PROFITABILITY AND RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH

MD. ABDUL KADER

DEPARTMENT OF AGRICULTURAL ECONOMICS
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
SHER-E-BANGLA NAGAR, DHAKA-1207.

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BY
MD. ABDUL KADER

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Approved by

……
(Dr. Rokeya Begum)
Supervisor
Professor
Dept. of Agricultural Economics
Sher-e-Bangla Agricultural University,
Dhaka -1207

……
(Dr. A. S. M. Anwarul Huq)
Co-Supervisor
Member Director
Agricultural and Rural Sociology Division
Bangladesh Agricultural
Research Council (BARC),
Dhaka-1215

……
(Prof. Gazi M.A. Jalil)
Chairman
Department of Agricultural Economics
Sher-e-Bangla Agricultural University, Dhaka -1207

DEPARTMENT OF AGRICULTURAL ECONOMICS
Sher-E-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh

CERTIFICATE

This is to certify that the thesis entitled **"PROFITABILITY AND RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH"** submitted to the Department of Agricultural Economics, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Economics**, embodies the result of a piece of bona fide research work carried out by **MD. ABDUL KADER, Registration No. 11-04561** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:
Dhaka, Bangladesh

(Dr. Rokeya Begum)
Supervisor
Professor
Dept. of Agricultural Economics
Sher-Bangla Agricultural University

THIS THESIS IS LOVINGLY DEDICATED TO

MY PARENTS

PROFITABILITY AND RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH

ABSTRACT

The study was conducted to delineate the socio-economic characteristics of tomato producers in the study area; to estimate the costs and returns of tomato production in the study area, to find out the factors that affect profitability of tomato cultivation, and to assess the resource use efficiency of tomato cultivation. Cumilla district was selected purposively for the study on the basis of extensive tomato production. A total of 80 tomato cultivators were randomly selected to conducting farm level survey with pre-tested questionnaire. Data were collected during 1st January, 2019 to 31st March, 2019. Per acre cost of tomato production was Tk. 26033 for all farm categories in the study area. Total cost was highest for small farm (Tk. 30903) followed by large farm (Tk. 29602) and medium farm (Tk. 28945). Per acre gross return of tomato cultivation under small, medium and large farms were Tk. 56208, Tk. 54912 and Tk. 52864 respectively which indicates that per acre gross return of small farms were higher than large and medium farms. Per acre gross margin of tomato cultivation under small, medium and large farms were Tk. 38704, Tk. 38551 and Tk. 36126 respectively. Per acre net return of tomato cultivation under small, medium and large farms were Tk. 25305, Tk. 25967 and Tk. 23262 respectively, which indicates that net return was highest in small farms than large and medium farms. Per acre benefit cost ratio (BCR) of tomato cultivation under small, medium and large farm were 1.82, 1.90 and 1.78 respectively. Cobb-Douglas production function model was used to determine the effects of key variable inputs. The most important nine explanatory variables were included in the model to explain the gross income or return of tomato cultivation. Most of the variables in the production function were significant in explaining the gross return except the positive and insignificant effect of human labour cost, urea, MP, irrigation and pesticides. Resource use efficiency indicated that all of the resources were under used for tomato cultivation except overutilization of human labor, TSP and Mop. In the study area, unavailability of good quality seed was the most severe problem among the farmers and lack of irrigation facility was the last problems of the farmers.

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December, 2018 **The Author**

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BCR	Benefit Cost Ratio
BDT	Bangladesh Taka
DAE	Department of Agricultural Extension
FAO	Food and Agricultural Organization
FC	Fixed cost
GOs	Government Organizations
GR	Gross returns
HYV	High Yielding Variety
LUC	Land Used Cost
MP	Muriate of Potash
NR	Net Return
SPSS	Statistical Package For Social Sciences
TC	Total cost
TSP	Triple Super Phosphate
TVC	Total variable costs

CHAPTER I
INTRODUCTION

1.1 General Background of the Study

Bangladesh is predominantly an agricultural country due to its fertile land. Besides cereal crops, global third vegetable producing country is Bangladesh. Among the different vegetables tomato is one of the most important vegetable in term of acreage, production, yield, vitamins. It comes in early 19th century from South America in Asian Sub-continent (Vegetable facts-2018). It is the third most important vegetable after potato and sweet potato. It is mainly used for Salad, Pickle, Ketchup, Sauce, Soup, and Fresh or cooked. It is the good source of Vitamin C (31gmper 10 gm), Vitamin A, Calcium, Iron etc. Due to topography, climate, HYV, development of summer tomato like BARI hybrid tomato-3 & 4 tomato production increase. The area of tomato cultivation during 2016-17 was about 68000 acres with total production 389000 M. Ton where Yield was 5686 kg/Acre (BBS, 2018). Which is about 7 times higher than 1971. In Comilla district during 2016-17 tomato production was 3541 Acres and yield was 27028 M. Ton. (BBS, 2018). Where it was 3984 acre and 27899 M. Ton respectively in 2014-15. (BBS, 2016). Its demand for both domestic and foreign market has increased manifold due to its nutritional and processing qualities like canning (Hossain et al. 1999).

Bangladesh is first and foremost an agriculturally based country subdued by crop production. Bangladesh appreciates by and large a sub-tropical monsoon climate. Bangladesh has been notorious for growing large variety of tropical crops particularly rice, wheat, Tomato, jute, pulses, oilseeds, sugarcane etc. Bangladesh is a country of around 150,000 square kilometers. The population has reached a staggering 160 million and amongst that more than 80% are living in the rural areas. The rural people just make enough to meets their ends and often live under extreme poverty. Seasonal drought, monsoon pouring and winter waves make it cruel reality of life that is built on poor infrastructure and centralized communication system. High population growth offset the increased agricultural production, thereby exacerbating the food deficit and poverty that has resulted in massive loss of willingness to strive among the majority.

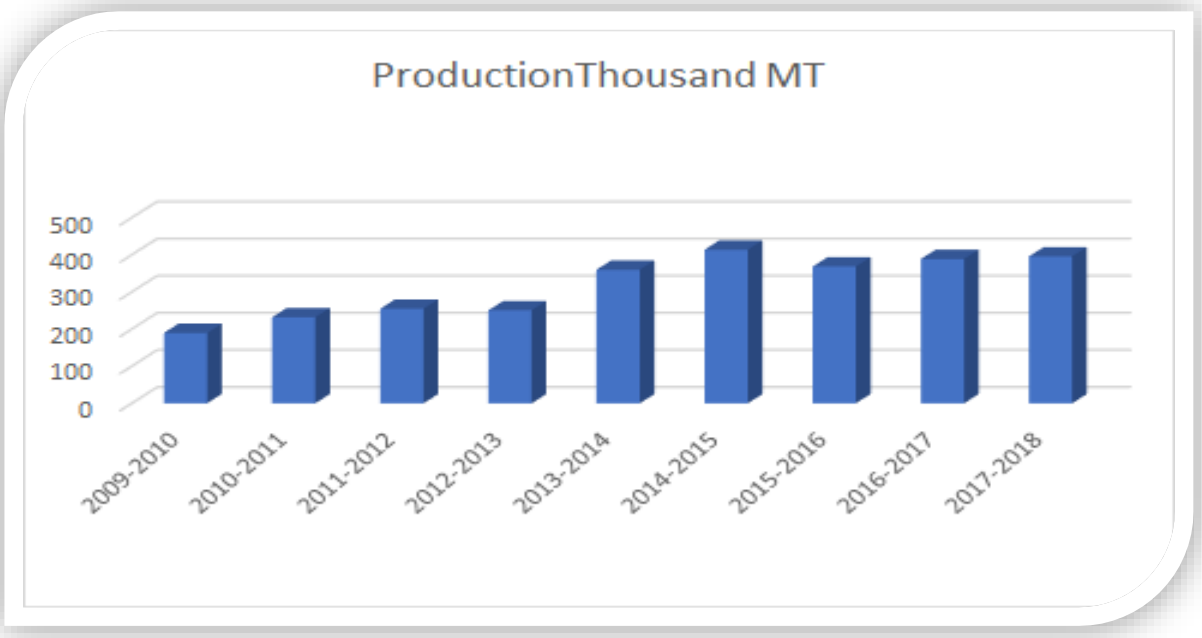
Vegetables are the cheapest source of vitamins and minerals and are considered as protective food. In Bangladesh, more than 70 varieties of vegetable are grown round the year in varied seasons. Doctors have been known to promote the consumption of vegetables to alleviate malnutrition and vitamin deficiencies. Production of tomato is mainly done through synthetic farming technique. It is being increasingly realized that enhancing vegetable production especially tomato would ensure the fulfillment of the objective of household food, nutritional and economic security in a single go. The issue of economic security is of utmost importance for Bangladesh's farming community in general and small and marginal farmers in particular.

Diversification into vegetable crops and increasing commercialization can support the development of the agricultural sector in several ways. Commercialization is characterized by households moving from subsistence systems into semi-commercial and commercial systems (with the main objective of achieving food self-sufficiency), thereby maximizing profits and generating surplus (Pingali and Rosegrant 1995). It implies increased market transactions since farmers participate in the process to capture gains from specialization (von Braun 1995).

Similarly, increasing capital intensity in production and processing leads to growth in the agribusiness sector. As a result, the number of agro-processing, distribution and farming put provision companies increases (Reardon and Barrett 2000). Commercialization can take place on the output side—when the farmer sells their products on the markets— or on the input side with increased use of purchased inputs (von Braun 1995). If these changes take place, and income and employment opportunities subsequently grow causing an increase in real wages, then increasing commercialization and the development of agribusiness contribute to overall growth and economic development.

Yet, little is known on how commercialization-led income growth is actually distributed among different social groups, and whether it actually reduces poverty (von Braun 1995; Barron and Rello 2000; Reardon and Barrett 2000) or how it affects women as compared to men (Spring 2001).

The small landholders are poor, usually undernourished and poverty stricken; and by and large practice subsistence agriculture. They have limited financial resources and are not able to grow major crops like wheat, sugarcane, rice, etc due to long gestation period of these crops. Their plight calls for urgent need to augment their income for ensuring food security and alleviating poverty. The growing demand for tomato is considered to have favorable economic effect on small holders who dominate the Bangladeshi agriculture scenario. They have a distinct advantage in tomato production as vegetable cultivation is labor intensive and small holders have abundant labor. They have small land holdings and can make use of the land more intensively, as tomato are short duration crops and provide regular income to meet the day to day requirements of the family. Besides, with a view to advantage of opportunities arising out of agricultural diversification toward tomato farming particularly for small holders, it is important to assess the profit and income of tomato growers of different farm sizes and particularly the small holders for whom it is being promoted and are being diversified. The last nine years tomato production in Bangladesh are presented in the Figure 1.



(Source: BBS, 2019)

Figure 1.1: Tomato production in Bangladesh

Tomato has the status of being a very money-making crop with few 'evenly profitable' substitutes. Among the variety of argues mentioned by the farmers for cultivating Tomato, the profitability portion was overwhelming principal and regarded is an extremely beneficial Vegetable.

1.2 Statement of the Problem

Agriculture is the deliverance of Bangladesh. The most important livelihood of the people of Bangladesh is associated with Agriculture. Farmers of this country at the outset produce crops what satisfies family life wants then they exemplify interest on production of cash crop such as cotton, jute, tea, Tomato, coffee, and so on are mostly expected in dealing demand of home market and sell abroad in foreign currency in support of developing countries.

Vegetables are important for both domestic and export markets. Almost all households in Bangladesh include vegetables in their diets. Nutritionally, vegetables are good sources of vitamins, protein minerals and fiber. For those in the producing areas, vegetable production is a major source of income for farmers in time past the production of vegetables was largely subsistence, with a major portion of the produce consumed by the farm household. Due to increase in demand for winter season vegetables, however, producers now see tomato production as a business and produce all year round.

An efficient production system is necessary to ensure increased production. The efficiency of the production system also important since it determines the producer's income, consumers living costs as well as facilitates the allocation of productive resources, among alternative uses.

Tomato are high value crops, which require intensive cultural practices and the financial, and labor inputs involved are therefore greater than those required for most staple crops.

