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

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CERTIFICATE

This is to certify that thesis entitled, **" PROFITABILITY AND RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION IN SOME SELECTED AREAS OF NARSINGDI DISTRICT IN BANGLADESH"** submitted to the faculty of Agribusiness management, Sher-E-Bangla Agricultural university, Dhaka, in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (M.Sc.) IN AGRICULTURAL ECONOMICS**, embodies the result of a piece of bona fide research work carried out by **AMINA KHATUN** bearing registration no: 12-05211 under my supervision and guidance. No part of thesis has been submitted for any other degree or diploma.

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

01 December, 2019
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Dedicated to
My
Beloved Parents

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

ABSTRACT

In the agrarian and poor densely populated country like Bangladesh which is situated in South Asia, vegetable plays a crucial role in supplying nutrition and generating income and employment opportunities. The study was conducted to analyse the profitability, contribution of factors in yield and socioeconomic status of tomato (*Lycopersicon esculentum)* producing farmers at Narsingdi Sadar & Raipura thana under Narsingdi district to assess the profitability, contribution of factors to production and changes in socio-economic status of the farmers. The study was based on primary data, collected from 90 farmers, selected using a simple random sampling technique. The main factors of production like, seeds, human labour, tillage, fertilizer, manure, irrigation, hormone and pestticides were considered to estimate the impacts on tomato production. Amongst 2 thanas, farmers from Raipura earned highest profit. Gross returns for per hectare were Tk. 933160 corresponding net returns was Tk. 545637. Moreover, the undiscounted benefit cost ratio of was in total (2.4). The coefficient of determinations (R^2) was about 0.876, which indicates that about 87 percent of variations of tomato production are explained by the independent variables. The result showed that human labour, tillage, fertilizer and manures of the variables were significantly positive, which implies independent inputs had effective contribution to increase tomato production. The ratio of MVP and MFC of seed, land preparation, Fertilizer, Manure, Hired labour and Irrigation was found 5.18, 2.42, 12.62, 7.86, 0.877 and 30.88 respectively. About 35 % of total variable cost was incurred for using human labour, respectively. Timely non availability of labour, insect and diseases attack was reportedly the major problems for tomato production. Effective policy and proper extension services have therefore, to be ensured to increase income and employment opportunities of the tomato farmers.

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ABBREVIATIONS AND ACRONYMS

AEO	Agriculture Extension Officer
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistic
BCR	Benefit Cost Ratio
BDT	Bangladeshi Taka
BER	Bangladesh Economic Review
BS	Block Supervisor
CV%	Percentage of Coefficient of Variation
DAE	Department of Agricultural Extension
Df	Degrees of Freedom
et al.	and others (at elli)
etc.	Etcetera
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GM	Geometric Mean
GoB	Government of Bangladesh
GR	Gross Return
Ha	Hectare
HIES	Household Income and Expenditure Survey
HYV	High Yielding Variety
IOC	Interest on Operating Capital
Kg	Kilogram
Ln	Natural logarithm
Max.	Maximum
MFC	Marginal Factor Cost
MoP	Muriate of Potash
MPP	Marginal Physical Price
Mt	Metric Ton
MVP	Marginal Value Product
NGO	Non-Government Organization

RUE	Resource Use Efficiency
T	Ton
TC	Total Cost
TFC	Total Fixed Cost
Tk.	Taka
TSP	Triple Super Phosphate
TVC	Total Variable Cost
US	United States
$	US Dollar

CHAPTER 1

INTRODUCTION

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INTRODUCTION

1.1 Background of the Study

Bangladesh is basically an agricultural country where agriculture dominantly plays an important role in the economic sector. The country is densely over populated with an area of 1, 47,570 sq. kilometers. The population growth rate is about 1.37 percent per year and statistically the overall male female ratio is 100.2:100 and the per capita income is 1909 US Dollars in the country (MoF, 2019). About 21.8 percent of the populations live in the poverty line under which about 11.3 percent live in the extreme poverty line estimated in the term of their minimum calorie intake per day (MoF, 2019).

Bangladesh has 16.37 crore people where the economy of Bangladesh is based firstly on agriculture with a growth of GDP 8.13 percent for FY2018-19, significantly higher than the growth of 7.86 percent in the preceding fiscal year.

Table1.1. The Share of Agriculture in GDP Over the Years (%):

Year	Agriculture	Crop	Livestock	Forestry	Fisheries
2005-06	19.00	11.1	2.38	1.86	3.67
2006-07	18.92	11.08	2.26	1.83	3.75
2007-08	18.68	10.88	2.19	1.82	3.79
2008-09	18.36	10.63	2.13	1.82	3.78
2009-10	18.38	10.79	2.06	1.81	3.73
2010-11	18.00	10.50	1.98	1.79	3.73
2011-12	17.38	10.01	1.90	1.78	3.68
2012-13	16.77	9.49	1.84	1.76	3.68
2013-14	16.33	9.11	1.78	1.74	3.69
2014-15	16.01	8.87	1.73	1.72	3.69
2015-16	15.35	8.35	1.66	1.69	3.65
2016-17	14.73	7.86	1.60	1.66	3.61
2017-18	14.22	7.51	1.53	1.62	3.56
2018-19	13.6	7.05	1.47	1.58	3.50

Source: MoF, 2019.

Among the broad 3 sectors of GDP, the growth of agriculture sector has increased to 3.51 percent in the FY2018-19, which was recorded 4.19 percent in FY2017-2018. Again Among three sub-sectors of agriculture and forestry sector, Animal farming's and forest and related services sub-sectors grew partly to 3.47 percent and 5.58 percent respectively; whereas crop and horticulture sub-sector declined significantly to 1.75 percent in the present fiscal year which was 3.06 percent in the previous fiscal year. As the productivity of agriculture sector is less than the industrial sector, the contribution of large agricultural sector to the GDP decreased to 13.6 percent in FY2018-19, which was 14.23 percent in the immediate fiscal year (MoF, 2019). Although the contributions of agricultural percentage share declining but total national value is increasing in the economy of Bangladesh. In an agro-based country like Bangladesh crop sector contributes the largest part to the whole agricultural production. From only crop sector, the gross domestic product (GDP) at market prices in case of agriculture is 246266 (taka in crore) in FY2018-19 which was 227353 (taka in crore) in FY2017-18.

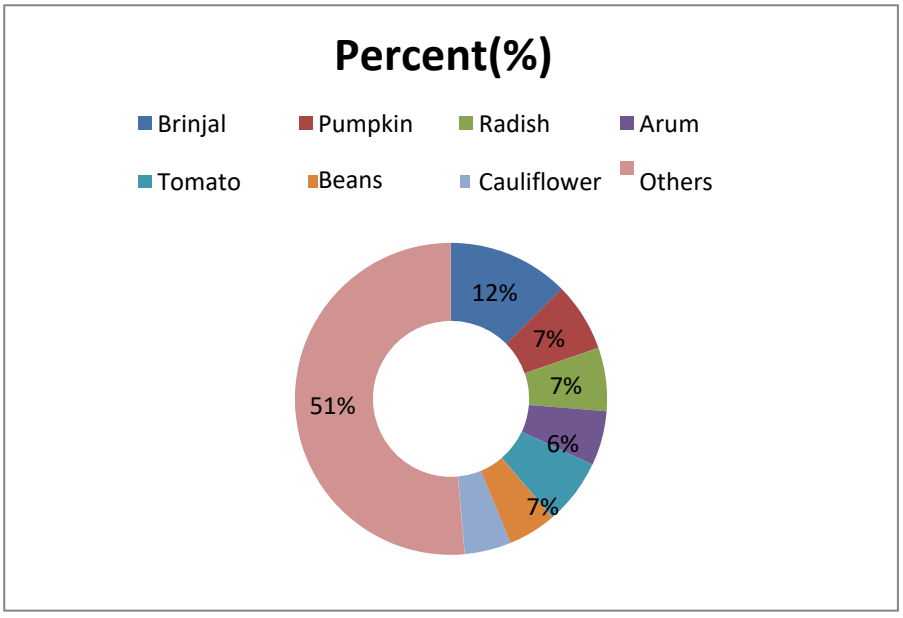


Fig 1.1: Area under Vegetable (winter& summer) in Bangladesh, 2015-2016
Source: BBS, 2017.

Fig 1.1 represents the percentage of individual vegetable production in Bangladesh

Where brinjal is in the highest position, pumpkin & tomato is in the second position, arum is in the third position for the FY2015-16.

The soil condition of Bangladesh is highly conducive to vegetable crops production. Vegetables are considered to be the instant cash crop of Bangladesh. Land quality and land productivity is deteriorating owing to intensive cropping: poor soil management practices and low socio-economic condition of the farmers (*Hossain et al, 1981*). But day by day the condition is improving due to educational training and government interference.

Vegetable sector plays a significant role in meeting the nutrient demand, earning foreign exchange and socio-economic development of the rural poor by reducing poverty through creating employment generation.

1.2 Worldwide Importance and Condition of Tomato among the Vegetable Crops of Horticulture

Vegetables play as important components of a healthy diet, and their sufficient daily consumption can help to prevent major diseases such as certain cancers. Low fruit and vegetable intake is calculated to cause about 31 percent of ischemic heart disease and 11 percent of stroke worldwide. Overall it is calculated that up to 2.7 million lives could potentially be saved each year if fruit and vegetable consumption were sufficiently increased. A recently published report on the Joint FAO/WHO Expert Consultation on diet, nutrition and the prevention of chronic diseases, suggests the intake of a minimum of 400g of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease, cancer, diabetes and obesity as well as for the prevention and alleviation of different micronutrient deficiencies, especially in less developed countries.

According to FAO, World vegetable production has quintupled over the past five decades to reach the target about one billion tonnes of vegetables. Considering population growth, this has presented in a doubling of the per capita consumption of vegetables from approximately 50 kg in 1963 to 102 kg in 2009 on world average.

Table 1.2: Per Capita Consumption of Vegetables in Different Country:

Name of the country	Per capita consumption of vegetables (g/day)
Bangladesh	56
China	292.05
India	228.76
Indonesia	117.53
Japan	432.6
Republic of Korea	684.38
Thailand	257.53

Source: FAO, Statistics Division, 2015

Asia is the world leader in vegetable consumption but Bangladesh is in very low position having per day per capita consumption is 56 g where per day per capita consumption for China 292.05, India 228.76, Indonesia 117.53, Japan 432.6, Republic of Korea 684.38 and Thailand 257.53.(FAO STAT 2017).

Tomato (*Lycopersicon esculentum*) is the second most significant vegetable crop next to potato. Tomato is a highly popular fruit/ vegetable that is consumed by people across the world and is used in many cuisines worldwide. The plant species is origin to Central and South America. These fruits have a moderate vitamin C source and low in dietary nutrients. Tomatoes are consumed worldwide and used in diverse ways in different world cuisines such as raw in salads or used to prepare tomato soup and ketchup.

On a global scale, the annual production of fresh tomatoes amounts to about 160 million tonnes where in comparison, three times more potatoes and six times more rice are grown around the world (FAO, 2016). Total production and per hectare yield of this vegetable may be increased by using high yielding variety (HYV) and improved production technologies (*Gonzales et al., 1993*).

The top five tomato producers namely as China, India, the USA, Turkey and Egypt, represent about 60 percent of the world production. Yet, according to the United Nations international trade statistics, Mexico is the leading exporter country of fresh tomatoes, followed by the Netherlands and Spain.

