazila in Jashore were taken for facile survey. In addition, small sample survey from each of the cited areas were plausible during Covid-19 pandemic situation as continual expedition was also tough. Thus, this definite research finding may not specify the commercialization scenario as a whole in Bangladesh. Consequently, an ample scope of farther survey to measure the pertinent between other comparable factors and other AEZ region corresponding with this study area is conceivable for conclude the result more significantly.

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APPENDICES

Appendix I

Department of Agricultural Statistics

Sher-e-Bangla Agricultural University

AN ENGLISH VERSION OF THE INTERVIEW SCHEDULE

An Interview Schedule for a research study entitled

"**PROFITABILITY ANALYSIS OF DATE PALM MOLASSES COMMERCIALIZATION IN SELECTED PLACES OF JASHORE, BANGLADESH**"

(Please response the following questions and put-check mark whenever application)

01**. Preliminary information of farmer**: Sample no:……

Name: …….. Village: ……..……..

Upazila/Thana: ……..… District …….

02. **Age:** How old are you? ..... Years.

03. **Revenue sources**: Agriculture / Stationary store / Day labor / Transport service / Remittance / Official job / Student / Others (more than one may be applicable)

04. **Family financial condition:**

4.a. Number of family member: …….

4.b. Number of earning family member: ……..

4.c. Availability of family labor support in molasses production: ……..

05. **Relevance with molasses commercialization:**

5.a. Relevance time period: ……. years

5.b. Training on molasses production: ……. Times

06. **Social-economic position after molasses production**:

Additional nutritious food intake	
Infrastructure development	
Recreation and societal security	
Societal organization / community involvement	

07. **Number of saps tapping date palm tree**: …….

08. **Revenue from molasses**

Subjects	Current	10 years before
Production (Kg)		
Price (BDT/kg)		
Revenue from other		
Total		

09. **Expenditure for tapping purpose**

(Concerted market price)

Methods	Current	10 years before
Direct contracted money		
Proportional distribution of saps		
Pre-defined molasses contract		
Tapping saps from own tree		

10. **Production cost:**

10.a. Fixed production cost

Particulars	Cost (BDT)	
	Current	10 years back
Saps tapping contract		
Pitcher / pot		
Saps condensing materials		

10.b. Variable production cost

Particulars	Cost (BDT/month)		Cost (BDT/Kg harvest)	
	Current	10 years back	Current	10 years back
Firewood				
Pitcher / pot alteration				
Labor cost				

Mold and accessories				i. Gachi cost				
Weight machine				ii. Condensing, mold and wrapping labor cost				
Vehicle (If any)								
Total =				Total =				

11. **Marketing Molasses**

11.a. Molasses marketing place

Marketing place	% of sale
Household yard	
Contractual production	
Local market	
Haat / highway market	
Direct to central Dhaka market	
Other	

11.b. Marketing cost nature

Cost nature	Cost (BDT/Kg product)	
	Current	Initial
Sorting and wrapping		
Polythene / Paper		
Transportation / Delivery		
Promotion and mobile cost		
Total =		

12. **BCR calculation**	**12.a.** Total variable cost	**12.b.** Total cost	**12.c**. BCR
	10.b. + 11.b.	10.a. + 12.a.	8 / 12.a.
Current			
10 years back			

13. **Women participation**

13.1. Number of women participations: …….

13.2. Women participation score: (put-check mark the degree of participation)

Sl no.	Technologies	Degree of participation		
		Frequently (2)	Occasionally (1)	Never (0)
i.	Syrup condensing & processing			
ii.	Molasses sorting and wrapping			
iii.	Molasses marketing			

Women participation range: Low (0-2), Medium (3-4) and High (5-6)

14. **Perplexities / prospects throughout production & marketing**

(put-check mark on the right side of the preferred options)

Key opportunities	Present	Absent	Key hindrances	Present	Absent
Comparatively money making			Lack of quality saps		
Relatively short production period			Stealing possibility		
Easy production process			Lack of gachi / efficient labor		
Use household labor			Lack of promotion and training feasibility		
Increasing customer demand			Asymmetrical cost and revenue		
Others (If any)			Adulterated molasses presence in market		

15. **Household own perception / opinion / expectation**:

……

……

Thank you for your warm co-operation

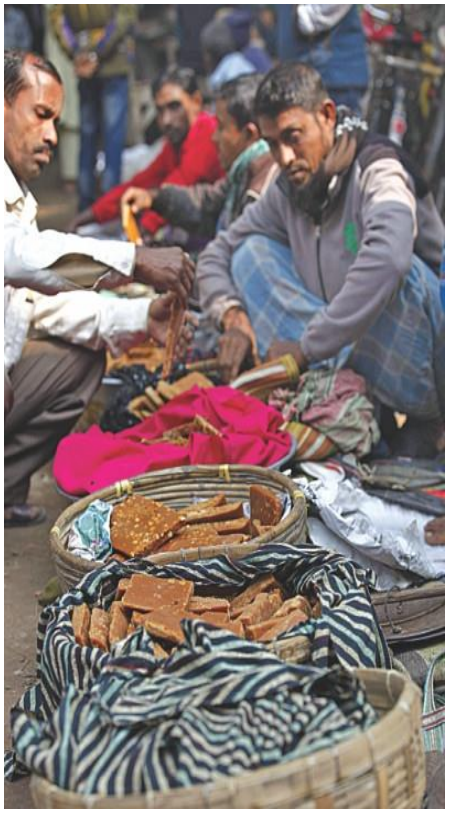
Date: .....

…… ……

Signature of Responded participant Signature of Interviewer

APPENDIX II

Remarkable photographs during data collection



APPENDIX III

Summary output of Cobb-Douglas production function analysis of molasses household revenue influenced by selected factors

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.976[a]	.953	.949	.12515	.953	278.852	5	69	.000	1.646

a. Predictors: (Constant), Ln_tap_contract, Ln_pot, Ln_labor, Ln_firewood, Ln_markteting

b. Dependent Variable: Ln_rev

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	21.838	5	4.368	278.852	.001[b]
	Residual	1.081	69	.016		
	Total	22.918	74			

a. Dependent Variable: Ln_rev

b. Predictors: (Constant), Ln_tap_contract, Ln_pot, Ln_labor, Ln_firewood, Ln_markteting

Model	Unstandardized Coefficients		T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	-2.066	.550	-3.755	.000	-3.163	-.968		
Ln_tree_tap	1.101	.195	5.658	.001	.713	1.489	.040	24.762
Ln_pot	-.182	.052	-3.489	.001	-.285	-.078	.230	4.351
Ln_labor	-.288	.131	-2.192	.032	-.550	-.026	.081	12.398
Ln_firewood	.633	.106	5.955	.000	.421	.845	.091	10.953
Ln_marketing	.155	.048	3.215	.002	.059	.251	.485	2.063

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions					
				(Constant)	Ln_tree_tap	Ln_pot	Ln_labor	Ln_firewood	Ln_marketing
1	1	5.992	1.000	.00	.00	.00	.00	.00	.00
	2	.005	34.983	.03	.00	.28	.00	.00	.04
	3	.002	55.229	.12	.00	.00	.00	.00	.57
	4	.001	103.536	.28	.01	.43	.01	.17	.34
	5	.000	196.800	.26	.01	.12	.52	.44	.00
	6	4.62 E-005	359.953	.32	.99	.18	.46	.38	.05

a. Dependent Variable: Ln_rev

… … … Fi Amanillah … … …