Tomato has a substantial implication in nationalized economy. Small hard work has been completed to study the economics of the Tomato production. By the way cost of production

and profitability determination should be premeditated. This study will be intended at determining causes of variation and aspect of success among farms growing Tomato; it is indispensable both for the farmers and planners to carry out a program considered for eliciting agricultural production. Updating knowledge on profitability of Tomato is one rationalization of this study. It is essential to evaluate substitute profitability of this investment in terms of land and other resources keen to Tomato farming. This research possibly will endow with a number of detailed benefits to the individual farmers for efficient operation and management of the farm and also to the research personnel for supplementary studies of related natural history and to the planners and policy makers who provide the farmers centrally for Marco- level strategy assessment.

1.3 Significance of the study

The study will help provide scientific information on the necessary social and psychological factors that would influence the cultivation and any large-scale tomato production in the study area as well as in Cumilla district. Bangladeshi's age-old farming practices have taken a turn in recent years. There has been a technological breakthrough because of the evolution of high yielding variety seeds, increasing use of fertilizer, insecticides, pesticides, the installation of pumping sets, and tractorization. To maintain this tempo and pace of increased production through technological development, an assurance of remunerative prices to the farmers is a prerequisite and this assurance can be given the farmer by developing an efficient marketing system. Thus the present study sought to provides answer to the following questions.

- What is per unit cost incurred and returns obtained from tomato production?
- What is the technological breakthrough has led to a substantial increase in production on the farms and to the larger market?
- What are the possibilities of the resource for profit maximization?
- Various constraints hindering technological adoption and augmenting tomato production on sample farm etc. This study generated valuable information on tomato production and value chain that would assist concerned authorities to make relevant decisions to intervene in the development of tomato return and value chain

and designing of appropriate policies and strategies. The findings of the study would also be useful to producers, traders, consumers, and marketing agents to make their respective decisions.

1.4 Justification of the study

Bangladesh Agriculture is mainly dominated by the cereal crops like Rice, Wheat etc. But for solving some recent important issues like unemployment, poverty, hunger, malnutrition, food scarcity vegetable like tomato production may help the rural people. On the other hand, most, farmer want to optimize their resources like land, labor, capital, water and other inputs to maximize their income. However, some farmer may use sub-optimally. Some farmer may increase yield by using extra inputs, some may degrade soil fertility and some other ignore the environmental issues. As result social cost may increase. Resources are scarce in one hand malnutrition in another hand is the key focus on the study. This study may provide comparative analysis of resource use efficiency and profitability or tomato cultivation in selected area. For economic growth, employment of vast population with 160.0 million encompassing area of 147570 sq. km agriculture can provide large number of employments. Vegetable production create new employment opportunity particularly for the landless farmer in developing countries.

1.5 Objectives of the study

1. To delineate the socio-economic characteristics of tomato producers in the study area;
2. To estimate the costs and returns of tomato production in the study area;
3. To find out the factors that affect profitability of tomato cultivation; and
4. To assess the resource use efficiency of tomato cultivation.

1.6 Outline of the study

This thesis contains a total of eight chapters which have been organized in the following sequence. Chapter 1 includes introduction. The review of literature is presented in Chapter 2. Methodology of the relevant study is discussed in Chapter 3. Chapter 4 contains the socio- economic characteristics of the tomato farmers. Chapter 6 deals with the profitability of tomato cultivation. Chapter 6 describes the factors affecting profitability of tomato

cultivation. Chapter 7 presents problems faced by the farmers in tomato cultivation. Finally, Chapter 8 represents the summary, conclusion and policy recommendations to increase tomato production.

CHAPTER II
REVIEW OF LITERATURE

Assessment of related literatures in any research is necessary in the good judgment that it allows for an extent for reviewing the collection of knowledge & information appropriate to the future research. This knowledge & information give an instruction in designing the potential research problem & validating the new determinations.

"Profitability of summer BARI hybrid tomato cultivation in Jessore District of Bangladesh". These studies revealed that the average yield of BARI hybrid tomato was found 32.78 t/ha. The average return per acre over variable cost is observed to be Tk. 11,44,387 on full cost basis and Tk. 12,07,481 on cash cost basis. On an average benefit cost ratio was found to be 4.19 on full cost basis and 5.09 on cash cost basis. The cost per kilogram of hybrid tomato cultivation was Tk. 10.94 and return from one kilogram of tomato production was Tk. 45.83.

Adenuga *et al.* (2013) reported that tomato is one of the major fruit vegetables in Nigeria. In view of its seasonal availability and the need to make it available all-year round, effort must be made to increase efficiency of its production especially during the dry season. A study was therefore carried out to examine the economics of dry season tomato production in Kwara state, Nigeria. It estimated the costs and returns and assessed the technical efficiency of dry season tomato production. A two-stage random sampling technique was used to select 105 respondents for the study.

Akhtcr et al. (2001) conducted a survey on potato production in some selected areas of Bangladesh. Thisstudy investigated the production piactices, input use, costs, returns, and constraints in potato (high yielding varieties) production in 5 locations in Bangladesh, viz., Rangpur, Bogra, Jcssorc, Munshigang, and Comilla. The results showed that potato production is highly profitable and it could provide cash money to farmers. In terms of profitability, potato production was more attractive than any other winter vegetables. Per unit yield and gross return of potato were found higher than other competitive crops.

Akhter *et al*. (2011) conducted a study on "An economic analysis of winter vegetables production in some selected areas of Narsingdi district". These studies revealed that production of all the selected vegetables were profitable.

Ameer et al. (2008) highly significant data revealed that maximum yield (9639.3 kg ha-1) was obtained in T-7010, closely followed by T-7012 and T-7008 with 8002.7 and 7897.9 kg ha-1, respectively and all these hybrids showed a non-significant behavior against each other. Statistical alike results were reported for T-7030 and TP-002 with 6121.7 and 5473.5 kg ha-1. PTM-1603 showed minimum yield per acre of 1375.7 kg followed by 68-F1 producing (3006.6 kg/ha). Being much better fertilizer and environmental responsive hybrids, these hybrids including T-7010, T- 7012 and T-7008 produced better yield.

Begum et al. (2011) conducted a study to assess the costs and returns from the cultivation of selected crops in different locations. He finds the benefit cost ratios over total costs were 1.61, 1.72, 1.62, 3.55, 1.90, 2.17, 3.72, 1.94 and 2.64 for the cultivation of maize, groundnut, mungbean, sweet potato, cabbage, cauliflower, tomato, cucumber and okra respectively. High costs of fertilizers and insecticides were the major constraints to higher production for most of the crops as mentioned by the sample farmers.

Ferdausi et al. (2014) conducted a study on an economic study on maize production in some selected areas of Bogura district and found that cost and return analysis reveal that maize is a profitable crop for all categories of farmers. On an average per hectare total cost of maize production was estimated at Tk. 46278 for all farmers and Tk. 41263, 53554 and 48715 for small, medium and large farmers, respectively. Again, gross margins from maize production were estimated at Tk. 67592, 64694 and 74089 for small, medium and large farmers, respectively. However, net returns for the farm size groups of small, medium and large were calculated at Tk. 57823, 53895 and 64138 per hectare, respectively. BCR was the highest (2.40) for the small farmers followed by medium (2.01) and large (2.32) farmers, respectively. Cobb-Douglas production function analysis indicated that out of nine variables, the effects of using seed, manure, fertilizer, irrigation and insecticide had significant impact on gross return from maize production for all farmers. Efficiency

analysis indicated that most of the farmers inefficiently used their inputs. The findings of the study revealed that large farmers earned higher profit than those of small and medium farmers.

Haque (2004) conducted a study on comparative technical efficiency and profitability of potato, tomato and cauliflower production in a selected area of Netrokona district. The study revealed that per hectare total cost for potato was height and followed by cauliflower and tomato. Per hectare gross return of potato, tomato and cauliflower were Tk. 68915, Tk. 91495 and Tk. 60061, respectively. Per hectare gross margin of potato, tomato and cauliflower were Tk. 44591, Tk. 74766 and Tk. 42198, respectively. The return from tomato was the maximum due to lower production cost. On the contrary, benefit cost ratio was the lowest for potato and cauliflower due to higher production cost.

Hasan (2008) completed a study on economic efficiency and constraints of maize production in the northern region of Bangladesh and said that by attaining full efficiency through reallocating the resources there had scope to increase maize productivity. The study shows that maize is more profitable than boro rice. The main constraints faced by the farmers are seed prices are high, low grain price, fertilizers are unavailable at time when required. It was suggested that, inputs are supplied at fair price at required time and an organized marketing system is essential for expanding the maize production in the country.

Himayatullah et al. (2000) stated econometric model to test the hypothesis that small, medium, and large farms and owner-operated, owner-cum- tenanted and tenanted farms are equally technically efficient. The results suggest that medium and owner-operated farms are relatively technically more efficient than small and large farms and owner-cum-tenanted and tenanted farms, respectively, in the rainfed farming system of Lakki Marwat and that small, medium and large farms and owner operated, owner-cum-tenanted and tenanted farms are equally technically efficient in the Peshawar Valley.

Hossain (2013) conducted a study on the farmers' perception on profitability of Mustard cultivation in between aman and boro rice. Findings indicate that majority of the farmers'

(59 percent) had high level of perception on profitability of Mustard cultivation in between Aman and Boro rice. Still there were some respondents (41 percent) had medium perception. Thus, it is indicative that there is scope to take necessary steps to bring 41 percent farmers to high level of perception.

Hossain *et al.* (2004) reported that tomato variety BARI 7 produced the highest yield (57.02 t/ha) and BARI 5 produced the lowest yield (51.38 t/ha). Evaluated seven promising tomato cultivars and found that DT-39 was the earliest to flower (53.5 days), HYT-1 recorded the highest fruit yield of 41.05 t/ha which was at par with that of Selection-7 (35.31 t/ha) and RHRT-33-1 recorded the longest shelf life (15 days), followed by RHRT-6-1(14 days).

Islam et al. (2000) conducted a field survey on the Potato production system in Bangladesh. This paper analyzed the productivity and resource use efficiency of potato production using true potato seed (TPS) technology by means of a Cobb-Douglas production function and input cost data. Profitability of TPS technology was compared with the traditional tuber technology. Data were gathered from a sample of 200 growers in the major potato growing districts of Bogra and Jessore in 1998. Resource use and management varied in the two-production system causing variability in costs and returns. The TPS technology was found to have a higher benefit-cost ratio than the traditional technology. It was revealed from efficiency analysis that the potato growers using TPS technology allocated their resources in the rational stage of production (e.g. Stage IE). However, inefficiency exists in the use of human labor, seed, manure and fertilizers in TPS technology. Potato output could be increased by 20% given efficient use of resources.

Khan (2004) conducted a study on productivity and resource use efficiency of Boro rice cultivation in some selected haor areas of kishorganj district. The study revealed that small farmer paid higher cash cost for boro rice cultivation (Tk. 17531/ ha) compared to the large farmers (Tk. 17350 / ha) and the medium fanners (Tk. 17115/ ha). Per hectare net returns for small, medium, large and all farms were Tk. 6404.98, Tk.7570.86, Tk. 8162.02 and Tk. 7308.50, respectively. The findings led to the conclusion that seed, fertilizer and irrigation significantly affected the return of Boro rice. Education level and family size also

significantly affected the return of Boro rice. Most of the studies on potato conducted so far were based production and comparative analysis with respect to other crops. None of the studies seems to have explored intensively the production variation under improved and farmer's management. The present research is designed to carry out in depth study on potato under improved and farmer's management. Thus the findings from the huge volume of data from the Department of Agricultural Extension may generate useful information to researchers, policy makers and other users.

Rahman et al. (2007) conducted a study on measuring the costs of production, based on sizes of farm operation on rice farmers in Jessore district of Bangladesh study. The objectives of the study were to measure the differences in the cost of production of Boro rice farmers on the basis of land. They included three types of rice farmers in this, small, medium &large. They found that although there were no significant differences in the quantity of inputs used for all categories of farmers, the unit cost of some inputs significantly varied between small-large medium-large, thus affecting the cost of production. The reason is that most of the small medium farmers purchased inputs on credit, spending comparatively more than cash &they paid higher interest on borrowed money. They showed that for that reason rice production increased regardless of the land operation size but small &medium farmers still have a serious problem especially the increasing cost involved in the production.