Table 1.3 Worldwide Tomato Productions

Country	M. tons
China	59,626,900
India	20,708,000
Turkey	12750000
USA	10910990
Egypt	7297108
Spain	5163466
Iran	6177290
Italy	6015868
Mexico	4243058
Brazil	4230150

Source: FAOSTAT, 2017

In 2018, the amount of tomatoes produced worldwide stood at 188M tonnes which rise by 3.5 percent against the previous year and the global tomato market revenue was $190.4B in 2018, rising by 6.5 percent against the previous year. The market value increased at an average annual growth rate of +3.1 percent from 2007 to 2018. The speed of growth was the most pronounced in 2011, when the market value was increased by 9.6 percent. Over the period under review, the global tomato market reached its peak level at $196.1B in 2014; however, from 2015 to 2018, consumption remained at a low. (FAOSTAT 2017)

The summary of producing and exporting countries demonstrates the great diversity in production conditions between the competitors on global tomato markets. Tomatoes are cultivated in open fields, in greenhouses or under plastic covers; in tropical, subtropical and temperate climates, and with machine harvesting (for processing) or manual harvesting (for freshmarkets).

1.3 Origin & Nutritional Status of Tomato

The tomato is the edible, often red berry of the plant *Solanum lycopersicum*, originated in western South America and Central America. The Nahuatl (the language used by the Aztecs) word *tomatl* gave rise to the Spanish word *tomate* from which the English word *tomato* was derived. Its use as a cultivated food may have originated with the indigenous peoples of Mexico. The Aztecs used tomatoes in their cooking at the time of the Spanish conquest of the Aztec Empire and after the Spanish encountered the tomato for the first time after their contact with the Aztecs they brought the plant to Europe. From there, the tomato was introduced to other parts of the European-colonized world during the 16th century.

Table 1.4 Nutrient Contamination of Tomato

See the table below for in depth analysis of nutrients: Tomato (Lycopersicon esculentum), red, ripe, raw, Nutrition value per 100 g. (Source: USDA National Nutrient database)		
Principle	**Nutrient Value**	**Percentage of RDA**
Energy	18 Kcal	1%
Carbohydrates	3.9 g	3%
Protein	0.9 g	1.60%
Total Fat	0.2 g	0.70%
Cholesterol	0 mg	0%
Dietary Fiber	1.2 g	3%
Vitamins		
Folates	15 µg	4%
Niacin	0.594 mg	4%
Pyridoxine	0.080 mg	6%
Thiamin	0.037 mg	3%
Vitamin A	833 IU	28%
Vitamin C	13 mg	21.50%
Vitamin E	0.54 mg	4%
Vitamin K	7.9 µg	6.50%
Electrolytes		
Sodium	5 mg	>1%
Potassium	237 mg	5%
Minerals		
Calcium	10 mg	1%
Iron	0.3 mg	4%
Magnesium	11 mg	3%
Manganese	0.15 mg	6.50%
Phosphorus	24 mg	3%
Zinc	0.17 mg	1.50%
Phyto-nutrients		
Carotene-ß	449 µg	--
Carotene-α	101 µg	--
Lutein-zeaxanthin	123 µg	--
Lycopene	2573 µg	--

Source: USDA, 2019

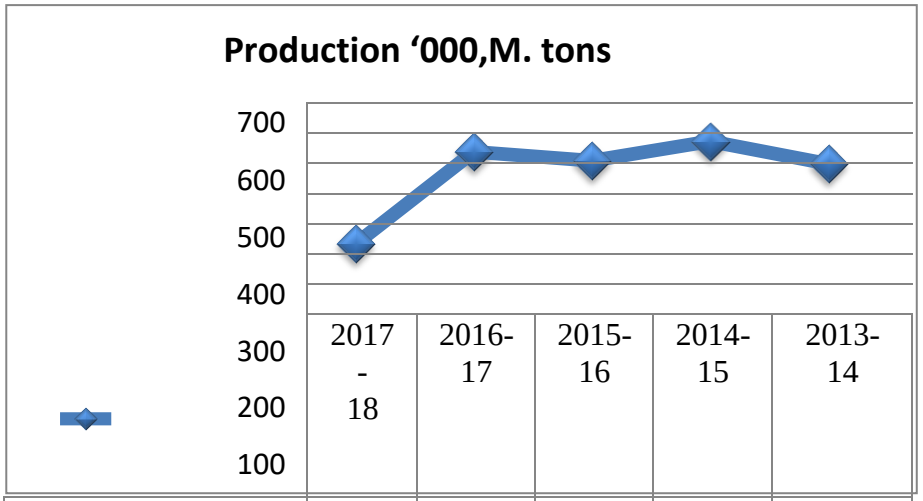
1.4 Importance of Tomato in the Economy of Bangladesh

Tomato (*Lycopersicon esculentum* Mill.) is a member of Solanaceae family and is one of the important, popular and nutritious vegetables grown in Bangladesh during winter as well as summer season and cultivated mostly in all parts of the country. At present record, tomato ranks third, next to potato and sweet potato, in terms of world vegetable production. The yield of tomato in our country is not pleasing enough in comparison to requirement. The low yield of tomato in Bangladesh, however, is not a point of low yielding ability of this crop, but of the fact that the tomatoes grown are not always of high yielding cultivars and that the traditional practices commonly used by the growers are not improved. But majority of the tomato growers of Bangladesh have little knowledge about the advantage of pruning in tomato production. Pruning and different levels of potassium is an important factor for successful tomato production. Rajshahi, Bangladesh, Tomato farming is gaining popularity in all the 16 districts under Rajshahi division particularly in the vast tract of Briand area. This indicates the introduction of high yielding and hybrid varieties, as well as the use of modern technology.

Lali, Abilash, Nayak, Moon, Delta, Mintoo super, Success, Oxheart, Marglobe, Sunmargino, Roma VF, Pusa Rubi are some popular tomato varieties and recently BARI developed varieties are Ratan, Manik, BARI Tomato-3, BARI Tomato-4, BARI Tomato-5,BARI Tomato-6, BARI Tomato-7, BARI TOMATO-8, Chaiti, Apurba, Shila, Lalima and Anupama. BARI Tomato-4, BARI Tomato-5, Chaiti, Lalima and Anupama (hybrid) can also be grown in summer season. The rates of production of the developed varieties are comparatively high and more profitable compared to traditional varieties.

Tomato farming is gaining popularity day by day everywhere and it is now considered the second cash crop in the Rajshahi region and signifies an important role in the economy, financially benefiting at least 0.2 million houses there.At least one and half lakh families in the division derive direct financial benefit from either cultivating tomato or its trading.

Fig 1.3 represents that tomato production was almost constant rate from 2013-2017 but it became very low in the year 2018.



	2017 - 18	2016-17	2015-16	2014-15	2013-14
Production ‘000,M. tons	237	542	513	577	502

Fig 1.2 Trend of Tomato Production in BD over the Five Years
Source: BBS, 2018.

Many educated and uneducated youths are now engaged in tomato cultivation. Tomato cultivation has created job opportunities for hundreds of educated youths of the region and it could change the socio- economic condition of the poor people if marketing and cost- effective environment-friendly technologies are ensured.

Apart from this, prospects for tomato cultivation in the country’s northwester region in both the winter and summer seasons are bright if farmers get international markets and preservation facilities.

1.5 Tomato Cultivation Areas & Production of Bangladesh

Table 1.3 represents the annual production of tomato in the 2015-16 to 2017-18 in different division of Bangladesh including- Dhaka, Khulna, Barisal, Rangpur, Rajshahi, Sylhet, Chittagong, Mymensing division.

Table 1.3 reports that Rajshahi district gives the highest amount of production where the most production hectres of land are used in Chittagong district.

Table 1.4 Annual Production of Tomato in the 2015-16 to 2017-18

Zila/Division	2015-16		2016-17		2017-18	
	Area (ha)	Production (M. Ton)	Area (ha)	Production (M. Ton)	Area (ha)	Production (M. Ton)
Barisal	1030.73	6920	1148.9	7687	1159	8380
Chattogram	6668.81	65109	6146.78	60974	6063.8	60208
Dhaka	4192.54	51388	4286.43	55921	4366.16	52544
Khulna	2895.93	30296	3010.46	31766	3075.2	33195
Mymensingh	1761.2	27496	1787.9	34738	2157.38	37403
Rajshahi	5368.16	85376	5501.7	87928	5551.48	90094
Rangpur	3627.7	77932	3736.87	80885	3676.17	75163
Sylhet	1793.57	23604	2047.7	28826	2079.28	28051

Source: BBS, 2018

1.6 Justification of the Study

Tomato is an important vegetable on perspective of Bangladesh for improving farmer's living standard and achieving self-sufficiency in income because of its low cost of production. Tomato acts just like cool air in warm weather for small farmers and it is considered as one of the most important groups of food crops having high nutritional value. Tomato cultivation can become a huge possibility to control demand and earn extra currency for the increasing population of Bangladesh. Tomato is considered as a flexible natural source of supplementary food and can be grown in a short duration. Presently government and non-government organizations are introducing hybrid variety of tomato cultivation. The management practices and input use are also can be influenced by socio-economic factors such as farmer's age, education, occupation, resource base and access to information. In order to develop the production tomato to the maximum possible extent, it was necessary to identify the factors behind the yield differences so that policy interventions might be made accordingly.

This study will provide baseline information on socio-demographic characteristics of tomato farmers, level of input use and its pricing, cost and returns, factors affecting productivity of tomato farms, resource use efficiency, consequences and problems associated with tomato cultivation. The present study was conducted in Karimpur & chinispur village of Narsingdi sadar upazila & morjal village of Raipura upazilla under Narsingdi district. This study was expected to add some important information to the existing body of knowledge regarding tomato cultivation particularly with respect to

the area under study. This study provides appropriate suggestion and policy recommendations which might help the agencies and policy makers of the country for advancing the livelihood of low income people.

1.7 Objectives of the Study

The major objectives of the study are as follows-

- To identify the socio-demographic record of the respondents.
- To estimate the profitability of tomato cultivation
- To confess the resource use efficiency of tomato cultivation.
- To address the problems of tomato cultivation.

1.8 Organization of the Thesis

This thesis consists of nine chapters. Chapter I deal with the introduction including the background, world production, justification and objectives of the study. Later, review of related literature is presented in Chapter II. Chapter III discuss with the research methodology of the study. The results and the discussion of the study are presented in Chapter IV, V, VI, VII and VIII. Finally, Chapter IX represents the summary, conclusions and policy recommendations of the study.

CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2
REVIEW OF LITERATURE

2.1 Introduction

This section presents the literature review on details resource use efficiency and profitability measurement analysis for tomato production using different financial analysis. The main purpose of this chapter is to review some related studies connected with the present study. Although a number of studies have been found related to tomato production in Bangladesh, only a few studies have so far done related to financial profitability and resource use efficiency. Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a positive influence on the present study.

2.2 Metzel and Ateng (1993) conducted a study where they collected data in 1992 from 200 farm household in 10 thanas, selected to present major geographic and agro-ecological zones in the Bangladesh. The paper attempted to identify problems related to diversified crops, based on farmers' perceptions. More importantly, farm characteristics are examined to explain levels of crop diversity and results from regression analyses are shown. The survey results recommend several constraints to crop diversity, such as, low profitability, high input cost, susceptibility to weather variation and pests. The Simpson Index of diversity is found to decline with farm size, showing that large farmers specialize in few crops, particularly rice and few cash crops. Among other things, provability to towns increases crop diversity while credit is found to reduce it. The study was however unable to identify any relationship between strength by NGOs and the degree of crop diversity on farms.