Rajput et al. (2001) conducted a study of the profitability of wheat cv. Lok-1, WH-147 and Sujata India was conducted in 5 villages of Indore district, Madhya Pradesh, India. Farms classed as small (up to 2 ha), medium (2.1-5 ha) and large (>5 ha) were analysed. Yield averaged 3.4, 3.35 t/ha in the 3 cultivars as listed. Due to the lowest cost of cultivation (Rs. 8448/ha) and highest cost benefit ratio (1; 2.10), Sujata was the most profitable cultivar, and also had the highest market price at harvest. Net returns were largest in Lok-1, due to its higher yield than in Sujata.

Rayhan et al. (2013) conducted in Sirajganj district of Bangladesh to determine the profitability and resource use efficiency of Mustard production. Both descriptive statistics

and functional analysis was done to achieve the objectives of the study. The author showed that the productivity and profitability was satisfactory for Sirajganj Mustard farmers. The author also suggested that if the farmers of Sirajganj district use the resources efficiently it could increase the production level more for the Mustard farmers in the study area.

Sadiq et al. (2013) conducted a study on Profitability and Production Efficiency of Small-Scale Maize Production in Niger State, Nigeria and found that the costs and returns analysis indicated that maize production was profitable with an average net farm income of N48, 109.00/hectare, and a gross ratio of 0.39; a production efficiency index (2.50) per farmer further adjudged the profitability of the enterprise, that is, the returns cover the cost of production almost three times.

The per acre gross cost of production of tomato, cauliflower and cabbage were Tk. 118000, 116977 and 120522, respectively and the corresponding gross returns were Tk. 217020, 210000 and 220000, respectively. The per acre net returns of producing tomato, cauliflower and cabbage were Tk. 97000, 93023 and 99478, respectively.

Uddin (2008) completed an economic study on maize production under different farm size groups in Kishoregonj district of Bangladesh. He determined the profitability, productivity and resource use efficiency under different farm size groups. This study revealed that selected explanatory variables had impacts on maize production of all categories of farmers. The findings of the study revealed that medium farmers earned higher profit than those of small and large farmers. Some recommendations were made for the development of maize production in Bangladesh.

Wilson et al. (2001) conducted a survey on the technical inefficiency in wheat yields in Eastern England, UK. Variation in technical inefficiency explained using different variables representing a number of managerial biographical details, managerial drives and motivations, and practices procedures with respect to business planning. Panel data for the 1993-97 crop years have been used. The results indicate that the majority of wheat farmers in Eastern England operate close to maximum technically feasible yield levels and that

there is limited potential to improve technical efficiency. Variables constructed to represent managerial business objective, profit maximization and concern for maintaining the environment, are shown to have a significant and positive effect on levels of technical efficiency. Increasing farm size and seeking information are also associated with higher levels of efficiency.

Concluding remarks

The above-mentioned discussion and review indicate that most of the studies dealt with cost, return and profitability of tomato production. Some studies also determine the factors affecting the profitability. Maximum studies examined parameters, which influence production, more than a decade ago. Within this period changes might have taken place in production process, and owing to these changes, the validity of those factors needs to be looked into again. Side by side the influence of other factors identified by the researchers of other countries is needed to study in the context of Bangladesh. Very limited integrated studies were conducted on profitability of tomato production in Bangladesh. Therefore, this study is expected to be conducted taking into account those aspects. The review of literature was helpful to re-design methodological aspects with a view to overcome the limitations of previous studies. From the above studies the researcher felt the need of conducting and analyzing the profitability of tomato production in Bangladesh within the current development context, which will help the policy makers to understand the current situation and take programmes to increase tomato production and improving the livelihood of people in Bangladesh. On the other hand, this researcher believed that the findings of this study would provide useful updated information, which would help the policy makers and researchers for further investigations.

CHAPTER III
METHODOLOGY

The survey method is probably the most widely used formal method obtaining farm management data. This chapter discusses about the selection of the study area, period of the study, sampling technique and sample size, data processing and analysis.

3.1 Selection of the study area

Cumilla district was chosen purposively as a study area because this district is one of the renowned areas for tomato production in Bangladesh. Barura upazila and Chandina upazila was selected at random from the 16 upazila of Cumilla districts as the study area. An opening survey was carried on in some villages of Barura and Chandina upazila to collect primary knowledge about the tomato production, productivity and efficiency of the tomato growers. After preliminary visit three villages namely; Katakhola, Khaisara, Ethberpur and Aozbon were selected randomly as the study area. Most of the farmers in these villages used to produce high yielding varieties of tomato and sell their product to different middlemen. The main criteria behind the selection of the upazila were as follows:

1. The selected Sub-district was a good tomato producing area.
2. The researcher is well-known with the language, living, beliefs, and other socio-economic characteristics of the villages of this Sub-district.
3. Previously such type of study was not conducted in this area.

3.2 Period of the study

Data for the study were collected during the month of 1st January, 2019 to 31st March, 2019.

3.3 Selection of the sample and sampling techniques

A random sampling technique was applied for selecting sample. Through random sampling 80 farmers were selected for the study. Among the 80 farmers, 63 were small, 11 were medium and 6 were large. Farm

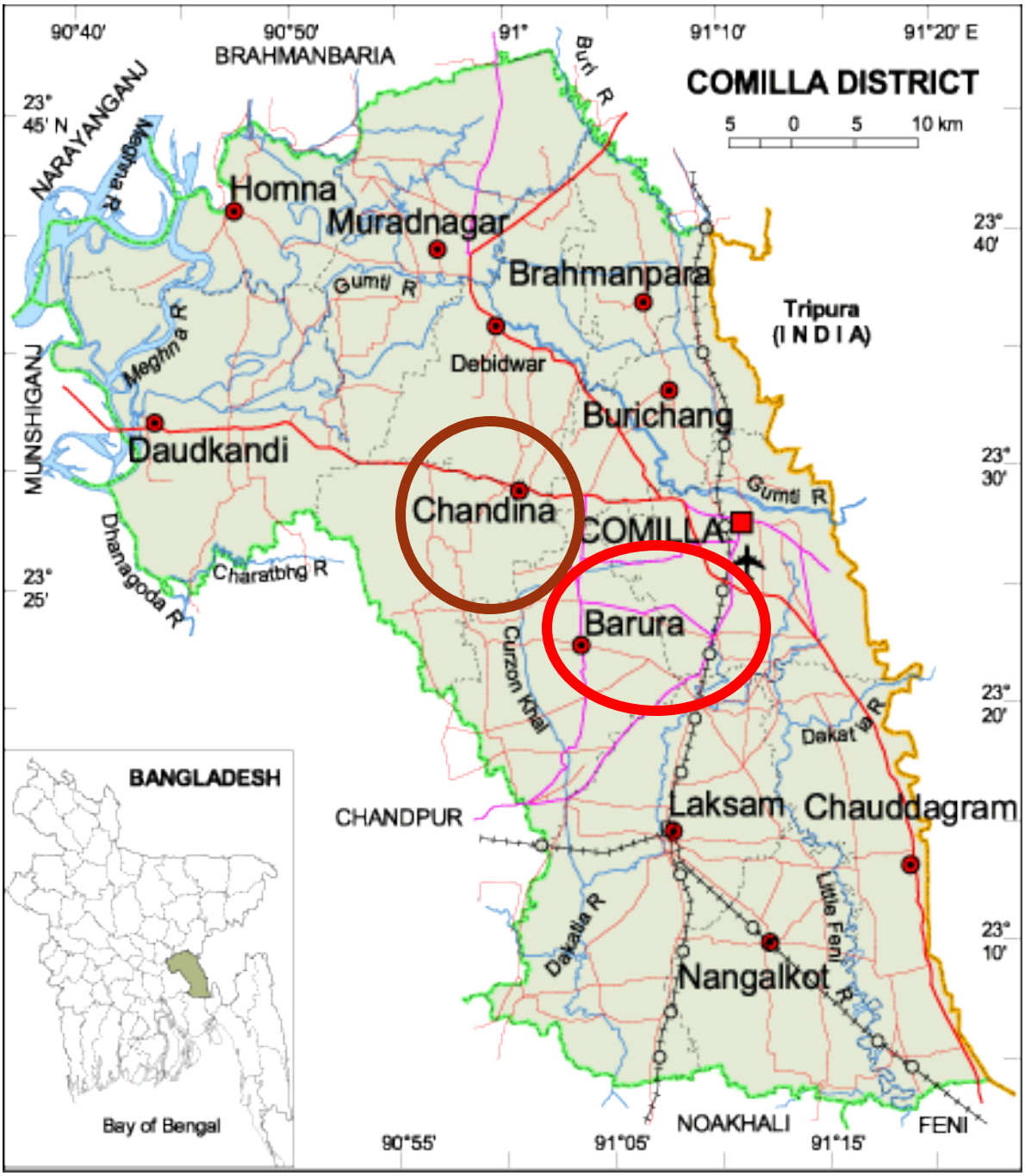


Figure 3.1: Map of Cumilla District showing the Barura and Chandina upazila

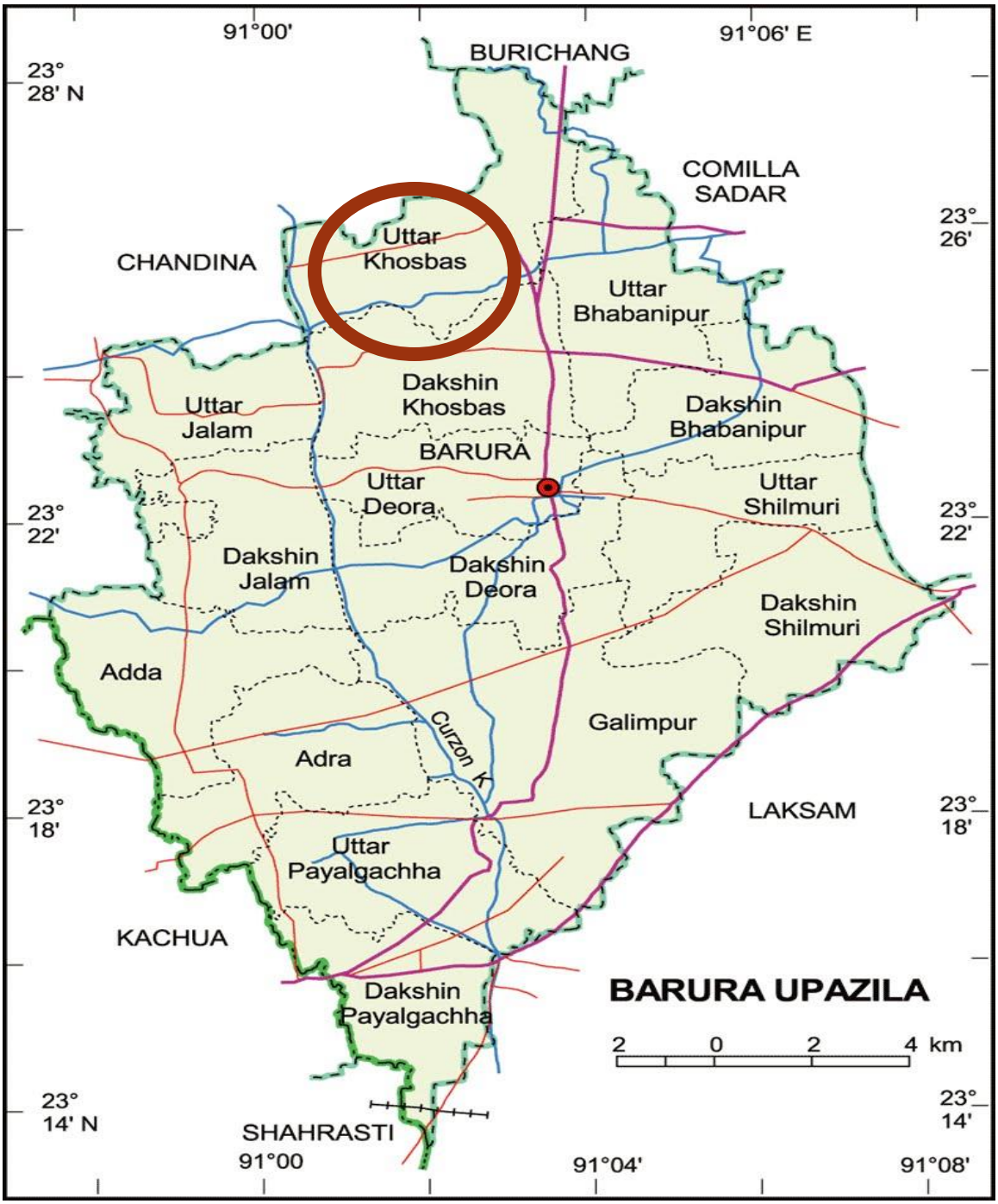


Figure 3.2: Map of Barura upazila showing the study area

3.4 Primary data

Primary data were collected by the researcher through personal interview with the respondents. To get accuracy and reliability of data, care and caution were taken in data collection. The researchers took all possible effort to establish a congenial relationship with the respondents do not feel hesitation or hostile to provide correct data. Prior to interviewing, the objectives of the study were explained to each and every owner of the Tomato growers. As a result, they were convinced that the study was purely an academic one and was not likely to have an adverse effect on their business. During data collection an attention was also paid to the mood of the owners of the Tomato growers.