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Kere *et al.* (2003) conducted a study from September 2001 to August 2002 to investigate the effect of irrigation schedule and mulching materials on the yield and quality of greenhouse-grown fresh market tomato in the Kenya highlands (2200m above Sea Level). The experimental design was embedded in randomized complete block design replicated every two and three days, respectively. Mulching material includes clear (transparent) plastic, dry grass and no mulch (control) formed the sub-

plot. Dry grass mulch and irrigation after every two days produced the lowest fruit dry weight. Total marketable tomato fruit yields were not significantly affected by either less irrigation schedule or mulch type and dry grass mulch produced the lowest total soluble solids.

Zaman *et al.* (2006) conducted a study where they made an experiment return of summer tomato cultivation by using the data collected from experimental plot in Regional Agricultural Research Station, Jamalpur. BARI released variety BARI Tomato-10 (Anupama) showed best with a per hectare yield of 28240 kg. To cultivate summer tomato in one hectare of land, total variable cost involved BDT 292936 and total cost of production was BDT 297936. Gross margin was BDT 695464, net return or profit was BDT 690464 and benefit cost ratio (BCR) was 3.32 and they concluded that cultivation of summer tomato is profitable for Jamalpur region.

Mohiuddin *et al.* (2007) conducted a study in Patiya and Satkania upazila of Chittagong district in 2005-2006 to assess the adoption status, agronomic practices and profitability of improved tomato variety among the farmers. All the improved varieties that are cultivated in the study area Surokka (Indian variety) are ranked first followed by Ratan (BARI variety) and Ruma VF (Indian variety). Farmers' consciousness about improved tomato cultivation was found increasing where gross margin was Tk 101566/ha and Tk. 140015/ha on the basis of variable cost and cash cost respectively. Per hectare net return from tomato cultivation was Tk. 100338. On the basis of variable cost, returns to labour and returns to irrigation were found Tk. 483 and Tk. 13.33 respectively. Major reasons in case of improved tomato cultivation were higher yields, thick fruit skin, large size, long durability and high price due to attractive colour and size. The farmers of improved tomato adopters facing several problems like non-availability of quality seed, unfavourable weather, good quality fertilizer and insecticide for tomato cultivation among which high price of inputs was recorded as one of the major problem to the tomato farmers.

Agele *et al.* (2008) conducted his study about responses of some cultivars of tomato to weather events of the cropping seasons in terms of growth, fruit yield, and nitrogen use efficiency when grown under the application of inorganic and organic

manures. The tomato varieties selected for evaluation of both early and dry season crops in the humid rainforest zone of Nigeria. The cultivars were characterized by strong genotype by environment interactions and seasonal and/or genotype-specific N use efficiency and in case of both cropping seasons, the tomato cultivars differed in their ability to take up and accumulate N in the shoot and fruit tissues from the organic and mineral fertilizers. Actually higher values of fresh and dry weights of root and shoot biomass were produced by tomato plants grown in plots in which NPK and poultry manure were applied over unmanured plots. Delayed planting did not considerably decrease N uptake, but decreased final crop dry matter yields.

Karim *et al.* (2009) conducted an experiment on Profitability of Summer BARI Hybrid Tomato Cultivation in Jessore District of Bangladesh at Bagherpara thana under Jessore district to assess the profitability, contribution of factors to production and changes in socio-economic status of the farmers. About 42 percent and 21 percent of total variable cost was allotted for tunnel preparation and using human labour, respectively. The average yield of BARI hybrid tomato was found 32.78 t/ha where the average return per hectare 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 resulted 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 but return from one kilogram of tomato production was Tk. 45.83. The functional analysis gives the result that MP and TSP had positive significant contribution to yield while human labour, hormone, irrigation and seed had negative significant impact on yield of hybrid tomato. As a whole, the overall socio-economic status of the sample farmers was found increased by 20.33 percent. High price of tunnel materials, timely non availability of hormone, insect and diseases attack were the major problems for tomato production.

Tijani *et al.* (2010) studied about the Profitability of tomato (*Lycopersicon esculentum* Mill.) production and constraints for which data were collected from 80 respondents in local government areas in Ogun State, Nigeria, and analysed using descriptive statistics and enterprise budgetary analysis. The gross margin was found ₦43,350.29 (₦, Nigerian currency) and net profit was found ₦36,382.68, indicating that tomato production was profitable. Other calculation of ratio of net returns to

total expenses (27%), operating expense ratio (72%), and net farm income ratio (21%) indicated that there is room for incensement in tomato production. Major constraints were found lack of access to credit facilities, price fluctuations, and high cost of inputs. Credit accessibility from formal and informal sources, agricultural price support programs for fair pricing of output, provision of subsidies on inputs, and formation of farmer groups/cooperatives are suggested as essential to improve productivity and profitability of tomato production under tropical conditions.

Begum *et al*. (2011) conducted a study to estimate the costs and returns from the cultivation of selected crops in different locations. He found 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, mung bean, sweet potato, cabbage, cauliflower, tomato, cucumber and okra respectively. High costs of fertilizers and insecticides were the major problems to higher production for most of the crops as mentioned by the sample farmers.

Saleh *et al* (2014) conducted a study on yield Performance of local and exotic hybrid tomato varieties in Bangladesh where thirteen local and exotic hybrid tomato varieties viz. BARI F1 Tomato-4, BARI F1 Tomato-5, BARI F1 Tomato-6, BARI F1 Tomato-7, BARI F1 Tomato-8, Lali, Abhilash, Nayak, Moon, Delta, Mintoo super, Mintoo, and success were evaluated to see their performances during the winter season of 2012-2013. RCBD (Randomized Complete Block Design) was used having three replications. Yellow leaf curl virus infection was maximum in the variety Lali (10.41%) and minimum (2.08%) in BARI F1 tomato-5 and Mintoo and no virus infection were found in the rest varieties. The maximum yield was performed from BARI F1 tomato-4 while minimum yield was obtained from Delta. Considering the results it can be concluded that most of the local varieties showed greater performance compared to the exotic varieties.

Ibitoye *et al.* (2015) conducted a field survey on resource use efficiency among tomato farmers in Kogi State, Nigeria. The data were collected from 240 respondents through purposive sampling in 2014. Questionnaire design was the main instrument used for data collection. Data collected were examined through the use of simple descriptive statistics, OLS regression analysis and efficiency ratio. Farmers'

educational status, farming experience, contact with extension workers, and farm size were positively related and was found significant at 1 percent in influencing the output of tomato produced in the State. Resources such as pesticide, labour, years spent in school, quantity of seed and farm size were positively and significantly related to tomato yield in Kogi State. Quantity of pesticide, seed and fertilizer were found over utilized while labour and farm size were found underutilized. It is recommended that government should impose policies that will facilitate the efficient use of agricultural resources among tomato farmers in Kogi State.

Samshunnahar *et al.* (2016) conducted a field survey to analyse the profitability, contribution of factors in yield and socioeconomic condition of small-scale tomato producing farmers in some selected areas in Bangladesh. The main variables of production like, seeds, human labour, tillage, fertilizer, irrigation and insecticides were considered to calculate the impacts on tomato production. Amongst 3 farm size groups, small tomato farmers earned the highest profit. Gross returns for per acre of small, medium and large farms were recorded Tk. 104180, 95000 and 82600 and their corresponding net returns were recorded Tk. 46978, 45356 and 5354, respectively. Moreover, the undiscounted benefit cost ratio of was the highest for medium farmers (1.91) than small farmers (1.82), while it was the lowest for large farmers (1.74). The coefficient of determinations (R^2) was about 0.694, which indicates that about 69 percent of variations of tomato production are found to be explained by the independent variables. The result showed that human labour and tillage was significantly positive, which implies that various independent inputs uses had significant contribution to increase tomato production. It was finally observed that a considerable development took place to increase household income of the studied farmers and to improve the financial conditions with the introduction of small-scale commercial tomato production. Effective policy and perfect extension services have therefore, to be ensured to increase income and income opportunities of the tomato farmers.

Ali *et al.* (2016) conducted a study on resource use efficiency and return to scale in off-season tomato production in Punjab province of Pakistan. Simple random sampling requiring 70 off-season tomato growing farmers was used for collecting primary data. Cobb-Douglas function was used to check the production elasticity of

different inputs and overall goodness of model was revealed (R^2) (0.693) and f-statistics (11.888). Elasticity of production showed positive significant effect in case of age, education, experience, polythene sheet, tractor use, irrigation, labour-man days and contact with extension agents. Underutilization of resource was found for polythene sheet, tractor hours and irrigation followed by over utilization of input resources was observed for NPK, seed quantity, chemical sprays and labour-man days. There is decreasing return to scale but its value would be increased after efficient use of all inputs. Results showed the possibility of increasing output by adjusting the use of inputs which is helpful for policy makers to develop horticulture based agricultural policy.

Parvin (2017) conducted a study based on the cost of production and profitability of Tomato producers at Rangpur district. Data was gathered from 100 farmers by using simple random sampling method. The Tomato farmers answered their opinion in their socio-economic characteristics and unconditional majority of them belonged to young age category (20-35 years) having medium family size, primary education level, small farm size (0.01- 0.33 acre). The study denominates that the small farmers were almost profitable than to others. Main difficulty reported by the Tomato farmers were lower price of Tomato during harvesting period, lack of good quality seed, higher price of inputs and lack of government intervention etc. The findings ultimately will be supportive to the planners and policy makers in formulating micro or macro level policy for the improvement of Tomato production in the country.

Saha *et al.* (2017) recently conducted an experiment at ARS, BARI, Satkhira on three types of organic fertilizer (OF) like OF from Co-compost (Faecal Sludge and Municipal Solid Waste), earthworm compost (Vermicompost) and cow dung whereas chemical fertilizer were used as control treatment. Now a day's farmers are cultivating tomato in saline areas where they do not use any compost fertilizers as an organic fertilizer. This experiment was conducted in RCBD design with three dispersed replications in the winter season 2016-17 at ARS, Satkhira with four fertilizer doses viz., T1 = 100% Chemical Fertilizer, T2 = Co-compost with 50 percent RDF, T3 = Vermicompost with 50 percent RDF, T4= Cow dung; were set as the treatments. Tomato (BARI Tomato-14) was planted on 15 November 2016 and from the economic study, higher income was obtained from using co-compost along

with chemical fertilizer followed by T3, T1 and T4. Now, it is clear that 2 ton co-compost with 50 percent inorganic fertilizer from Recommended Dose of Fertilizer (RDF) provide the highest yield with economic benefit.

Farooq *et al*. (2017) conducted a field survey on the impact of Tomato Spotted Wilt Virus (TSWV) on root depth, fresh root weight, dry root weight plant and yield of twenty tomato varieties namely BARI Tomato-1, BARI Tomato-2, BARI Tomato-3, BARI Tomato-4, BARI Tomato-5, BARI Tomato-6, BARI Tomato-7, BARI Tomato-8, BARI Tomato-9, BARI Tomato-10, BARI Tomato-11, BARI Tomato-12, BARI Tomato-13, BARI Tomato-14, Roma VF T-311, Unnayan F1, Udayan F1, Rio Grande, Tidy and Digonta. The study was done at Amtoli Upazilla in Barguna district under the AEZ 18 in Bangladesh during winter season of 2008-09. BARI-T2 gifted the highest reduction of root depth and the lowest reduction in Digonta; reduction of fresh root weight was found to be highest in BARI-T1 and lowest in Rio Grande and reduction of dry root was found to be lowest in BARI-T11 and highest in Roma. The fruit yield reduction was noticed higher due to early infection followed by mid and late infection stages in all the varieties. The highest fruit yield reduction was collected in BARI-T2, while the lowest in BARI-T12 due to TSWV infection.

Islam *et al*. (2017) conducted a field experiment at the Horticulture Department, Sylhet Agricultural University, Sylhet, Bangladesh to find out the suitability of tomato production during summer season of May to October, 2014. Five tomato hybrids viz., BARI hybrid tomato-3, BARI hybrid tomato-4, NHC-1, NHC-2 and NHC-3 were conducted for tomato production during summer season under Sylhet condition. Among the hybrids maximum 5.3% total soluble solid was found in BARI hybrid tomato-3. The hybrid, BARI hybrid tomato-4 gave the highest fruit yield followed by NHC-1. Benefit cost ratio showed that one can earn more than four thousand taka/decimal by growing tomato during summer season in Sylhet region. This study indicated that there is a bright scope of tomato production during summer in Sylhet region.

Mukherjee *et al*. (2018) conducted a field study where tomato was grown during Nov.–Mar. 2003–2005 below the following irrigation regimes: rain fed or irrigation when cumulative pan evaporation (CPE) reached 50 mm (CPE_{50}) or 25 mm (CPE_{25}) and the following mulch treatments: none, rice straw, and white or black

polyethylene. Fruit yield increased with higher irrigation frequency. Mulch enhanced fruit yield by 23%–58% than no mulch. The cost–benefit (CB) ratio increased with an improvement in irrigation frequency. Rice straw, which is less costly and easily available, gave the highest CB ratio (1:3.1) in all moisture conditions, followed by black polyethylene (1:2.9). Use of black polyethylene when water is scarce (rain fed, CPE_{50}) has the influence to increase income compared to plants in bare soil when water is plentiful.

Maitra and Sharmin (2019) conducted a field study to determine the risk attitude and profitability of tomato farmers in Bangladesh. Sixty sample respondents of tomato farmers were selected from Mymensingh district while obit regression model was utilized to calculate the factors affecting risk attitudes of tomato farmers. In addition, financial profitability was examined and results found that only 18 percent of farmers were risk preferring than 42 percent of farmers were risk averse. Training and education help to understand the significance of receiving newly introduced technology, timely application of seed, irrigation and fertilizer. Education assists to admit from diversified sources that make them risk preferred. The benefit cost ratio (BCR) of tomato farming was 2.31 indicating that tomato farming is perfectly profitable. Productivity and profitability of tomato farmers can be developed if farmers can manage different risks and uncertainty associated with production practices.

2.3 Conclusion

The above mentioned discussion and review indicate that most of the studies consult with cost, return, profitability and productivity of tomato. Moreover, this study was conducted using updated data to get recent information regarding production. Maximum studies examined indicators, which influence production, more than a decade ago. Side by side the influence of other factors identified by the researchers of other countries is needed to study studied in the perspective of Bangladesh. Very limited unique studies were conducted on productivity and resource use efficiency of tomato farming in Bangladesh. The review of literature was congenial to re-design methodological aspects with a view to overcome the limitations of previous studies which would help the policy makers and researcher for further investigations.

CHAPTER 3

METHODOLOGY

CHAPTER 3
METHODOLOGY

3.1 Introduction

The proper result of a survey research depends, to a great extent, on the appropriate methodology used in the research. Proper methodology is determined by the nature, condition and objectives of the study. It also depends on the bound of necessary funds, materials and time. The present study was based on primary data that actually were collected from the field survey and reliable sources. In this study, random survey method was chosen because it is less expensive, it requires less time and after all it is simple and easy technique. But the main shortcoming is that the investigator has to depend upon the memory of the respondents. To overcome the shortcoming, repeated visits were made to collect data in the study area and the questions were asked so that the respondents could answer from memory. The survey for the present study involved some necessary steps.

3.2 Selection of the Study Area

A farm management research usually involves the selection of one or more areas which are particularly suitable enough for fulfilling the objectives according to the study requirement. Again, according to Yang (1962), the area in which a farm business survey is to be carried out depends on the particular purpose of the study and the possible cooperation from the farmers. For the present study, Narsingdi Sadar upazilla and Raipura Upazilla area of Narsingdi district was selected randomly. Primary data was collected from Chinishpur, Karimpur and Morjal villages. The major reasons for selecting the study area were as follows:

1. Easily accessible and good communication facilities.
2. Availability of amount of tomato cultivating farmer in the study area.
3. Expected better communication & cooperation from the farmers as area is well known to the researcher.
4. No such type of study was conducted in this area.

5. These villages had some identical characteristics like homogeneous soil and climatic situation for producing tomato.

3.3 Selection of the Samples

A list of tomato farmers were collected from Upazilla Agricultural Office and Department of Agricultural Extension of Narsingdi Sadar Upazilla. The selection of the respondents was made randomly from the given list where 90 tomato farmers were selected as samples.

3.4 Sources of Data

Data necessary enough for the present study were collected from primary and secondary sources. Primary data were collected from farmers and secondary data from various published sources. Secondary sources included Bangladesh Bureau of Statistics (BBS), Bangladesh Economic Review (MoF) and other related agencies in Bangladesh.

3.5 Preparation of the Survey Schedule

Firstly, a survey schedule was designed for recording the desired information with objectives of the study. After preparing a related questionnaire the drafted copy was revised and a date was fixed for covering a face to face interview with the respondent. The questionnaire involves the following things:

1. Present socio-economic situation of the farmers.
2. Cost of using resources and other additional activities.
3. Return from the yield.
4. Problems faced by the farmers at the time of production.

3.6 Method of Data Collection

Farm Management data can be collected by different methods of which survey, cost accounting, financial accounting methods etc. are mostly used. The reason why survey method was used in the present study is realistic, less costly, less time consuming and easier to collect.

3.7 Period of Data Collection

The whole survey was conducted by the researcher herself during the month of April to June of 2019. Data was collected through several visits by the researcher.

3.8 Collection of Data

Collection of accurate and reliable data from the field is not a flexible task. Reliability of data highly depends on the method of data collection. To ensure accuracy and reliability, data were collected from the sample respondents by direct interview with designed schedules for the study. During the interview, each respondent was given a summary about the nature and purpose of the study for quick and free response. To capture accuracy and reliability of data, care and caution were taken in the time of the data collection. Attention was paid on the basis of the mode of the respondent and a congenial relationship was maintained between the respondent and researcher.

3.9 Problems Faced in Collecting Data

In collecting primary data, following outcomes were faced by the researcher:

- Most attentive problem was the time limitation for collecting primary data.

- Most of the farmers in the selected areas did not want to give actual information about their income sources because they thought that it can be harmful for them.

- Another selected problem faced by researcher in study areas was that the researcher had to rely totally on the memory of the respondents for collecting data because they did not keep any written record.

- Most of the respondents in the study areas did not have any oral knowledge about research study and it was therefore tough to explain the purpose of this research to convince them.

- Sometimes, the farmers did not cooperate friendly with the researcher as they did not find any benefit to give information to the researcher.

- On many cases farm respondents were not available enough at home and in such cases the researcher had to give extra effort and time to collect the information from them.

3. 10 Processing and Tabulation of Data

The processing of data is important on the basis of objectives of the study. The responses were checked to calculate errors involved in them. After collection of data from the field data for the study were then coded, tabulated, summarized and processed for analysis. The data had been transformed into SPSS sheet from the interview schedules with MS excel.

3.10.1 Analytical Technique

Data were analysed on account to achieving the objectives of the study. For this study, the following techniques were used:

i) Tabular technique

ii) Statistical analysis

Tabular Technique

Tabular technique was applied to verify data in order to get meaningful findings by using simple statistical measures like means, percentage and ratios.

Statistical Analysis

This component included to financial analysis was designed to study the factors affecting to tomato cultivation and resource use efficiency. For this, a production function analysis was carried out to explore the necessity and productivity of the individual inputs. The data for this analysis was ordered on per hectare basis.

3.10.2 Financial Profitability Analysis

The primary and major goal of a farm is profit maximization. Some of the other goals are attaining a particular output level or business size; preserving a certain time for leisure activities; business growth; business survival and maintain stable time

overtime. Cost and return analysis is the most commonly used 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-

Profit or net return is the variance between total revenue (gross return) i.e. total value product (TVP) and total production cost (TPC). Total factor costs include all kinds of variable and fixed costs involved with the production process. The following traditional profit equation was applied to calculate farmer's profitability level in the study areas.

Net return = Gross return – Total factor cost

= TVP- TPC

Net profit, $\pi = (\sum P_t Q_t + \sum P_a Q_a) – (\sum (P_{xi} X_i) + TFC)$

π = Net profit/Net return from tomato cultivation (Tk. /ha)

TVP refers the value of total output,

Total value product, TVP= $\sum P_t Q_t + \sum P_a Q_a$

Where,

P_t = Per unit price of tomato (Tk. /kg);

Q_t = Total quantity of the tomato production (kg/ha);

P_a = Per unit price of by product (Tk. /kg);

Q_a = Total quantity of by product (kg/ha);

On the other hand, Total factor cost (TFC) of a product adds all kinds of variable and fixed costs involved in the production process.

Total Factor cost, TFC= $P_{xi} X_i$ + TFC

Where,

P_{xi}= Per unit price of i-th inputs (Tk.);

X_i = Quantity of the i-th inputs (kg/ha);

TFC = Total fixed cost (Tk.); and

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

Benefit Cost Ratio

Benefit cost ratio was calculated by the following formula

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

3.11 Functional Analysis

To calculate the production function, one requires improvement of its properties leading to specification of an explicit functional form. One of the most specifically used production function for empirical estimation is the Cobb Douglas production which was originally used by C.W. Cobb and P.H. Douglas in twenties to calculate the marginal productivities of labour and capital in American manufacturing industries. Their main purpose was to estimate the portion of labour and capital in total product; hence they used this function with the assumption that the sum of elasticities or regression coefficients should total one. Cobb and Douglas finally fixed the function to time series 1930s and 1940s; the same equation was used for cross section of industries. The popularity of this function is just because of the following characteristics of the function:

- It provides the elasticities of production with accustomed to inputs;
- It permits more degrees of freedom than other algebraic forms (like quadratic function) which allow increasing or decreasing marginal productivities, and
- It facilitates the calculations by reducing the number of regression to be handled in regression analysis.

The original form used by Cobb and Douglas was

$$\mathbf{Q = a\ L^{\beta}\ K^{1-\beta}\ U}$$

This forces sum of elasticities is equal to one. Their later modification was

$$\mathbf{Q = a\ L^{\alpha}\ K^{\beta}\ U}$$

Where, $\boldsymbol{\alpha+\beta}$ need not to equal one. In agriculture, this form of function has not been used in its primitive form. Neither the sum of elasticities is kept limited to one nor is the number of variables limited to two. Even then as the basic logic of functional

form was provided by Cobb and Douglas, The Cobb–Douglas production function, in its stochastic form, may be explored as

$$Y= a\ X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8} e^{Ui}$$

The input-output relationships in tomato production was analysed with the help of the following:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + Ui$$

Where,

Y= Gross return (Tk. /ha);

a= intercept value;

X_1= Cost of seed (Tk. /ha);

X_2 = Cost of labour (Tk. /ha);

X_3 = Cost of land preparation (Tk. /ha);

X_4= Cost of irrigation (Tk. /ha);

X_5 = Cost of insecticide (Tk. /ha);

X_6 = Cost of fertilizer (Tk. /ha)

X_7= Cost of hormone (Tk. /ha)

X_8= Cost of manure (Tk. /ha)

Ui= Error term;

i= 2, 3, ...80;

b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8 = Co-efficient of respective variance.