3.5 Preparation of the survey schedule

In conformity with the objectives of the study, a preliminary survey questionnaire was designed for recording data from the farmers. After pretesting, the questionnaire necessary corrections and modifications were made and then the questionnaire was finalized. The questions were arranged in logical sequences.

3.6 Methods of collecting data

The data for the present study were collected from both primary and secondary sources. Primary data were collected by the researcher himself through personal interview with the respondents. To attain accuracy and reliability of data, care and caution were taken in data collection. The researcher look all possible effort to establish a congenial relationship with the respondents so that the respondents do not feel hesitation or hostile to furnish correct data. Before interviewing, the aims and objectives of the study were explained to each and every owner of the tomato growers, as a result they were convinced that the study was purely an academic one and was not likely to have an adverse effect on their business. During data collection an attention was also paid to the mood of the owners of the tomato growers.

3.7 Processing and analysis of data

Collected data were scrutinized and summarized for the purpose of tabulation. Data were transferred to a master sheet and compiled with a view to facilitating classified. Two

techniques of analysis were used in this study, tabular and statistical. Analysis by tabular technique included socio-economic characteristics of tomato farmers, classification of size of tomato land, production practices, inputs used and returns of tomato farmers. Statistical analysis was used to show the effect of inputs used and other related factors of tomato cultivation. Enterprise costing and gross margin analysis technique was used for calculating costs and returns for tomato cultivation.

3.8 Analytical techniques

Both descriptive and statistical analysis will be used for analyzing the data.

3.9 Descriptive analysis

Tabular and graphical analysis will be generally used to find out socio-economic status of the respondents. The tabular technique of analysis will be used to determine the cost, returns and profitability of tomato producing farmers. It will used to get the simple measures like average, percentage and ratio. Tabular technique included production practices and input use, cost and returns of tomato production.

3.10 Statistical analysis

Cob-Douglas production function analysis will be used to estimate the productivity and resource use efficiency of tomato production. Marginal productivity of selected inputs will be calculated to ascertain the level of efficiency of individual input use. To determine the contribution of the most important variables in the production process, the following specification of the model will be applied:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}X_7^{b7}X_8^{b8}X_9^{b9}e^{ui}$$

$$\text{Or } \ln Y = \ln a + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_6\ln X_6 + b_7\ln X_7 + b_8\ln X_8 + b_9\ln X_9 + U_i$$

Where, Y= Per acre yield of tomato production (Tk./acre);

a = Constant or Intercept of the function,

X_1 = Human labor (Tk./acre);

X_2 = Land preparation (Tk./acre);

X_3 = Seed/Seedling (Tk./acre);

X_4 = Urea (Tk./acre)

X_5 = TSP (Tk./acre)

X_6 = MoP (Tk./acre);

X_7 = Manure (Tk./acre)

X_8 = Irrigation (Tk./acre);

X_9 = Pesticides (Tk./acre);

b_1…..b_7 = Coefficient of the respective variable;

And, Ui= Error Term;

i= 1, 2…, 8.

3.11 Procedure of computation of costs

The farmers producing tomato had to incur cost for different inputs used in the production process. The input items were valued at the prevailing market price and sometime at government price in the area during survey period, or at the priced at which fanners bought. Sometimes, the farmers purchased hired labor, seed, fertilizer, manure and insecticide from the market and it was easy to pricing these items. But, farmers did not pay cash for some input such as family labor, home supplied seed, cowdung etc. So it was very difficult to calculate the cost of production of these inputs. In this case opportunity cost principle was used. In calculating the production cost, the following components of cost were considered in this study area:

- Human labor
- Land preparation/Mechanical power cost
- Seed
- Cowdung
- Fertilizer
- Insecticides
- Irrigation
- Pesticides cost
- Interest on operating capital and

• Land use.

3.11.1 Cost of human labor

Human labor cost was one of the most important and largest cost items of tomato production in the study area. It is required for different farm operations like land preparation, planting, weeding, application of fertilizer and insecticide, harvesting and carrying etc. Mainly two types of human labor used in the study area; such as family labor and hired labor. Family labor includes the operator himself, the adult male and female as well as children of a farmer's family and the permanently hired labor. To determine the costs of unpaid family labor, the opportunity cost concept was used. In this study the opportunity cost of family labor was assumed to be market wage rate, i.e., the wage rate that the farmers actually paid to the hired labor. The labor that was appointed permanently was considered as a family labor in this study. In computing the cost of hired labor, actual wages were paid and charged in case where the hired labors were provided with meals; the money value of such payment was added to the cash paid. The labor has been measured in a man-day unit, which usually consisted of 8 hours a day. In producing tomato human labor were used for the following operations:

- Land preparation/ploughing/laddering
- Transplanting
- Fertilizing, weeding and irrigation
- Pest control
- Harvesting, storing and marketing

3.11.2 Cost of ploughing and laddering

Human labor and mechanical power were jointly used for ploughing and laddering. Ploughing and laddering cost was the summation of hired and home supplied draft power and human labor. Hired ploughing and laddering cost were calculated by the prevailing market prices that were actually paid by the farmers. Home supplied mechanical power and human labor cost was estimated on the basis of opportunity cost principle.

3.11.3 Cost of seeds

Cost of seed was also estimated on the basis of home supplied and purchased seed. Home supplied seed were calculated at the prevailing market rate and the costs of purchased seed were calculated at the actual price.

3.11.4 Cost of cow dung

Cow dung may be used from home supplied or through purchased. The value of home supplied and purchased cow dung was calculated at the prevailing market price.

3.11.5 Cost of fertilizer

It is very important for vegetable cultivation to use the fertilizer in recommended dose. In the study area, farmers used mainly three types of chemical fertilizer i.e., Urea, TSP (Triple Super Phosphate), MP (Muriate of Potash) and Zinc sulphate for growing tomato cultivation. Fertilizer cost was calculated according to the actual price paid by the farmers.

3.11.6 Cost of pesticide

Most of the sample farmers used Dithane M-45, Thiovit 80wp and Rovral 50wp for tomato. The cost of these insecticides was calculated by the prices paid by farmers.

3.11.7 Cost of irrigation

The cost of irrigation included the rental charge of machine plus the costs of fuel. Someone rent/borrow only water from the shallow tube well (STW) owners by paying some charge.

3.11.8 Interest on operating capital

Interest cost was computed at the rate of 9% per annum. It was assumed that if farmers would take loans from a bank, they would have to pay interest at the above-mentioned rate. Since all expenses were not incurred it the beginning of the production process, rather they were spent throughout the whole production period the cost of operating was, therefore, computed by using the following formula:

Interest on operating capital = $\frac{\text{Operating Capital * Rate of interest x Time}}{2}$

This actually represented the average operating costs over the period because all costs were not incurred at the beginning or at any fixed time. The cost was charged for a period of 6 months at the rate of Tk. 9 per annum.

3.11.8 Land use cost

The price of land was different for different plots depending upon location and topography of the soil. The cost of land used was estimated by the cash rental value of land. In calculating land use cost, average rental value of land per acre for a particular year. In computing rental value of land of the land used cost (LUC), it was calculated according to farmer's statement.

3.12 Profitability Analysis

Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of tomato cultivation is calculated by the following way-

3.12.1 Calculation of Gross Return

Per acre gross return was calculated by multiplying the total amount of product and by-product by their respective per unit prices.

Gross Return= Quantity of the product * Average price of the product + Value of by-product.

3.12.2 Calculation of Gross Margin

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on TVC basis. Per acre gross margin was obtained by subtracting variable costs from gross return. That is, Gross margin = Gross

return – Variable cost.

3.12.3 Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return = Total return – Total production cost.

The following conventional profit equation was applied to examine farmer's profitability level of tomato producing farms in the study areas.

$$\text{Net profit, } \pi = \Sigma P_m Q_m - TFC.$$

Where,

π = Net profit/Net return from tomato cultivation (Tk/acre);

P_m=per unit price of tomato (Tk/kg);

Q_m=Total quantity of the tomato cultivation (kg/acre);

TFC = Total fixed cost (Tk) and

i = 1, 2, 3,....., n (number of inputs).

3.12.4 Undiscounted Benefit Cost Ratio (BCR)

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per acre.

$$\textbf{BCR} = \frac{\text{Total Return}}{\text{Total Cost}}$$

3.13 Resource use efficiency

In order to investigate the resource use efficiency, the ratio of marginal value product (MVP) to the marginal factor cost (MFC) for each input was computed and tested for its equality to 1,

That is, $\boxed{\frac{MVP}{MFC}} = r$

Where, r = Efficiency ratio MVP = value of change in output resulting from a unit change in variable input (BDT) MFC = price paid for the unit of variable input (BDT).

Under this method, the decision rules are that, when: r >1, the level of resource use is below the optimum level, implying under-utilization of resources. Increasing the rate of use of that resource will help increase productivity. r <1, the level of resources use is above the optimum level, implying over utilization of resources. Reducing the rate of use of that resource will help improve productivity. r = 1, the level of resource use is at optimum implying efficient resource utilization.

The most reliable, perhaps the most useful estimate of MVP is obtained by taking all input resources (Xi) and gross return (Y) at their geometric means (Dhawan and Bansal, 1977). All the variables of the fitted model were calculated in monetary value. As a result the slope co-efficient of those independent variables in the model represent the MVPs, which were estimated by multiplying the production co-efficient of given resources with the ratio of geometric mean (GM) of gross return to the geometric mean (GM) of the given resources, that is,

$$MVP\ (Xi) = \beta_i \quad \boxed{\frac{\bar{Y}(GM)}{\ddot{X}i(GM)}}$$

Where, $\bar{Y}$ (GM) = Geometric mean of gross return (BDT)

$\ddot{X}i(GM)$ = Geometric mean of different independent variables (BDT)

β_i = Co-efficient of parameter i = 1, 2,……..n

3.14 Problems faced in collecting data

The researcher had to face following problems in the field during the collection of data.

- The farmers did not keep records of their farming activities. Therefore, the researcher had to depend upon their memory. It was difficult to get information from memory.

- Most of the farmers in the study area thought that the investigator was a government officer. So, they initially hesitated to answer the questions relating to their income and expenditure. Some were afraid of position of new taxes.

- Sometimes, the farmers were not available at their home because they remained busy with outside work. That is why sometimes more than two visits were required to get information from them.

CHAPTER IV
SOCIO-DEMOGRAPHIC CHARACTERICTICS OF THE TOMATO FARMERS

In this chapter the findings of this study have been discussed in relation to the present findings and also to those found in other studies. Thirteen characteristics of the farmers were selected for this research. The characteristics include: age, education, experience in tomato cultivation, occupation, family size, credit received and credit received sector. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

4.1 Age

Age of the farmers ranged from 23 to 67 years. On the basis of age, the farmers were classified into three categories: 23-35 years, 36-50 years and above 50 years. The distribution of the farmers according to their age is shown in Figure 4.1.