A log–linear regression model involving any number of variables the coefficient of each of the X variables calculates the (partial) elasticity of the dependent variable Y with respect to that variable. If output and all inputs changes in unique proportion, it is known as constant returns to scale, if changes in output is less than changes in all inputs, it is known as decreasing returns to scale and if changes in output is greater than changes in all inputs, it is known as increasing returns to scale.

3.12 Measurement of Resource Use Efficiency

In according to test the efficiency, the ratio of Marginal Value Product (MVP) to the Marginal Factor Cost (MFC) for each input were computed and tested for its equality to 1. i.e,

$$MVP/MFC = 1.$$

In this study the MPP and the relevant values of MVP will be obtained as follows:

$$MPP_{xi} \times P_{yi} = MFC,$$

Where, $MPP_{xi} \times P_{yi} = MVP,$

But, $MPP = b_i \times (Y/x_i)$

So, $MVP = b_i \times (Y/x_i)\ P_{yi}$

Where, b_i= regression coefficient per resource,

Y_i = Mean output,

X_i = Mean value of inputs,

P_{yi} = price of output,

MFC = price of per unit of input.

Thus, when Resource-use efficiency

RUE =1, resources were optimally utilized,

When RUE < 1, resources were over utilized, and

When RUE > 1, resources were underutilized.

3.13 Cost Items

The cost of inputs is an important factor that plays a significant role in financial decision making for performing and income generating activity. Respondents in the study area used purchased inputs as well as home circulated inputs. The cost of purchased inputs and home circulated inputs were not calculated separately. The cost of Tomato cultivation can be mainly classified under the following two heads:

a) Variable cost

b) Fixed cost

a) Variable Cost

i) Cost of seed

ii) Hired Labour cost

iii) Fertilizers cost

iv) Land preparation and irrigation cost

v) Interest on operating capital

vi) Manure cost

vii) Insecticide & Hormonal cost

viii) Additional cost

b) Fixed Cost

i) Land use cost

ii) Family labour

Cost of Seed

Seed cost is estimated on the basis of home preserved and purchased seed. Home supply seed were estimated on the basis of prevailing market price and purchase were actual market price.

Fertilizer & Manure Cost

Fertilizer & Manure were one of the valuable cost items of tomato cultivation. Cost of fertilizer involved Urea, TSP, MP, Gypsum etc. Fertilizer costs were calculated at the prevailing local market rates and estimated according to the cash price paid by the farmers per kg.

Insecticide & Hormonal Cost

Farmers supplied Redomilgold, Flora, Andene, Thiovit 80 WP etc. for tomato cultivation. These costs are estimated on the basis of price paid by the farmers.

Human Labour Cost

Human labour cost was the largest and most valuable input in the production of Tomato. Labour cost involves family and hired labour because there was significant use of hired labour in this cultivation. Eight adult male hours were equivalent to one man-day and the opportunity cost principle was formulated to estimate the wage rate of labour.

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Land Preparation and Irrigation Cost

The costs of Machinery services were calculated by taking into account the actual costs paid by the Tomato farmers. In the study area almost all the sample farmers used power tiller, tractor and other machineries for land preparation. They mainly used hired tractor. A power tiller owner supplied fuel as well as driver for land preparation and service charge was included into the machinery cost.

Cost of irrigation was calculated by adding the rental charge of machine and the cost of fuel. Sometimes farmer collect only water from the shallow tube well by paying charge.

Land Use Cost

The cost of land use was different for various points, according to the location, topography and fertility of the soil. Land was used for a period of four months for cultivating tomato starting from land preparation to harvesting. In the present study, the cost for use of land was estimated by taking the cash rental value of land and the other choice to account for the cost of land use.

Interest on Operating Capital

The amount of money needed to meet the expenses on hired or purchased inputs was determined as operating capital in this study. Interest on operating capital was calculated by using the following formula (Miah et al., 2013)

$$IOC = AIIt$$

Where,

IOC= Interest on operating capital

I= Rate of interest

AI= Total investment / 2

t = Total time period of a cycle

3.14 Return Items

Return items were as follows:

(i) Return from selling Tomato.

(ii) Return from selling by product.

3.15 Procedure for Evaluation of Return

Per hectare gross return was calculated by multiplying the total amount of product by their corresponding average market price. Gross return per hectare composed of the value of main product and the value of by- product. Net return was found by deducting all direct cash and non-cash expenses from the gross return.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

CHAPTER 4
DESCRIPTION OF THE STUDY AREA

4 .1 Introduction

A brief description of the selected study area is presented in this chapter. The knowledge of the study area is essential to understand and explain the findings of the study. The description of the study area includes location, physical features and topography, climate, temperature and rainfall, population, religion and culture, agriculture, transportation of the study area.

4.2 Location

The study area covers Narsingdi Sadar & Raipura upazila of Dhaka District. Chinishpur, Karimpur and Morjal villages from those upazilla were selected for this purpose. Narsingdi is surrounded by Kishoreganj in the north and north-east, Brahmanbaria in the east and south-east, Comilla in the south and south-east, Narayanganj in the south and south-west and Gazipur in the west. It lies between 23°46' to 24°14' north latitude and 90°35' to 90°60' east longitude where it comprises a total area of 3360.59 sq. km (Wikipedia, 2019).

4.3 Physical Features and Topography

The study area is covered by both high and low land where the soil varies from sandy loam to sandy clay loam. The land surface of the study area is plain strongly acidic and fertile and soil structure of these areas are almost similar. The favourable water level, flat topography and loamy soil have encouraged the expansion of ground water irrigation facilities.

Table 4.1 Land Use Statistics under Rural & Urban Areas

Owned Area	Operated Area	Homestead Area	Net Cultivated Area	Irrigated Area	Temporary Crops Gross Area	Intensity of Cropping (%)
230597	224519	31783	175545	123975	249059	155