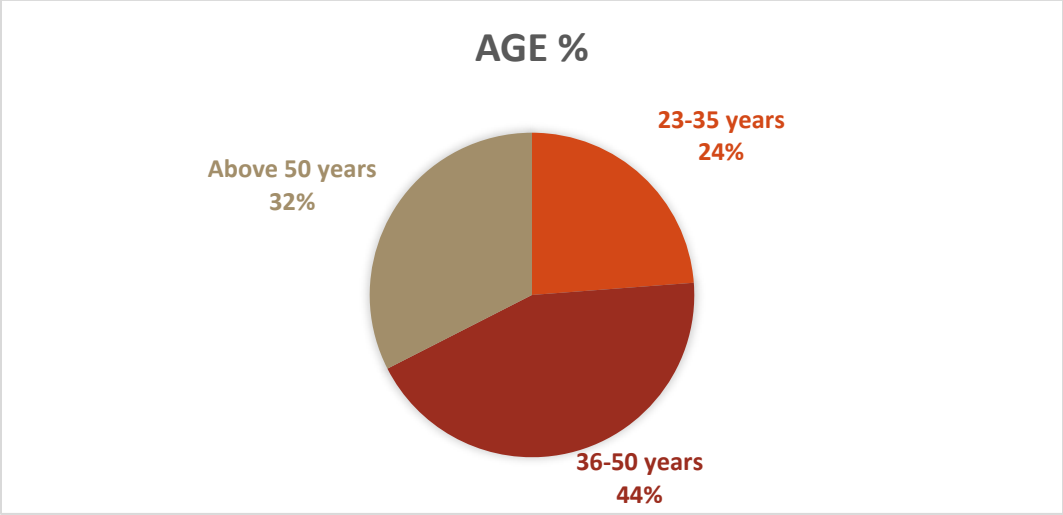


Figure 4.1 Distribution of the farmers according to their age

Source: Field Survey, 2019

Figure 4.1 showed that the highest proportion 44 percent of the tomato farmers fell in the 36-50 years age, while 32 percent of them fell in the above 50 years age category and 24 percent in the 23-35 years age category.

4.2 Education

The education scores of the farmers ranged from 0 to 18. On the basis of their educational scores, the farmers were classified into four categories, namely "illiterate (0-0.5), primary (1-5), Secondary (6-10) and above secondary education (above 10). The distribution of the farmers according to their education is shown in Figure 4.2.

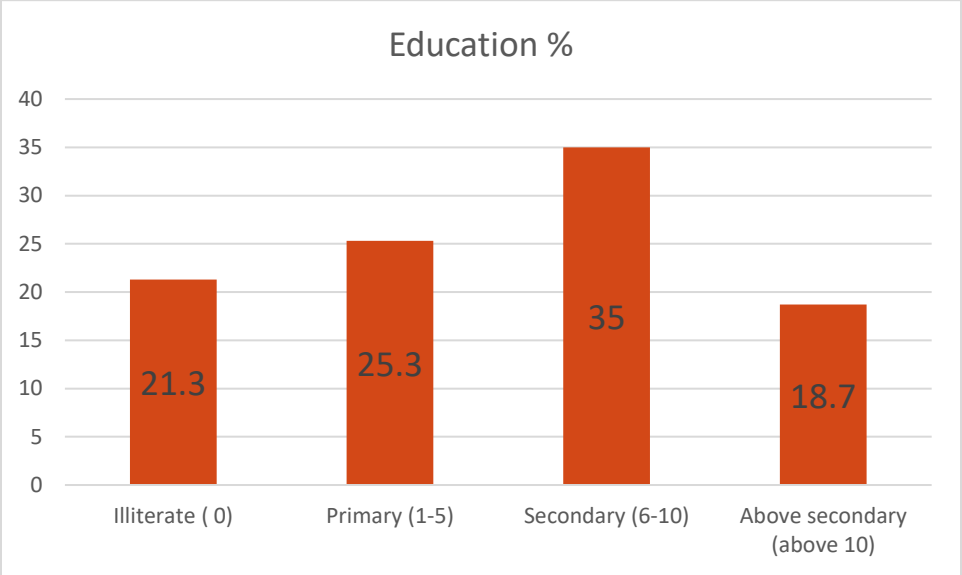


Figure 4.2 Distribution of the farmers according to their education

Source: Field Survey, 2019

Figure 4.2 indicated that the majority (35 percent) of the farmers had secondary level of education compared to 25.3 percent of them having primary level of education. About 22.3 percent of the farmers were illiterate and 18.7 percent of the farmers were above secondary level of education.

4.3 Experience in tomato cultivation

Experience in tomato cultivation of the farmers ranged from 3 to 50 years. On the basis of experience, the farmers were classified into three categories: 3-10 years, 11-25 years and above 25 years. The distribution of the farmers according to their experience is shown in Figure 4.3.

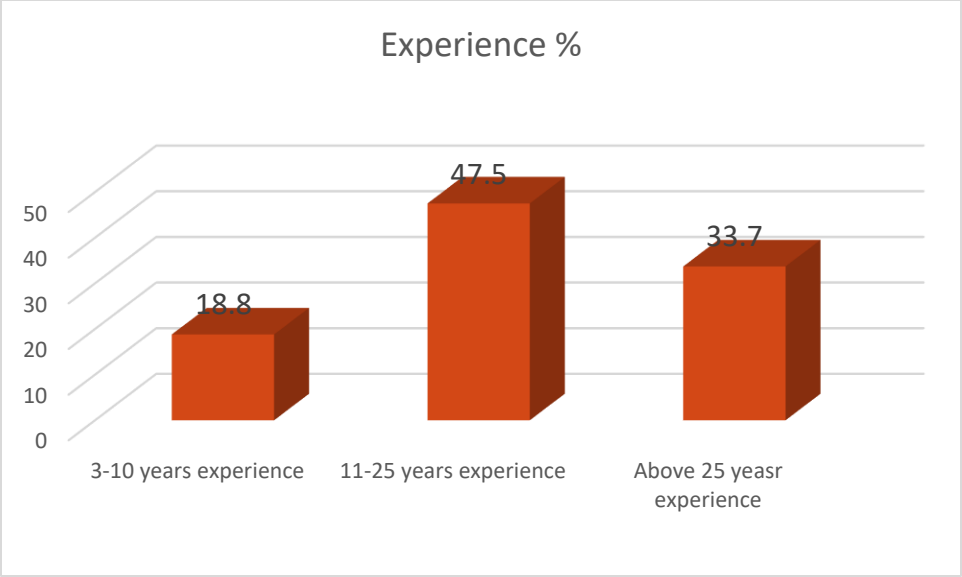


Figure 4.3 Distribution of the farmers according to their experience

Source: Field Survey, 2019

Figure 4.3 showed that the highest proportion 47.5 percent of the tomato farmers had 11-25 years' experience, while 18.8 percent of them had 3-10 years' experience category and 33.7 percent had above 25 years' experience.

4.4 Occupation

Occupation scores of the farmers ranged from 1 to 3. On the basis of their occupation, the respondents were classified into three categories namely, agriculture, business and service. The scale used for computing the occupation score of a respondent is given Figure 4.4.

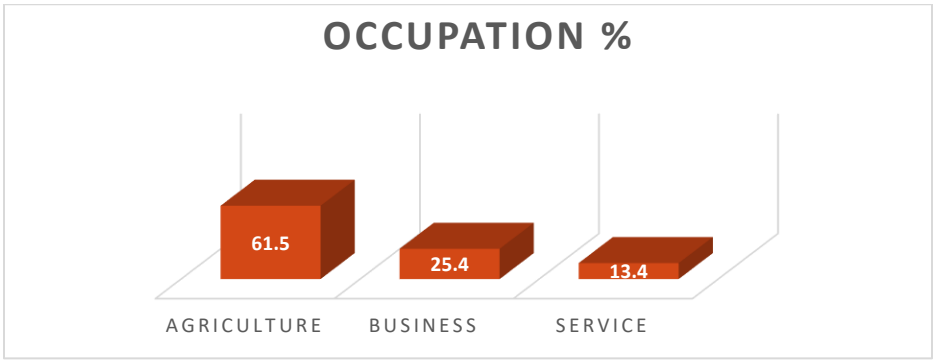


Figure 4.4 Distribution of the farmers according to their occupation

Source: Field Survey, 2019

Data contained in the Figure 4.4 indicated that the highest proportion (61.5%) of the respondents had agriculture and (25.4%) had business and (13.4%) had service holder, respectively.

4.5 Family size

The family size of the farmers ranged from 2 to 12 members. On the basis of their family size the farmers were classified into the following three categories: "small family" (2-4), "medium family" (5-7) and "large family" (above 7). Figure 4.5 contains the distribution of the farmers according to their family size.

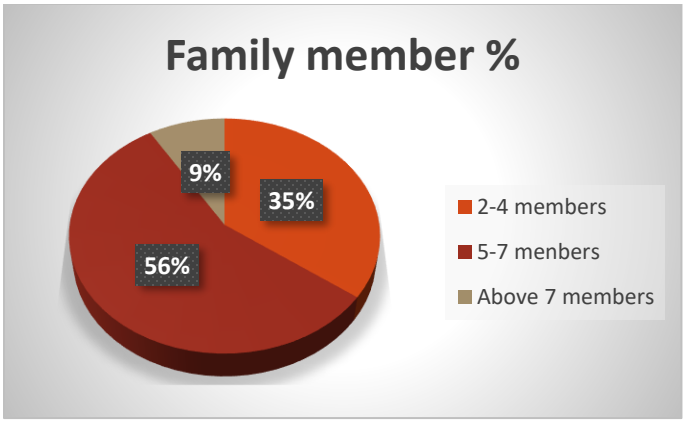


Figure 4.5 Distribution of the farmers according to their family size

Source: Field Survey, 2019

Figure 4.5 showed that the majority of the 56 percent of the tomato farmers had of 5-7 members compared to 37.2 percent of them having of 2-4 members. The proportion of above 7 members was 9 percent.

4.6 Credit received

Credit received of the farmers were two groups such as yes and no. It is evident that about 48.8 percent of the tomato farmers had credit received and rest of 51.2 percent of the mustard farmers had no credit received.

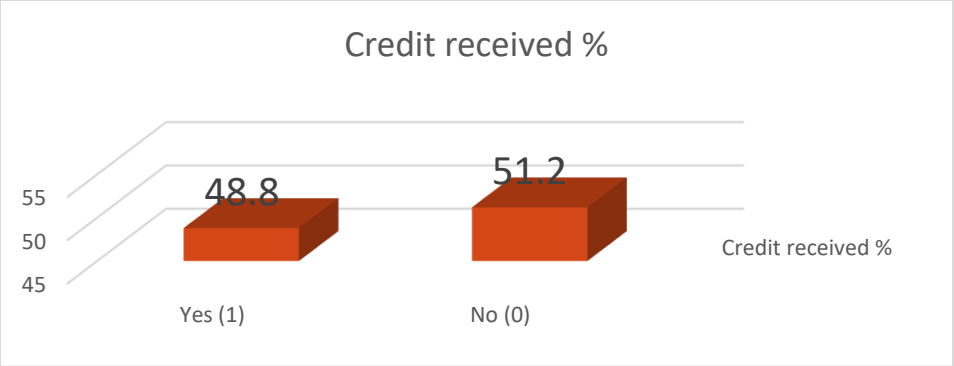


Figure 4.6 Distribution of the farmers according to their credit received

Source: Field Survey, 2019

4.7 Credit received sector

Credit received sector scores of the farmers ranged from 1 to 3. On the basis of their credit received sector the respondents were classified into three categories namely, Bank, NGOs, and others. The scale used for computing the credit received sector score of a respondent is given Figure 4.7.

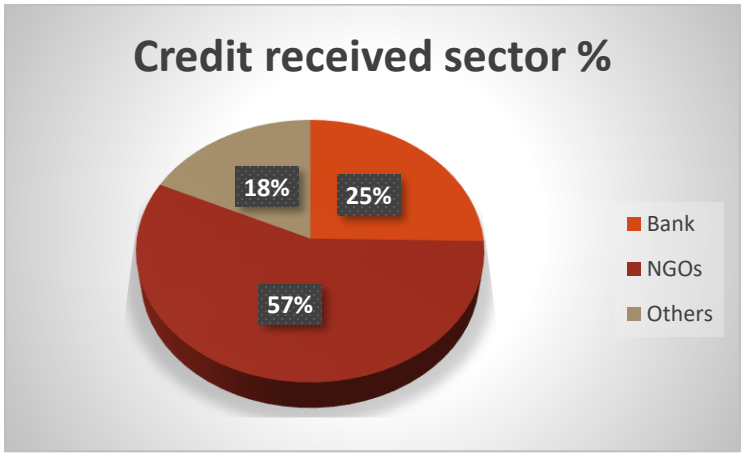


Figure 4.7 Distribution of the farmers according to their credit received sector

Source: Field Survey, 2019

Data contained in the Figure 4.7 indicated that the highest proportion (57%) of the respondents had credit received from NGOs and (25%) had credit received from bank, 18%) had others sources, respectively.

4.8 Annual family income

Credit received sector scores of the farmers ranged from 60 to450 thousand. On the basis of their annual family income of the respondents were classified into three categories namely, (60-150 thousand), (151-250 thousand) and (above 250 thousand). The scale used for computing the income score of a respondent is given Figure 4.8.

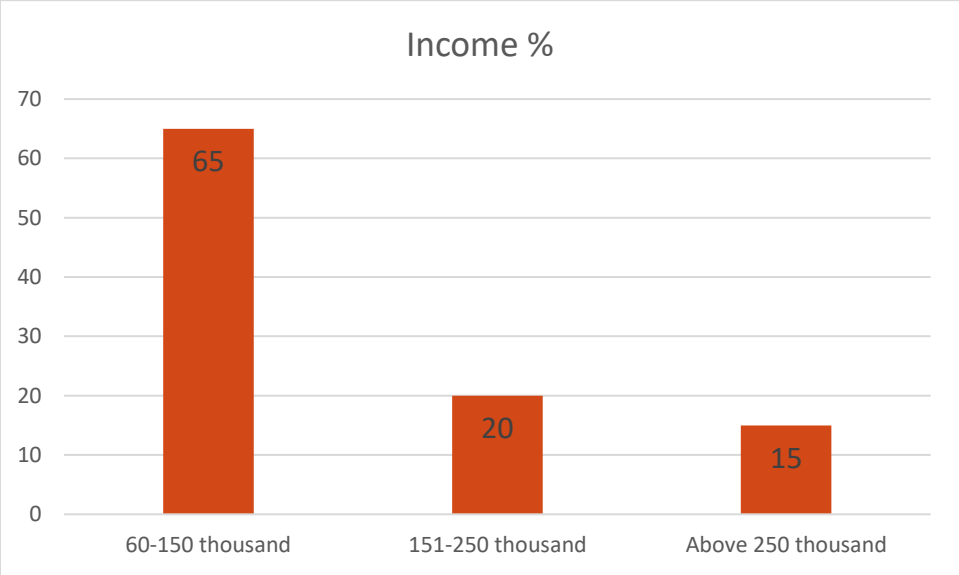


Figure 4.8 Distribution of the farmers according to their family income

Source: Field Survey, 2019

Data contained in the Figure 4.8 indicated that the highest proportion (65%) of the respondents had 60-150 thousand income level and (20%) had of the farmers had 151-250 thousand income level and 15% had above 250 thousand income, respectively.

CHAPTER V
PROFITABILITY OF TOMATO CULTIVATION

5.1 Profitability of tomato cultivation

Cost analysis was done through human labor cost, land preparation cost, seed cost, fertilizer cost, manure cost, irrigation cost and pesticides cost.

5.2 Land preparation cost

The use of power tiller was increasing rapidly in the study area and farmers widely used mechanical power for their land preparation. Mechanical power such as power tiller owner supplies fuel as well as a driver for land preparation. The owner charged a fixed amount of money as service charge for using tiller, which was Tk. 250 per bigha (local unit) land preparation for one tillage. Total cost of power tiller for tomato cultivation under small, medium and large farm were Tk. 2625, Tk. 2469 and Tk. 2476 respectively (Table 5.1).

5.3 Cost of seed

Farmers used both homes supplied and purchased seed. The cost of purchased seed was calculated on the basis of actual price paid by the farmers. The cost of home supplied seed was calculated on the basis of actual price paid by the farmers. The cost of home supplied seed was calculated on the basis of actual price paid by the farmers for purchased seed. It was found that per acre cost of seed for tomato production under small, medium and large farm were Tk. 1425, Tk. 1467, and Tk. 11302 respectively (Table 5.1).

5.4 Manure cost

Farmers used manure to keep their land fertile. The average cost of manure for tomato production was found to be Tk. 391, Tk. 358 and Tk. 376 per acre (Table 5.1).

5.5 Cost of fertilizer

In the study area, farmers mainly used three types of fertilizer namely urea, Triple super Phosphate (TSP) and Muriate of potash (MP). In case of tomato cultivation under small, medium and large farm total cost of fertilizer were Tk. 3986, Tk. 3652 and Tk. 3965 (Table

5.1). From the Table 5.1 it may be concluded that total cost of fertilizer for small farm was higher and followed by medium and large farm.

5.6 Human labor cost

Human labor cost was one of the most important cost items of tomato production in the study area. It is required for different farm operations like land preparation, planting, weeding, application of fertilizer and insecticide, harvesting and carrying etc. Mainly two types of human labor used the study area; such as a) Family labor: for which no payment is made and b) Hired labor: for which farmers have to pay in cash. In this study, human labor was measured in man-days. One-man day was equivalent to eight (8) hours in work by an adult. One day's human labor cost was Tk. 450. In pricing the labor no distinction was made between the family and hired labor. Family labor was priced at the prevailing wage rate in cash to hired labor. The wage rate was fixed for different types of activities. Cost of human labor is presented in Table 5.1. Total human labor cost/acre was taka 2523 for all farm category. Total labor cost was highest for small farm (Tk. 2625 category which was Taka followed by large farm (Taka 2476) and medium farm (Taka 2469).

5.7 Cost of pesticide

Farmers of the study area used pesticide computed on the basis of the price, which the farmers actually paid. Many farmers, however, did not have appropriate knowledge about the exact quantity to be applied and brands name of the pesticides. It was found that per acre cost of pesticides for tomato production under small, medium and large farm were Tk. 1243, Tk. 1132, and Tk. 1133 respectively. From this table it may be conclude that cost of pesticide for small farm size was higher than the medium and large farms (Table 5.1).

5.8 Cost of irrigation

Irrigation was a leading input for tomato production. The cost of irrigation water was charged at fixed rate of unit of area. The irrigated farms marginal, small and medium farmers were enjoying the irrigation facility. The irrigation cost for small, medium and large farm were Tk. 682, Tk. 605 and Tk. 616. It was found that per acre cost of irrigation for tomato production under small, medium and large farm were Tk. 682, Tk. 605 and Tk.

616 respectively. The cost for small farms for irrigation was higher than large and medium farms (Table 5.1).

Table 5.1: Per acre cost of Tomato cultivation in the study areas

Cost items	Small farm	Medium farm	Large farm	Average
Land preparation	2625	2469	2476	2523
Seed cost	1425	1467	1302	1398
Manure cost	391	358	376	375
Fertilizer cost	3986	3652	3965	3868
Labor cost	7152	6678	6870	6900
Insecticides and Pesticides	1243	1132	1133	1169
Irrigation	682	605	616	634
Total variable cost	17504	16361	16738	16867
Interest on operating capital	788	736	753	759
Land use cost	12611	11848	12111	8407
Total fixed cost	13399	12584	12864	9166
Total cost	30903	28945	29602	26033

5.9 Total variable cost

Total variable cost was estimated adding all the variable costs such as hired labor cost, mechanical power cost, purchased seed cost, cost of urea, TSP, MP, Gypsum, cost of pesticide & insecticides, cost of irrigation. In farm category total variable cost was Tk. 17504, Tk. 16361 and Tk. 16738 per acre for small, medium and large farm tomato cultivation respectively (Table 5.2).

5.10 Interest on operating capital

It may be noted that the interest on operating capital was calculated by taking in to account all the operating costs incurred during the production period of tomato cultivation. Interest

on operating capital for tomato production was estimated at Tk. 788, Tk. 736 and Tk. 753 per acre respectively (Table 5.1).

5.11 Cost of land use

The price of land was different for different plots depending upon location and topography of the soil. The cost of land used was estimated by the cash rental value of land. In computing rental value of land of the land used cost (LUC), it was calculated according to farmer's statement. Per acre land use cost of tomato cultivation were Tk. 12611, Tk. 11848 and Tk. 12111 under small, medium and large farms respectively. These results indicate that per acre land use cost of tomato cultivation was comparatively higher for small farm than the large and medium farms (Table 5.1).

5.12 Total fixed cost

Total fixed cost was the summation of all fixed cost which was land use cost. In monetary terms small farm incurred highest amount of fixed cost which was Tk. 13399 followed by large farm Tk. 12864 and medium farm Tk. 12584 per acre (Table 5.1).

5.13 Total cost

Total cost was the summation of total variable cost and total fixed cost. Per acre cost of tomato production was Tk. 26033 for all farm categories in the study area. Total cost was highest for small farm (Tk. 30903) followed by large farm (Tk. 29602) and medium farm (Tk. 28945) (Table 5.1).

5.14 Gross return of tomato production

Per acre gross return of tomato production under small, medium and large farms are shown in Table 5.2. Gross return per acre consisted of the value of main product. Per acre return was calculated by multiplying the total amount of products by their respective average market price. The average market price of tomato was Tk. 16 per kg. Per acre gross return of tomato cultivation under small, medium and large farms were Tk. 56208, Tk. 54912 and Tk. 52864 respectively which indicates that per acre gross return of medium farms were higher than large and small farms (Table 5.2).

Table 5.2 Per acre profitability and benefit cost ratio of tomato cultivation in the study areas

Item	Small farm	Medium farm	Large farm	Average
Tomato production (Kg. /acre)	3513	3432	3304	3416
Tomato price (Tk. /kg)	16	16	16	16
Gross return (GR)	56208	54912	52864	54661
Total variable cost (TVC)	17504	16361	16738	16867
Total cost (TVC+TFC)	30903	28945	29602	29816
Net return (GR-TC)	25305	25967	23262	24844
Gross margin (GR-TVC)	38704	38551	36126	37793
Benefit cost ratio (BCR)=GR/TC	1.82	1.90	1.78	1.83

5.15 Gross margin

Per acre gross margin of tomato production under small, medium and large farms are given in Table 5.2. Gross margin was estimated as the difference between gross return and total variable cost. The argument for using the gross margin analysis is that the farmers of Bangladesh are more interested to know their return over variable cost. For short run analysis as well as for farm planning, the gross margin analysis is widely used and this analysis is easily understandable to the farmers because of its simplicity. Table 5.2 shows that per acre gross margin of tomato cultivation under small, medium and large farms were Tk. 38704, Tk. 38551 and Tk. 36126 respectively. It indicates that the gross margin was highest in medium farms followed by small and large farms.

5.16 Net return and benefit cost ratio

Table 5.2 shows that per acre net return of tomato cultivation under small, medium and large farms were Tk. 25305, Tk. 25967 and Tk. 23262 respectively, which indicates that net return was highest in medium farms than large and small farms. Return over per Taka investment or Benefit-cost-ratio (undiscounted) was calculated as a ratio of gross return to total cost. Table 5.2 shows that per acre benefit cost ratio (BCR) of tomato cultivation under small, medium and large farm were 1.82, 1.90 and 1.78 respectively; implying that

production of tomato under medium farms was more profitable than the large and medium farm.

Benefit cost ratios was higher for medium farmers which was Tk. 1.90 followed by small (Tk. 1.82) and large farmers (Tk. 1.78).

CHAPTER VI
FACTORS AFFECTING RESOURCE USE EFFICIENCY OF TOMATO CULTIVATION

6.1 Factor affecting of tomato production

Human labor cost (X_1)

The co-efficient for human labor was 0. 056 and was positive and insignificant for tomato cultivation. This indicates that 1 percent increase in human labor cost keeping other factors constant, would increase the gross returns by 0.056 percent.

Land preparation cost (X_2)

It is evident from Table 6.1 that the coefficient of land preparation cost was 0.248 which was significant at 1 percent level for tomato production. That means, 1 percent in cost of this input keeping other factors constant would result in an increase of gross return by 0.248 per cent.

Seed cost (X_3)

The estimated co-efficient of seed was 0.196 which was significant at 5 percent level for tomato production. This indicates that an increase of 1 per cent in cost of this input keeping other factors constant would result in an increase of gross return by 0.196 per cent.

Urea cost (X_4)

The estimated value of the co-efficient of urea fertilizer was 0.135 for tomato production and was insignificant. It can be said that 1 percent increase in urea cost keeping other factors constant, would increase the gross returns by 0.135 percent.

TSP cost (X_5)

The estimated value of the co-efficient of TSP fertilizer was 0.170 for tomato cultivation and was significant at 5 percent level. It can be said that 1 percent increase in TSP cost keeping other factors constant, would increase the gross returns by 0.170 percent.