Source: BBS, 2019

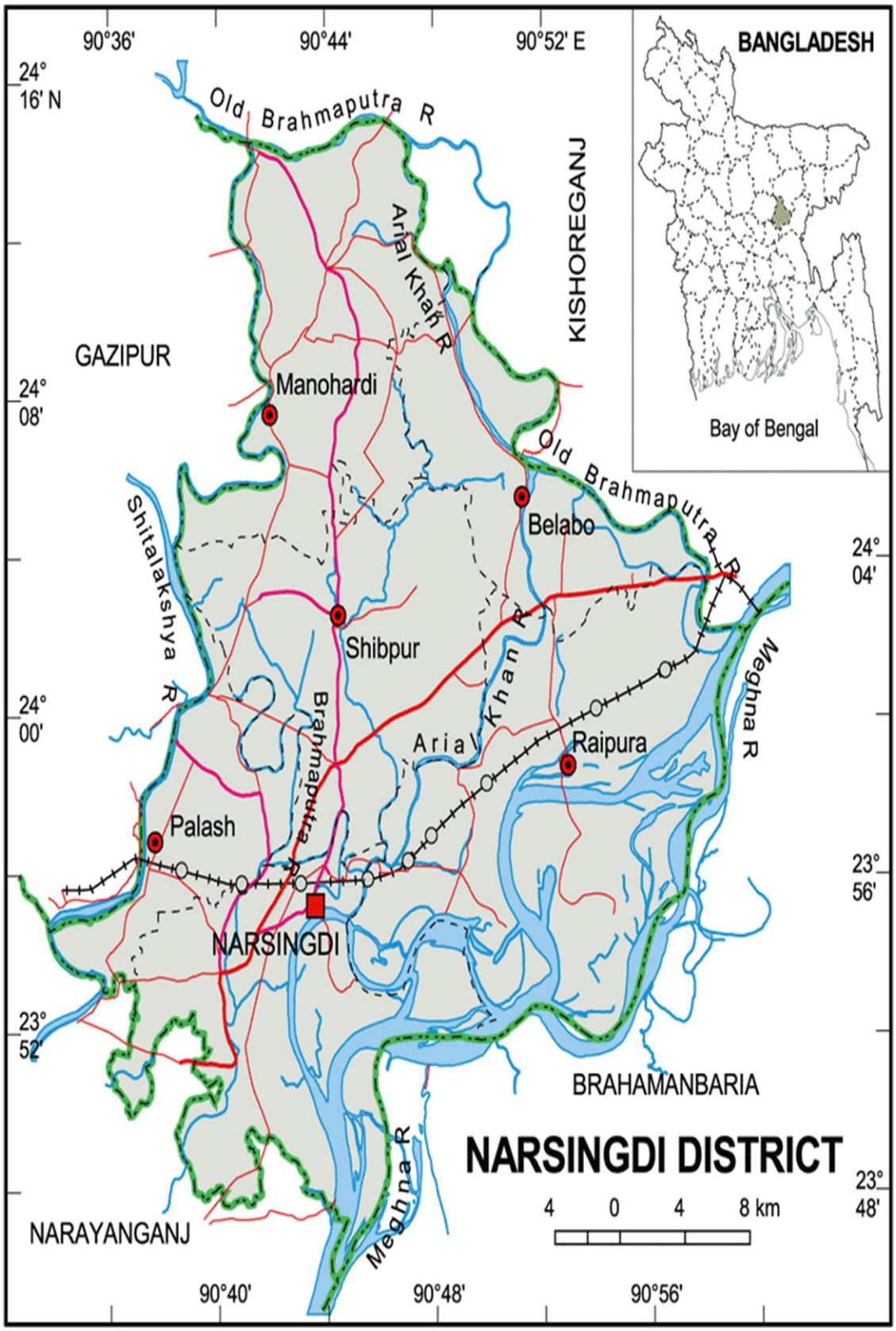

Figure 4.1: Map of Narsingdi District
Source: Internet

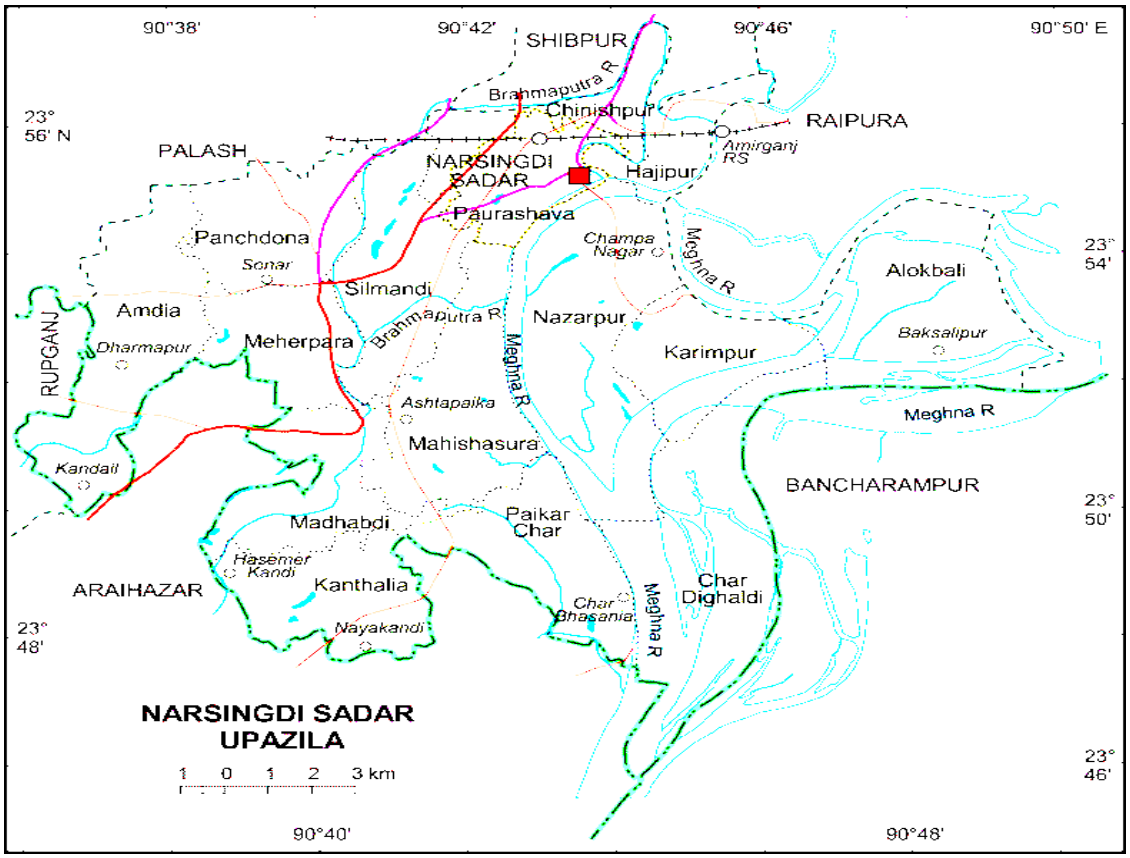

Figure 4.2: Map of Narsingdi Sadar Upazilla
Source: Internet

Figure 4.3: Map of Raipura Upazilla
Source: Internet

4.4 Irrigation Facility

Table 4.2 Area Irrigated by Different Means

Power Pump	Total Tube well	Traditional	Total Irrigated Area	Cropped Area	Irrigated Area (%)
39	131	1	171	363	47.10

Source: BBS, 2019.

According to BSS district statistic 2013, Total irrigated area is 47.10% where 363 acres is irrigated for crop cultivation. Day by day more other areas are being included for irrigation.

Table 4.3 Area Irrigated Under Different Crops

Crops	Area (in Acres)
Aman	12
Boro	121
Wheat	-
Sugarcane	-
Cotton	-
Potato	-
Vegetables	33
Other Crops	5
Total Irrigated Area	171

Source: BBS, 2019 (District Statistics 2013)

Narsingdi district has a huge possibility of vegetable production. According to BBS district statistics 2013, for producing boro rice it requires 121 acres of land, for vegetables it requires 33 acres of land among total irrigated area of 171 acres.

4.5 Religion and Culture

Most of the villagers in the study area are Muslims and non-Muslim villagers are mostly Hindus. The relations between Muslims and Hindus are flexible and the villagers are very faithful on their own religion. Their standards are simple and

straight forward. They are so much cooperative to each other in all sorts of social functions and the hospitality of the villagers is noteworthy.

4.6 Climate, Temperature and Rainfall

The climate here is tropical and in winter, there is much less rainfall than in summer. The climate here is classified by the Köppen-Geiger system. The average temperature in Narsingdi is 25.9 °C and the rainfall averages 2058 mm.

Table 4.4 Monthly Min., Max., Average Temperature, and Rainfall of the Study Area in 2018.

Month	Max Temperature(°c)	Min Temperature(°c)	Average Temperature(°c)	Rainfall (mm)
January	25.7	12.6	19.1	10
February	28.5	15.1	21.8	20
March	32.2	19.3	25.7	59
April	34.2	23.2	28.7	142
May	33.1	24.7	28.9	266
June	31.6	25.7	28.6	407
July	31.1	26.1	28.6	380
August	31.4	26.2	28.8	311
September	31.6	25.9	28.7	260
October	31.1	24	27.5	162
November	29.1	18.9	24	37
December	26.4	14.3	20.3	4

Source: Internet (Climate-data.org)

Table 4.4 shows that maximum and minimum temperature in the study area ranged from 34.2°c to 12.6°c. The average maximum temperature was the highest in April which was 34.2°C and the average minimum temperature was found in January which was l2.6°c. The maximum average rainfall is about 407 mm in June and the lowest in December. (Climate-Data,2019).

4.7 Area, Population and Literacy Rate

As of the 2013 Bangladesh census, Narsingdi Sadar has a population of 707525. Males constitute 51.42 percent of the population, and females 48.58 percent. Narsingdi Sadar has an average literacy rate of 50.9 percent; Raipura has a population of 535796. Males constitute 48.33 percent of the population, and females 51.66 percent. Raipura has an average literacy rate of 40.5 percent.

Table 4.5: Area, Population, Household, Sex ratio and Literacy rate of Narsingdi Sadar & Raipura Upazilla

Name of the Area	Household	Population		Sex ratio	Density Per sq. Km.	Literacy Rate (%)
		Male	Female			
Narsingdi Sadar	149820	363811	343714	106	3315	50.9
Raipura	110520	258993	276803	94	1713	40.5

Source: BBS, 2019.

4.8 Non- government Organizations (NGOs)

A good number of non-government organizations (NGO's) like BRAC, ASA, Grameen Bank, SSS (Society for Social Service) etc. are engaged in various types of rural development programmes in the study area. In recent years, NGOs are providing technical and financial supports in livestock, poultry, fisheries, homestead gardening, handicraft etc. Not only they are also engaged in educational programmes but also they provide loans in small amount (microcredit) to poor women and landless farmers.

4.9 Use of Modern Technology

Agriculture is the biggest field of employment facilities of the people in the study area. In Narsingdi Sadar & Raipura upazilla, the principal agricultural crop is rice which is cultivated in three seasons such as Aus, Aman and Boro. The winter crops

such as wheat, potato, mustard, and vegetables like brinjal, cucumber, bottle gourd, bean, tomato, lalshak, pumpkin etc. are also grown in the study area. Modern technology namely deep and shallow tube wells, power tiller, HYV seeds, chemical, fertilizers, insecticides, manure are widely used in the study area.

4.10 Roads, Communication and Marketing Facilities

Transport and marketing facilities are the main agricultural infrastructure and play an import role in agricultural as well as economic development of a country. Without well-developed transport system, it becomes impossible for the village people to enjoy the facilities of modem technology. Buses, bicycles, rickshaw, tempo and van services are the main transportation means in the study area. The marketing systems in these Upazilla headquarters are moderately good where there are many markets and Hat in the study area. Generally farmers purchase daily requirements including agricultural inputs and sell their products to the village markets and to the middlemen e.g. Paikers, Beparies, Aratdars etc. The villagers sometimes receive fair price of their products.

4.11 Conclusion

The above short description gives an overview of the physical, topographical, demographic and socioeconomic situation of the Narsingdi district in general and for the study upazilla in particular. Narsingdi district has potential for tomato production and its contribution in the national economy. The proper management and utilization of the available natural resources is also compulsory to enhance the productivity of tomato production.

CHAPTER 5

SOCIOECONOMIC CHARACTERISTICS OF THE TOMATO FARMERS

CHAPTER 5
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5.1 Introduction

The section of the study deals with selected demographic characteristics of the sample farmers which often influence their production decision. Decision making behaviour of an individual is determined by his demographic characteristics Some important characteristics were considered in this study such as family size and composition, educational status, experience, occupation, and ownership pattern etc. A brief description on these cases is presented under the following sections.

5.2 Age Distribution of the Sample Farmers

Age of farmers have an influence on the production of the farming system. Some researchers think that older farmers are more experienced and more efficient in using of resources. Other researchers comment that younger farmers want to adopt improved technology than older.

Table 5.1 Age Distribution of the Respondent

Age Category yr	Narsingdi Sadar		Raipura		All	
	No	Percent	No	Percent	No	Percent
20-35	13	28.89	10	22.22	23	25.56
36-50	20	44.44	25	55.56	45	50
Above 50	12	26.66	10	22.22	22	24.44

Source: Field Survey, 2019

It is clear from the figure 5.1 that farmers between 20-35 years of age stood for 25.56 percent of the total sampled tomato farmers while farmers between 36-50 years constituted 50 percent. There are 24.44 percent sample farmers whose age were 51 years and above. Figure 5.1 revealed tomato farmers were of mostly middle aged group.

5.3 Educational Status of the Respondents

Education is generally regarded as a crucial factor of social improvement of a community since it plays a critically important role in reducing poverty and inequality, improving health and enabling the use of knowledge. Education means efficiency which helps farmers to increase skill and productivity.

Table 5.2 Educational Status of the Respondents

Level of Education	Narsingdi Sadar		Raipura		All farmers	
	No.	percent	No.	Percent	No.	Percent
Illiterate	5	11.11	3	6.67	8	8.88
Sign only	3	6.67	7	15.56	10	11.11
P.E.C	6	13.33	12	26.67	18	20
J.S.C	16	35.56	10	22.22	26	28.90
S.S.C	10	22.22	11	24.44	21	23.34
H.S.C & Above	5	11.11	2	4.44	7	7.77
Total	45	100	45	100	90	100

Source: Field survey, 2019.

It is evident from table 5.1 that out of 90 sample farmers, In total, 11.11 percent farmers had primary education, 20 percent farmers had completed P.E.C level education, 28.90 percent farmers had completed J.S.C level education, 23.34 percent farmers had completed their secondary level education, 7.77 percent farmers had completed their higher secondary education or above.

5.4 Occupational Status of the Tomato Farmers

Occupation is one of the major attributes of socio-economic characteristics. In Bangladesh, rural people's occupations are being versatile. They try to seek off-farm and non-farm income earning opportunities.

Table 5.3 Occupational Status of the Tomato Farmers

Occupation	Narsingdi Sadar		Raipura		All farmers	
	No.	%	No.	%	No.	%
Agriculture	2	4.44	2	4.44	4	4.44
Crop farming	11	24.44	5	11.11	16	23.33
Vegetable farming	28	62.22	36	80	64	77.77
Business	3	6.67	2	4.44	5	5.55
Services & others	1	1	-		1	1.11

Source: Field survey, 2019.

In the selected area, the tomato farmers were engaged in different occupations along with tomato cultivation as the farmer who are involved in tomato cultivation mainly they are vegetable farmers. In the case of main occupation, vegetable farmers accounted for 77.77 percent, Crop farming accounted for 23.33 percent, business accounted for 5.55 percent agriculture accounted for 4.44 percent and service and others accounted for 1 percent presented in the table. (Table 5.2)

5.5 Land Ownership Pattern of the Farmers

Average farm size = Own land in cultivation +Home +Mortgage in land + Pond – Mortgage out land

In the present study, land ownership was classified into different categories i.e. cultivated own land, home, land mortgaged in, land mortgaged out, pond and homestead area. Table 5.3 reveals the average farm size of Narsingdi Sadar, Raipura and all farmers were 0.344, 0.458, and 0.400 ha respectively. Average farm size was calculated using the above formula and is given below:

Table 5.4 Land Ownership Pattern of the Farmers

Items	Narsingdi Sadar		Raipura		All farmers	
	No.	percent	No.	percent	No.	Percent
Homestead	2.43	15.70	2.89	14.02	5.31	14.72
Own cultivable land	3.94	25.45	5.99	29.06	9.94	27.55
Pond	2.36	15.24	4.25	20.63	6.62	18.34
Mortgage In	4.85	31.33	4.58	22.22	9.42	26.10
Mortgage Out	1.90	12.28	2.90	14.07	4.80	13.30
Total Land Area	15.48	100	20.61	100	36.08	100
Average farm size	0.344		0.458		0.400	

Source: Field survey, 2019.

5.6 Experiences in Agriculture

Table 5.5 Experience Level of the Farmers

Experiance	Narsingdi Sadar		Raipura		Total	
	No.	Percent	No.	percent	No.	Percent
1-10 years	15	33.33	23	51.11	38	42.23
11-25 years	25	55.55	19	42.22	44	48.90
26-40 years	3	6.67	2	4.44	5	5.55
Above 40 years	2	4.44	1	2.22	3	3.33

Source: Field Survey, 2019

Experience is an important factor as it gives the farmer perception about the consequences and solution to any unexpected occurrence. Though the data which was presented above was not the experience level of tomato cultivation of farmers

but it was included to help them as it was related to other crops or vegetables. Experience level from 1-10 years was found, from the above table 33.33 , 51.11 and 42.23 percent; from 11-25 years was found 55.55, 42.22 and 48.90 percent; from 26-40 years was found 6.67, 4.44 and 5.55 percent and from above 40 years was found 4.44, 2.22 and 3.33 percent for Narsingdi Sadar, Raipura and all farmers respectively.(Table 5.4)

5.7 Family Size of the Tomato Farmers

The family member includes wife, sons & his wife, unmarried daughter, father, mother and brother. The total numbers of persons of all families were sectioned into four age categories according to their family size.

Table 5.6 Family Size of the Tomato Farmers

No. of family members group	Narsingdi Sadar		Raipura		All farmers	
	No.of farm family	Percent	No.of farm family	Percent	Total no. of farm family	Percent
1-3	5	11.11	9	20	14	15.55
4-5	9	20	8	17.78	17	18.89
6-7	16	35.55	15	33.33	31	34.45
Above 7	15	33.33	13	28.89	28	31.11
Total	45	100	45	100	90	100
Average family size				5.9		

Source: Field Survey, 2019

Table 5.5 shows that 15.55 percent families of tomato farmers consisted of 1-3 members, 18.89 percent families consisted of 4-5 members, 34.45 percent families consisted of 6-7 members, and 31.11 percent families consisted of above 7 members. The average family size of our country is 4.40 (BBS, 2018). But in the study area it was found 5.9 for tomato farmer, which was larger than average family size of the country.

5.8 Income distribution of the respondent

Annual family incomes of tomato farmers come from vegetable farming, business, agriculture, service, and others. In the present study, the incomes of tomato farmers were categorized as: less than 150,000, from 150,000 to 250,000 and above 250,000. It is evident from the table 5.6 that most of the farmer's yearly income belonged to the category of 150,000 to 250,000. About 56.2 percent of the tomato farmers were earned Tk. 150,000 to 250,000 per year, 42.23 percent of the farmers were earned Tk. less than 150,000 per year and 5.55 percent farmers were earned Tk. Above 250,000 per year where per capita national income is Tk 1,56,530(US Dollar 1909).

Table 5.7 Income Distribution of the Respondent

Ranges of Annual Income	Narsingdi Sadar		Raipura		All farmers	
	No.	Percent	No.	Percent	No.	Percent
Less than 150000	15	33.33	23	51.11	38	42.23
150000-250000	26	57.78	21	46.67	47	52.22
Above 250000	4	8.90	1	2.22	5	5.55

Source: Field survey, 2019

5.9 Conclusion

This chapter analysed the socioeconomic attributes of the sample farmers. The findings of analysis clearly indicate that most of the farmers are not well educated and their annual income is not high but most of the farmers are involved to agriculture with high experience.

CHAPTER 6

PROFITABILITY OF TOMATO CULTIVATION

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6.1 Introduction

The identity of this chapter is to estimate the costs, returns and profitability of cultivating tomato and to focus on the main factors affecting return of tomato production. The items of costs include fertilizer, manure, insecticide, hormone, irrigation, seed, labour cost, land cost and cost on operating capital @5.5 percent in 4 months. On the other side, gross return of Tomato cultivation comprised sales value of product and by-product. All the calculations were performed by hectare and gross margin, net return; returns per taka invested on total cost were estimated. The item wise costs and return of tomato production are discussed below.

6.2 Cost of Tomato Production

The cost means the total amount of funds used in production. In the present study, from table 6.2 and 6.4 represents the total costs of tomato production. Total variable cost and total fixed cost were Tk. 235316 and Tk. 152207 that were 60.72 and 39.28 percent of total cost, respectively. Thus, the item wise costs of tomato production are discussed below.

6.3 Variable Cost

6.3.1 Hired Labour Cost

Human labour is required for major activities and management of the selected farms such as- land preparation, sowing, weeding, mulching, harvesting etc. Human labour was classified into hired labour and family labour categories. It is easy to calculate hired labour costs

The labour of women and children was converted into man-equivalent day by presenting a ratio of 2 children day = 1.5 women days = 1 man equivalent day. Labour wage rate varies with respect to different regions and conditions. In the study area it varied from 350 to 450 Tk. per man-days but the computed average rate was Tk. 400 per man-days for tomato production.

Use of human labour and its different included cost were shown in table 6.1 & 6.2. The per hectare labour cost was Tk. 114400 which constituted 48.61 percent of total variable cost. Tk. 114750 as to 50.58 percent in Narsingdi Sadar and Tk. 113750 as to 46.50 percent in Raipura have been found.

Table 6.1 Per Hectare Variable Costs of Narsingdi Sadar & Raipura

Variable Cost Items	Narsingdi Sadar		Raipura	
	Cost	Percent	Cost	Percent
Human labour	114750	50.58	113750	46.50
Machinery & Animal Labour	19124	8.43	20796	8.50
Seed	8075	3.57	9048	3.69
Urea	4767	2.10	4823	1.97
TSP	6485	2.85	6566	2.68
MOP	3406	1.50	3105	1.26
Gypsum	557	.24	551	.22
Manure	17994	7.93	20224	8.26
Irrigation	7865	3.46	7876	3.21
Hormone	23717	10.45	24814	10.14
Pesticide	16002	7.05	19107	7.81
Mancha & Other Accessories	10013	4.41	9548	3.90
Interest on Operating Capital @ 5.5% for 4 months	4083	1.8	4404	1.8
Total Variable Cost	**226825**	**100**	**244612**	**100**

Source: Field Survey, 2019.

6.3.2 Machinery and Animal Labour Cost

For measuring financial profitability machinery and animal labour cost is the part. In the recent year use of animal power is diminishing with the introduction of machine power, but in the study area animal power was proportionately used for land preparation and mainly used for laddering, threshing and carrying. From the table 6.1 and table 6.2 it was found that machinery and animal power cost is Tk. 19124 tk. /ha which constituted 8.43 percent, Tk. 20796 tk. /ha which constituted 8.50 percent and Tk. 19460 tk. /ha which constituted 8.26 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively

6.3.3 Cost of Seed

Farmers prefer to use seed stored from their previous production but some new or other farmer like to purchase. In the Narsingdi Sadar Upazilla most of the farmers purchase seed but In Raipura upazilla, most of the farmers use stored seed. From the table 6.1 and table 6.2 it was found that seed cost is Tk. 8075 tk. /ha which constituted 3.57 percent, Tk. 9048 tk. /ha which constituted 3.69 percent and Tk. 8561 tk. /ha which constituted 3.63 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

6.3.4 Fertilizer & Manure Cost

The rate of fertilizer per hector was found low as most of the farmers do not have proper idea about the required dose. From the table 6.1 and table 6.2 it was found that fertilizer cost is Tk. 15215 tk. /ha which constituted 6.69 percent, Tk. 15045 tk. /ha which constituted 6.13 percent and Tk. 15127 tk. /ha which constituted 6.42 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

Again, from the table 6.1 and table 6.2 it was found that manure cost is Tk. 17994 tk. /ha which constituted 7.93 percent, Tk. 20224 tk. /ha which constituted 8.26 percent and Tk. 17554 tk. /ha which constituted 7.45 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

6.3.5 Irrigation Cost

Almost all the respondents in the study area used irrigation in their field though they did not apply in proper time. From the table 6.1 and table 6.2 it was found that

irrigation cost is Tk. 7865 tk. /ha which constituted 3.46 percent, Tk. 7876 tk. /ha which constituted 3.21 percent and Tk.7870 tk. /ha which constituted 3.34 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

6.3.6 Hormone & Insecticide/Pesticide Cost

Hormone was used to continue the growth circulation and increase healthy fruits. From the table 6.1 and table 6.2 it was found that hormone cost is Tk. 23717 tk. /ha which constituted 10.45 percent, Tk. 24814 tk. /ha which constituted 10.14 percent and Tk.22265 tk. /ha which constituted 9.47 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

Pesticides included to insecticides & fungicides was used by sample farmers and applied to field with different rates and the cost of pesticides was determined by the actual price paid by the farmers. From the table 6.1 and table 6.2 it was found that hormone cost is Tk. 16002 tk. /ha which constituted 7.05 percent, Tk. 19107 tk. /ha which constituted 7.81 percent and Tk.16055 tk. /ha which constituted 6.82 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

6.3.7 Mancha Preparation Cost

Bamboo, Sutli, nylon and Polythene were mainly used to prepare munch and it is not costly. From the table 6.1 and table 6.2 it was found that munch preparation cost is Tk. 10013 tk. /ha which constituted 4.41 percent, Tk. 9548 tk. /ha which constituted 3.90 percent and Tk. 9780 tk. /ha which constituted 4.15 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

6.3.8 Interest on Operating Capital

It is evident from the table 6.1 and table 6.2 that cost of interest on operating cost is Tk. 4083 tk. /ha which constituted 1.80 percent, Tk. 4404 tk. /ha which constituted 1.80 percent and Tk. 4244 tk. /ha which constituted 1.80 percent of total variable cost of Narsingdi Sadar, Raipura and total respectively.

Table 6.2 Per Hectare Total Variable Cost of Tomato Production

Variable Cost Items	Units	Quantity (Unit/ha)	Price (Tk./unit)	Cost (Tk.)	Percent of Total Variable Cost (%)
Human labour	Man-days	286	400	114400	48.61
Machinery & Animal Labour	-	-	400	19460	8.26
Seed	Kg	.33	30000	8561	3.63
Urea	Kg	316	22	4796	2.03
TSP	Kg.	318	20	6520	2.78
MOP	Kg.	153	16	3255	1.38
Gypsum	Kg.	52	12	556	.23
Manure	-	-	1	17554	7.45
Irrigation	-	-	-	7870	3.34
Hormone	-	-	-	22265	9.47
Pesticide	-	-	-	16055	6.82
Mancha & Other Accessories	-	-	-	9780	4.15
Interest on Operating Capital@ 5.5% for 4 months	-	-		4244	1.80
Total Variable Cost				**235316**	**100**

Source: Field survey, 2019

6.3.9 Total Variable Cost

In the experimental area, the total variable costs varied from year to year. From the table 6.4, total variable cost is Tk. 226825 tk. /ha which constituted 59.43 percent, Tk. 244612 tk. /ha which constituted 62.42 percent of total variable cost of Narsingdi Sadar and Raipura respectively. It was observed that the total per hectare variable cost for tomato production was Tk. 235316 which comprised of 60.72 percent of total cost (Table 6.4).