MoP cost (X_6)

The estimated value of the co-efficient of MoP fertilizer was 0.019 for tomato farmer and was insignificant. It can be said that 1 percent increase in MoP fertilizer cost keeping other factors constant, would increase the gross returns by 0.019 percent.

Manure cost (X_7)

The co-efficient of the variable was 0.092 and significant at 1 percent level. This suggests that an additional spending of 1 percent on manure would enable the farmers to earn 0.092 percent of gross return from tomato cultivation.

Irrigation cost (X_8)

The co-efficient of the variable was 0.161 and insignificant. This suggests that an additional spending of 1 percent on irrigation water would enable the farmers to earn 0.161 percent of gross return from tomato cultivation.

Pesticide cost (X_9)

The co-efficient of the variable was 0.156 and insignificant. This suggests that an additional spending of 1 percent on pesticide would enable the farmers to earn 0.156 percent of gross return from tomato cultivation.

Table 6.1 Estimated values of coefficients and related statistics of Cobb- Douglas production function

Explanatory variables	Coefficient	Standard error	p- value
Intercept	4.358	.406	.000**
Cost of human labor (X_1)	.056	.069	.446
Cost of land preparation (X_2)	.248	.064	.005**
Cost of seed (X_3)	.196	.077	.016*
Cost of urea (X_4)	.135	.058	.153
Cost of TSP (X_5)	.170	.053	.024*
Cost of MoP (X_6)	.019	.028	.737
Cost of manure (X_7)	.092	.019	.004**
Cost of irrigation (X_8)	.161	.108	.209
Cost of pesticide (X_9)	.156	.117	.286
R^2	.842		
Adjusted R^2	.834		
Return to scale	1.259		
F-value	112.232**		

Source: Field Survey, 2019

Note: ** Significant at 1 percent level; * Significant at 5 percent level and NS: Not Significant

Value of R^2

The co-efficient of multiple determinations, R^2 was 0.842 for tomato cultivars which indicates that about 84 percent of the total variation in return of tomato production is explained by the variables included in the model. In other words the excluded variables accounted for 16 percent of the total variation in return of tomato.

F-Value

The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns of tomato production.

Returns to Scale

The summation of all the production coefficients indicates returns to scale. For tomato production in farmers the summation of the coefficients was 1.259. This indicated that the production function showed diminishing returns to scale.

6.2 Resource use efficiency of tomato production

In order to identify the status of resource use efficiency, it was considered that a ratio equal to unity indicated the optimum use of that factor, a ratio more than unity indicated that the yield could be increased by using more of the resources. A value of less than unity indicated the unprofitable level of resource use, which should be decreased to minimize the losses because farmers over used this variable. The negative value of MVP indicates the indiscriminate and inefficient use of resource.

Table 6.2 showed that the ratio of MVP and MFC of human labor (0.14) for tomato cultivation was positive and less than one, which indicated that in the study area human labor for tomato cultivation was over-utilization. So, farmers should decrease the use of human labor to attain efficiency level.

The ratio of MVP and MFC of land preparation cost 5.81) for tomato production was positive and more than one, which indicated that in the study area land preparation was under-utilization (Table 6.2). So, farmers should increase the use of land preparation to attain efficiency considerably.

The ratio of MVP and MFC of seed was found to be 1.55 for tomato cultivation was positive and more than one, which indicated that in the study area use of seed for tomato production was under-utilization (Table 6.2). So, farmers should increase the use of seed for tomato production to attain efficiency considerably.

It was evident from the Table 6.2 that the ratio of MVP and MFC of urea (1.97) for tomato cultivation was positive and more than one, which indicated that in the study area use of urea for tomato cultivation was under-utilization. So, farmers should increase the use of urea to attain efficiency in tomato cultivation.

Table 6.2 Estimated Resource Use Efficiency in tomato Production

Variable	Geometric mean (GM)	$\bar{Y}$ (GM)/$\ddot{x}_i$ (GM)	Co-efficient	MVP (Xi)	r=MVP/MFC	Decision rule
Yield (Y)	18851.26					
Human labor cost (X_1)	7399.55	2.55	.056	0.143	0.143	Over-utilization
Land preparation cost (X_2)	804.26	23.44	.248	5.81	5.81	Under-utilization
Seed cost (X_3)	2378.86	7.92	.196	1.55	1.55	Under-utilization
Urea cost (X_4)	1327.68	14.20	.135	1.97	1.97	Under-utilization
TSP cost (X_5)	3239.31	5.82	.170	0.99	0.99	Over-utilization
MoP (X_6)	1120.62	16.82	.019	0.31	0.31	Over-utilization
Manure (X_7)	993.69	18.71	.092	1.75	1.75	Under-utilization
Irrigation cost(X_8)	1123.94	16.77	.161	2.70	2.70	Under-utilization
Pesticide cost (X_9)	908.65	20.75	.156	3.24	3.24	Under-utilization

Source: Field Survey, 2019

The ratio of MVP and MFC of TSP (0.99) for tomato cultivation was positive and less than one, which indicated that in the study areas use of TSP for tomato cultivation was over utilization (Table 6.2). So, farmers should decrease the use of TSP to attain efficiency

considerably.

It was evident from the Table 6.2 that the ratio of MVP and MFC of MoP (0.31) for tomato cultivation was positive and less than one, which indicated that in the study area use of MoP for tomato cultivation was over-utilization. So, farmers should decrease the use of MoP to attain efficiency in tomato cultivation.

It was evident from the Table 6.2 that the ratio of MVP and MFC of manure (1.75) for tomato cultivation was positive and more than one, which indicated that in the study area use of manure for tomato cultivation was under used. So, farmers should increase the use of urea to attain efficiency in tomato cultivation.

Table 6.2 revealed that the ratios of MVP and MFC of irrigation used for tomato cultivation was positive and more than one (2.70), which indicated that irrigation application was underutilized. So, farmers should increase the use of irrigation to attain efficiency in tomato cultivation.

It was evident from the Table 6.2 that the ratio of MVP and MFC of pesticide (3.24) for tomato cultivation was positive and more than one, which indicated that in the study area use of pesticide for tomato cultivation was under used. So, farmers should increase the use of pesticide to attain efficiency in tomato cultivation.

6.3 Concluding remarks

It is evident from the Cobb-Douglas production function model that the included key variables had significant and positive effect on tomato production except the positive and insignificant effect of human labor cost, urea cost, MP cost, irrigation and pesticide cost. Resource use efficiency indicated that all of the resources were under used for tomato production except overutilization of human labor cost, TSP cost and MP cost. So there is a positive effect of key factors in the production process of year round tomato production.

CHAPTER VII
PROBLEM FACED BY THE FARMERS IN TOMATO PRODUCTION

7.1 Introduction

It is well known that farmers in Bangladesh face various problems associated with tomato production. This chapter attempts to identify and analyze the problems and constraints concerned with the tomato production and ranked the problems according to their responses. Constraints to tomato, production experience says that farmers in Bangladesh cannot get the required quantity of inputs and technical supports and finally the optimum price of their products. They do not have enough funds for tomato cultivation due to their subsistence farming. The major problems of the selected farmers in the study were identified and their responses are represented in.

7.2 Problems faced by the farmers

Farmers face some problems in tomato production. Table 7.1 shows different problems mentioned by the farmers. These are described below:

7.2.1 Unavailability of good quality seed

High quality of seed is the main input for tomato cultivation. Farmers in the study area could not get high quality of seed. Sometimes seed were mixed with some other particle and could not proper germination. About 82.5% of the farmer in the study area thought that lack of quality seed is the big problem for tomato cultivation. The study areas unavailability of good quality seed was 1st in the rank order.

7.2.2 Labor crisis

Skilled labors are not available in the study area because most of the labors are involved in other business. Labors are tendency to waste time and cannot work properly. So Production cost became high as well as production level also lower. In study area, 42.5% of the farmers agreed that skilled labor was not available for tomato cultivation. In the rank order, problem of lack of skilled labor was the 5th in the study area.

7.2.3 Low prices at peak harvest period

Low prices at peak harvest period of tomato particularly just after harvesting of the product caused disincentive for the farmers to produce the crops. About 62.5% of the farmers in the study area responded this problem. In the rank order, low prices at peak harvest period of tomato was the 4th in order.

7.2.4 Damage caused by diseases

Damage caused by diseases in the study areas are the main problem for tomato cultivation. When disease attract in the field, it damaged large portion of tomato. It is a big loss for the tomato farmers. About 35% of the farmers in the study area claim that yield become lower because of disease attack. In the rank order, disease attack was the 8th problem in the study area.

Table 7.1 Problems faced index with rank order

List of problems	% of farmers	Rank order
Unavailability of good quality seed	82.5	1st
Labor crisis	42.5	5th
Low prices at peak harvest period	62.5	4th
Damage caused by diseases	35.0	7th
Unavailability of quality fertilizers in time	72.5	3rd
Lack of Government attention	80.5	2nd
High transportation cost	34.0	8th
Lack of storage facilities	40.5	6th
Lack of irrigation facility	24.5	9th

Source: Field Survey, 2019

7.2.5 Unavailability of quality fertilizers in time

Some areas in the study area farmers claim that some fertilizers are not available to them. So they bought fertilizer in the market which was far from village. Fertilizer unavailability was the problem for the farmers in the study area and 72.5% of the farmers reported. In the rank order, unavailability of fertilizer was the 3rd in the study area.

7.2.6 Lack of government attention

During the investigation, most of the farmers complained that they did not get enough support from the government. Only large farmers were benefited from the government institution. Input price should be reduced, proper training should be provided to the farmers. In the study area, lack of government attention was the 2nd problems among the farmers (Table 7.1).

7.2.7 High transportation cost

High transportation cost was another problem of the farmer to tomato production and marketing. For higher transportation cost farmers could not accumulate all types of input and could not get better price to sale tomato. So ultimately profit becomes low. 34% farmers in the study area mention that high transportation cost was another problem of the farmer to tomato production and marketing. In the rank order, High transportation cost was the 8th in the study area.

7.2.8 Lack of storage facilities

There was a lack of storage facility for tomato growers was the major problem in the study areas. Most of the products were sold just after harvest at a low price due to lack of proper storage facilities. About 40.5% of the famers reported that lack of storage facilities and high charge for storage discouraged them to produce more tomato. In the rank order, problem of lack of storage facility was the 6th in the study area.

7.2.9 Lack of irrigation facility

Irrigation water is one of the most important inputs for tomato production. Yield of tomato varied in the application of irrigation water. They took irrigation facility from other farmer by some rate of amount but it is a problem for timely supply of water. About 24.5% of the farmers in the study area reported that they were not received water timely and water charge was much higher for them. In the rank order, lack of irrigation facility was the 9th in the study area.

CHAPTER VIII
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Cumilla district was chosen purposively as a study area because this district is one of the renowned for tomato production in Bangladesh. Barura upazila and Chandina upazila was selected at random from the 16 upazila of Cumilla districts as the study area. An opening survey was carried on in some villages of Barura and Chandina upazila to collect primary knowledge about the tomato production, productivity and efficiency of the tomato growers. After preliminary visit three village's namely Katakhola, Khaisara, Ethberpur and Aozbon were selected randomly as the study area. Most of the farmers in these villages used to produce high yielding varieties of tomato and sell their product to different middlemen.

1. To delineate the socio-economic characteristics of tomato producers in the study area;
2. To estimate the costs and returns of tomato production in the study area;
3. To find out the factors that affect profitability of tomato cultivation; and
4. To assess the resource use efficiency of tomato cultivation.

8.1 Summary of the study

The highest proportion 44 percent of the tomato farmers fell in the 36-50 years age, while 32 percent of them fell in the above 50 years age category and 24 percent in the 23-35 years age category. The majority (35 percent) of the farmers had secondary level of education compared to 25.3 percent of them having primary level of education. About 22.3 percent of the farmers were illiterate and 18.7 percent of the farmers were above secondary level of education. The highest proportion 47.5 percent of the tomato farmers had 11-25 years' experience, while 18.8 percent of them had 3-10 years' experience category and 33.7 percent had above 25 years' experience. The highest proportion (61.5%) of the respondents had agriculture and (25.4%) had business and (13.4%) had service holder, respectively. The majority of the 56 percent of the tomato farmers had of 5-7 members compared to 37.2 percent of them having of 2-4 members. The proportion of above 7 members was 9 percent. About 48.8 percent of the tomato farmers had credit received and rest of 51.2 percent of the mustard farmers had no credit received. The highest proportion (57%) of the

respondents had credit received from NGOs and (25%) had credit received from bank, 18%) had others sources, respectively.

Total cost of power tiller for tomato cultivation under small, medium and large farm were Tk. 2625, Tk. 2469 and Tk. 2476 respectively. Per acre cost of seed for tomato production under small, medium and large farm were Tk. 1425, Tk. 1467 and Tk. 1302 respectively. The total cost of manure for tomato production was found to be Tk. 391, Tk. 358 and Tk. 376 per acre. In case of tomato cultivation under small, medium and large farm total cost of fertilizer were Tk. 3986, Tk. 3652 and Tk. 3965. From the result it may be concluded that total cost of fertilizer for small farm was higher and followed by medium and large farm. Total human labor cost/acre was taka 2523 for all farm category. Total labor cost was highest for small farm (Tk. 2625 category which was Taka followed by large farm (Taka 2476) and medium farm (Taka 2469). It was found that per acre cost of pesticides for tomato production under small, medium and large farm were Tk. 1243, Tk. 1132, and Tk. 1133 respectively. From this table it may be conclude that cost of pesticide for small farm size was higher than the medium and large farms. From this table it may be conclude that cost of pesticide for small farm size was higher than the medium and large farms. The irrigation cost for small, medium and large farm were Tk. 11264, Tk. 4600 and Tk. 8505. The irrigation cost for small, medium and large farm were Tk. 682, Tk. 605 and Tk. 616.

In farm category total variable cost was Tk. 17504, Tk. 16361 and Tk. 16738 per acre for small, medium and large farm tomato cultivation respectively. Interest on operating capital for tomato production was estimated at Tk. 788, Tk. 736 and Tk. 753 per acre respectively. Per acre land use cost of tomato cultivation were Tk. 12611, Tk. 11848 and Tk. 12111 under small, medium and large farms respectively. In monetary terms small farm incurred highest amount of fixed cost which was Tk. 13399 followed by large farm Tk. 12864 and medium farm Tk. 12584 per acre. Per acre cost of tomato production was Tk. 26033 for all farm categories in the study area. Total cost was highest for small farm (Tk. 30903) followed by large farm (Tk. 29602) and medium farm (Tk. 28945The average market price of tomato was Tk. 16 per kg. Per acre gross return of tomato cultivation under small, medium and large farms were Tk. 56208, Tk. 54912 and Tk. 52864 respectively which

indicates that per acre gross return of small farms were higher than large and medium farms. Per acre gross margin of tomato cultivation under small, medium and large farms were Tk. 38704, Tk. 38551 and Tk. 36126 respectively. Per acre net return of tomato cultivation under small, medium and large farms were Tk. 25305, Tk. 25967 and Tk. 23262 respectively, which indicates that net return was highest in small farms than large and medium farms. Per acre benefit cost ratio (BCR) of tomato cultivation under small, medium and large farm were 1.82, 1.90 and 1.78 respectively.

In this study, Cobb-Douglas production function model was used to determine the effects of key variable inputs. The most important nine explanatory variables were included in the model to explain the gross income or return of tomato cultivation. Most of the variables in the production function were significant in explaining the gross return except the positive and insignificant effect of human labour cost, urea, MP, irrigation and pesticides. The coefficient with expected sign indicates the selected inputs contributed positively to the gross return. The values of the coefficient of multiple determination of tomato cultivation was 0.842 which implied that about 84 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. Production function for tomato cultivation exhibits increasing returns to scale (1.259). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 1.259 percent. The F-value for the tomato cultivation was 112.232 which were highly significant at 1 percent level. Resource use efficiency indicated that all of the resources were under used for tomato cultivation except overutilization of human labor, TSP and MoP. So, there was a positive effect of key factors in the production process of tomato cultivation.

The findings revealed that unavailability of good quality seed, lack of government attention, unavailability of quality fertilizers in time, low prices at peak harvest period, labor crisis, lack of storage facilities, damage caused by insects, high transportation cost and lack of irrigation facility etc. were the major obstacle which stand in the way of tomato cultivation in the study area.

8.2 Conclusions

The main reason behind cultivating tomato is the far and wide detained observation that Tomato is emerging as a lucrative vegetable. Tomato is well thought-out as the most important vegetable crops and has more multipurpose usages in Bangladesh. High production of tomato depends on the spreading out of HYV and hybrid variety of seed, improved management and timely supplying of inputs. The rate of taking up of modern technology and sustainability of tomato production depend largely on its economic prosperity. The situation of tomato production & its industry is extremely to a great extent competitive.

The findings of the study that net profit per acre (TK. 24844). This research shows small farmers cultivate more land & earn highest net profit. Priority should be given to the development of such roads which link villages to the main roads and markets. Most of the farmers are illiterate. Dissemination of market information should be increased so that farmers can get fair price of the Tomato.

Tomato farmers enhanced to some extent. If modem inputs and production technology can be made available to the farmers in time, yield and production of Tomato may be augmented which can help the farmers to enlarge income and perk up livelihood conditions.

Government or no additional agency can the tomato farmer can put down his hands on durable ready cash the instant his produce is inclined of nothing like a good number other crops which yield proceeds as and when the Production is prepared for sale. This pretends as a most important unifying force for the farmers.

8.3 Recommendations

Some recommendations are given below:

1. The price of tomato should be readjusted from time to time safeguarding justice to the growers of tomato.
2. Government should reduce the pesticide and insecticide price.

3. The consciousness of the farmers needs to be increased. They may be delivered adequate training so that they can produce tomato appropriately.
4. Modern technology should be taking on for superior labor cost control.
5. Agricultural credit facilities to be ensured easily.
6. Provision for the introduction of crop insurance should be introduced. Therefore, the risk of Tomato cultivation would be minimized and farmers will get more ensured environment to produced tomato.
7. In the view of actual field experiences gained so far, it is accomplished that farmers did not get fertilizers at the government rate. So public interventions might be required for ensuring the reasonable price of fertilizers. Furthermore, farmers reported that they were suffered from adulterated fertilizers. Consequently, public initiative should be taken to maintain fertilizer quality.
8. Quality seeds of improved varieties in right quantity are recognized to be one of the key elements for enhancing agricultural production. Farmers also reported that they were suffered from seed adulteration.

8.4 Limitation of the study

1. The study was restricted to one Sub-district where tomato production was intensive. Three villages under that Sub-district were selected purposively.
2. Due to deficiency of time the study could not cover wide side areas for gathering obligatory information.
3. Some written records were asserted by the literate respondents, but maximum respondents had no written document. Therefore, the researcher had to depend solely on the memory of the respondents.
4. Respondents were very busy. A study that brings in interview of 80 farmers cannot conclude anything accurately and as such, it was based on miss information.
5. The largest part of the farmers in the study area contemplation that the investigator was a government officer. So, they originally hesitated to answer the questions relating to their income and expenditure. Some were afraid of imposition of new taxes.

REFERENCES

Adenuga, A. H., Muhammad-Lawal, A. and Rotimi, O. A. 2013. Economics and technical efficiency of dry season tomato production in selected areas in kwara state, nigeria. Agris on-line papers in economics and informatics; 5:1.

Akhter, S., Anwar, M. M. and Asaduzzaman, M. 2001. Potato production in some selected areas of Bangladesh. TCRC. BARI, Joydebpur. Gazipur, Bangladesh.

Ameer, K., Jilani, M. S., Alizia, A. A. and Waseem, K. 2008. Performance of different exotic tomato (Lycopersicon esculentum) cultivars under the agro-climatic conditions of Dera Ismail Khan. M.Sc. (Hons) Thesis, Dept. Of Hort. Fac. of Agric. Gomal Univ. Dera Ismail Khan, Pakistan.

BBS. 2010.Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

BBS. 2015. Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

BBS. 2016. Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

BBS. 2018. Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

BBS. 2019. Yearbook of Agricultural Statistics of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.

Haque, S. 2004. Comparative Technical Efficiency and Profitability of Potato, Tomato and Cauliflower Production in a Selected Areas of Netrokona District. An Unpublished Master Thesis. Submitted to the Dept, of Agril. Economics, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.

Hasan, M. F. 2008. Economic efficiency and constraints of maize production in the northern region of Bangladesh. J. innov. dev. Strategy, 2(1), 18-32

Himayatullah, A. M., and Iqbal, M. 2000. A comparative study of relative technical I efficiency of wheat growers in two different ecological zones of the Northwest Frontier Province of Pakistan, *Sarhad-Journal-of-Agriculture.* 16:2, 201-209.

Hossain, M. A., Goffer, M. A., Chowdhury, J. C. S., Rahman, M. S. and Hossain, M. I. 1999. A Study on Postharvest Practices and Loss of Tomato in Some Selected Areas of Bangladesh. *Bangladesh J. Agril. Res*. 24(2), pp-299.

Hossain, M. M., Khalequzzaman, K. M., Hossain, M. A., Mollah, M. R. A and Siddique, M. A. 2004. Influence of planting time on the extension of picking period of four tomato varieties. J. Biol. Sci.; 4:616-619.

Islam, S. M. F., Manos, B., Anwar, M. M. and Ogier, J. P. 2000. Potato production system in Bangladesh: resource use, productivity, efficiency and comparative profitability of true potato seed technology over traditional tuber technology. Dept. of Agricultural Economics, BSMR Agricultural University, Gazipur, 1706.

Karim, M. R., Rahman, M. S., and Alam, M. S. 2009. Profitability of Summer BARI Hybrid Tomato Cultivation in Jessore District of Bangladesh. J Agric Rural Dev.; 7(1-2):73-79.

Khan, M. A. K. 2004. Productivity and Resource Use Efficiency of Boro Rice Cultivation in some Selected Haor Areas of kishoreganj District. An Unpublished Master Thesis. Submitted to the Dept, of Agril. Economics, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.

Menzel, C. M. and Simpson, D. R. 1986. Lychee Cultivars. Queesland Agril. J. 112 (3): 125-136.

Pingali, P, Rosegrant, M. 1995. Agricultural commercialization and diversification: processes and policies. Food Policy; 20(3):171-185.

Rahman, S. M and Takeda, J. 2007. Measuring the Costs of Production Based on Sizes of Farm Operation: A Study on Rice Farmers in Jessore District of Bangladesh, American Journal of Applied Sciences 4 (5): 274-283.

Rajput, A. M., Saxena, K. K. and Bisoniya, K. S. 2001. Profitability of wheat varieties in Indore, M.P. Crop-Research-Hisar. 21:1, 27-29.

Rayhan, S. J., Rahman, M. S. and Summy, H. M. 2013. Profitability and Resource Use Efficiency of Mustard Production in Sirajganj District, Bangladesh. Paper accepted as Journal of Sher-e-Bangla Agricultural University.

Reardon, T., Barrett, C. B. 2000. Agro industrialization, globalization, and international development: an overview of issues, patterns, and determinants. Agricultural Economics; 23:195-205.

Sadiq, M. S., Yakasai, M.T., Ahmad, M.M., Lapkene, T.Y. and Abubakar, M. 2013. Profitability and Production Efficiency of Small-Scale Maize Production in Niger State, Nigeria. *Journal of Applied Physics* 2(3).

Scanlan, F. M. 1995. Fruit Production Manual. Department of Agricultural Extension, Bangladesh Agricultural Development Corporation. Dhaka. 286 P.

Spring, A. 2001. Positive effects of agricultural commercialization on women: a new paradigm. In: P. Webb and K. Weinberger (eds.). Women farmers: enhancing rights, recognition and productivity. Frankfurt: Peter Lang; 13-36.

Tindall, H. D. 1994. Sapindaceous Fruits, Botany and Horticulture. Hort. Rev., 16:143196.

Uddin, H. 2008. An economic study on maize production under different farm size groups in a selected area of Bangladesh, M. S. Ag. Econ. Thesis, Bangladesh Agricultural University, Mymensingh.

Vegetable Facts, 2018. History of Tomatoes. www.vegetable fscts.net/vegetable-history-of-tomatoes/.

Von Braun, J. 1995. Agricultural commercialization: impacts on income and nutrition and implications for policy. Food Policy; 20(3):187-202.

Wilson, P., D. Hadley and Asby, C. 2001. The influence of management characteristics on the technical efficiency of wheat fanners in eastern England, *Agricultural Economics.* 24:3, 329-338.