6.4 Total Fixed Costs

6.4.1 Land Use Cost

The term leasing arrangement cost describes the cost which was required for farmers to take land lease which would be used for tomato production to a particular period of time. Cost of leasing varies from one place to another depending on the location, soil fertility, topography of the soil and distance from the sources of water etc. and the value of own land was calculated as opportunity cost concept. Land use cost for tomato production was estimated at the prevailing rental price per hectare in the selected study area. From table 6.3, the rental value of per hectare land was Tk. 51323 tk. /ha which constituted 33.14 percent, Tk. 57216 tk. /ha which constituted 38.87 percent of total variable cost of Narsingdi Sadar and Raipura respectively. It was observed that the total rental value of per hectare land of tomato production was Tk. 56457 which comprised of 37.09 percent. (Table 6.3)

Table 6.3 Per Hectare Total Fixed Cost of Tomato Production

Fixed cost items	Narsingdi Sadar		Raipura		Total	
	Cost	Percent	Cost	Percent	Cost	Percent
Land use cost	51323	33.14	57216	38.87	56457	37.09
Family labour	103500	66.86	90000	61.13	95750	62.91
Total	154823	100	147216	100	152207	100

Source: Field survey, 2019

6.4.2 Family Labour

To determine the cost of family labour; the opportunity cost concept was used. In the study area, it was estimated that per hectare family labour cost for year round tomato

production was Tk. 103500 which comprised of 66.86 percent, Tk. 90000 tk. /ha which constituted 61.13 percent, Tk. 95750 tk. /ha which constituted 62.91 percent of total fixed cost of Narsingdi Sadar , Raipura and in total respectively. (Table 6.3).

6.4.3 Total Fixed Cost

In the study area, it was estimated that per hectare total fixed cost for year round tomato production was Tk. 152207 which comprised of 39.28 percent of total cost (Table 6.4).

6.5 Total Cost

In the study per hectare total cost of tomato production was calculated at Tk. 381648, Tk. 391828 and Tk. 387523 in Narsingdi Sadar, Raipura and total respectively (Table 6.4).

Table 6.4 Per Hectare Total Cost of Tomato production

Cost Items	Narsingdi Sadar		Raipura		All areas cost	
	Cost	%	Cost	%	Cost	%
Total Fixed Cost	154823	40.57	147216	37.58	152207	39.28
Total Variable Cost	226825	59.43	244612	62.42	235316	60.72
Total Cost	381648	100	391828	100	387523	100

Source: Field Survey, 2019

6.6 Returns from Tomato Production

The main aim of production of tomato, like all other businesses is to earn profit by selling fresh tomato. The aim of this section is to estimate the gross return and net return (Profit) from tomato production.

6.6.1 Gross Return

Here, per hectare gross return was found by multiplying the total amount of product by their respective prices. The gross return was found to be Tk. 915852, Tk. 948560 and Tk. 933160 per hectare in Narsingdi Sadar, Raipura and in total respectively. (Table 6.5)

Table 6.5 Gross Return from Tomato Production Per Hector

Items	Narsingdi Sadar		Raipura		Total Value(Tk.)	
	Yield (kg/ha)	Price (Tk./ha)	Yield (Kg/ha)	Price (Tk./ha)	Yield (Tk. /ha)	Price (Tk./ha)
Tomato	21806	42	23714	40	22760	41
Gross Return		915852		948560		933160

Source: Field Survey, 2019.

6.6.2 Gross Margin

Per hectare gross margin was found by subtracting variable costs from gross return. Per hectare gross margin was found to be Tk. 689027, Tk. 703948 and Tk. 697844 in case of Narsingdi Sadar, Raipura and in total respectively. (Table 6.6)

.Table 6.6 Gross Margin and Benefit Cost Ratio (Undiscounted) on full cost basis of Narsingdi Sadar, Raipura & All

Items	Amount (Tk./hectare)		
	Narsingdi Sadar	Raipura	All
Gross return (GR)	915852	948560	933160
Total variable costs (TVC)	226825	244612	235316
Total costs (TVC+TFC)	381648	391828	387523
Net return (GR-TC)	534204	556732	545637
Gross margin (GR-TVC)	689027	703948	697844
Benefit-cost ratio (BCR) =GR/TC	2.4	2.42	2.4

Source: Field Survey, 2019

5.6.3 Net return

Net return was measured by substituting the total cost from the gross return.The average net return was found to be Tk. 534204, Tk. 556732 and Tk. 545637 in case of Narsingdi Sadar, Raipura and in total respectively. (Table 6.6).

6.6.4 Benefit Cost Ratio (Undiscounted)

It describes financial efficiency of the farm. It seemed from the study that the benefit cost ratio of tomato production was accounted for 2.4 implying that Tk. 2.4 would be earned by investing Tk. 1.00 for tomato production. So, the tomato production was found to be profitable for farmers (Table 6.6). The benefit cost ratio in Narsingdi Sadar and Raipura is found 2.4 and 2.42. (Table 6.6).

6.7 Conclusion

It was evident from the result that per hectare total variable cost in case of tomato production was more than per hectare total fixed costs and it provided higher returns to the farmers. The variation found between two thanas is due to variation in variable cost but price per unit of output is almost same in both areas.

CHAPTER 7

RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION

Chapter 7

RESOURCE USE EFFICIENCY OF TOMATO PRODUCTION

7.1 Introduction

This chapter has been created to present a quantitative relationship between some key inputs and output of tomato production in the framework of functional analysis. To determine the effects of selected inputs on the production of Tomato, Cobb-Douglas production function was chosen on the basis of the best fit.

7.2 Tomato Production and Relative Factors

Tomato production function refers to the relationship between the inputs of factor services and the output of production of tomato. Production of tomato was considered to be explained by a number of inputs namely seed cost, land preparation cost, hired labour cost, fertilizer cost, manure cost, insecticide cost, hormone use cost and irrigation cost. On the other hand, unexplained variables were considered to be munching preparation cost, land use cost and other accessories.

7.2.1 Functional Analysis

To express the effects of variable inputs both liner and Cobb-Douglas production function models were estimated initially. The results of Cobb-Douglas models appeared to be excellent on theoretical and econometric grounds like

i) Adequate accessibility of the data,

ii) Computation flexibility,

iii) Sufficient degrees of freedom for statistical testing. So this model was accepted.

Cobb-Douglas production function analysis was done taking 90 tomato farmers. The function was specified as:

$$Y= a\ X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5}\ X_6^{b_6}\ X_7^{b_7}\ X_8^{b_8}\ e^{Ui}$$

The function transformed into the following log liner form:

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + Ui$

Where,

Y= Gross return (Tk. /ha);

a=Constant or intercept value;

X_1= Cost of seed (Tk. /ha);

X_2 = Cost of land preparation (Tk. /ha);

X_3 = Cost of hired labour (Tk. /ha);

X_4= Cost of irrigation (Tk. /ha);

X_5 = Cost of fertilizer (Tk. /ha);

X_6 = Cost of manure (Tk. /ha)

X_7= Cost of insecticide (Tk. /ha)

X_8= Cost of hormone (Tk. /ha)

U_i = Error term;

i= 2, 3,.....90;

b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8= Regression co-efficient of respective variables

ln =Natural log.

7.3 Interpretation of Results

1) F-value was used to measure the goodness of fit for accepted types of inputs.
2) The coefficient of multiple determinations (R^2) indicates the total variations of depended variable explained by the independent variables included in the model.
3) Coefficients were tested for significance level at 1 percent, 5 percent and 10 percent levels of significant.
4) Stage of production was estimated by using returns to scale which was the summation of all the production elasticity of various inputs.

7. 3.1 Seed (X_1)

The regression co-efficient of seed cost was 0.052 and insignificant for tomato production that implies the 1 percent increase in the cost of seed, keeping other factors constant, would decrease gross returns by 0.052 percent (Table 7.1).

7.3.2 Land Preparation (X_2)

The regression co-efficient of expenditure on land preparation was 0.063 which was insignificant and indicated that 1 percent decrease in land preparation cost, keeping other factors constant, would result in decrease of the gross return by 0.063 percent for tomato production (Table 7.1).

7.3.3 Hired Labour (X_3)

The regression co-efficient of hired labour cost was 0.228 which was significant at 5% level which implies that one percent increase in the human labour, keeping other factors constant, would result in an increase of the gross return by 0 .228 percent (Table 7.1).

7.3.4 Irrigation (X_4)

The regression co-efficient of expenditure on irrigation cost was .308 which was significant at 10% level and the analysis indicated that 1 percent increase in irrigation cost, keeping other factors constant, would result in increase of the gross return by 0.0308 percent for tomato production (Table 7.1).

7.3.5 Fertilizer (X_5)

The regression co-efficient of fertilizer cost was 0.204 which was significant at 10% level and implies that one percent increase in the fertilizer, keeping other factors constant, would result in an increase of the gross return by 0 .204 percent (Table 7.1).

7.3.6 Manure (X_6)

The regression co-efficient of expenditure on manure cost was .179 which was significant at 10% level and The results of the analysis indicated that 1 percent increase in manure cost, keeping other factors constant, would result in increase of the gross return by 0.179 percent for tomato production (Table 7.1).

7.3.7 Insecticide (X_7)

The regression co-efficient of pesticide cost was 0.067 which was insignificant and implies that one percent decrease in the pesticide, keeping other factors constant, would result in an decrease of the gross return by 0 .067 percent (Table 7.1).

Table 7.1 Estimated Values of Coefficients and Related Statistics of Cobb- Douglas Production Function

Explanatory variables	Coefficient	Standard error	t- value
Intercept	**2.74*** **	**.748**	**3.67**
Cost of seed	**.052**	**.062**	**.84**
Cost of land preparation	**.063**	**.125**	**.50**
Cost of hired labour	**.227****	**.108**	**2.10**
Cost of irrigation	**.307***	**.175**	**1.75**
Cost of fertilizer	**.204***	**.120**	**1.69**
Cost of manure	**.178***	**.103**	**1.73**
Cost of insecticide	**.067**	**.057**	**1.16**
Cost of hormone	**.017**	**.124**	**.14**
R^2	**.888**		
Adjusted R^2	**.876**		
Return to scale	**1.07**		
F- value	**80.25**		

Source: Field Survey, 2019

Note: *** Significant at 1% level ** Significant at 5% level

* Significant at 10% level

7.3.8 Hormone (X_8)

The regression co-efficient of hormone cost was 0.017 which was insignificant that one percent decrease in the hormone, keeping other factors constant, would result in an decrease of the gross return by 0 .017 percent (Table 7.1).

7.3.9 The Co-efficient Of Multiple Determinations (R^2)

The co-efficient of multiple determinations was 0.888. It shows that 88 percent of the variation in the gross returns was explained by the independent variables included in the model (Table 7.1).

7.3.10 Adjusted R^2

The term adjusted refers adjusted for the degrees of freedom. The adjusted R^2 for tomato production was found to be 0.87 which indicated that about 87 percent of the variations of the dependent variable were explained by the explanatory variables included in the model (Table 7.1).

7. 3.11 Goodness of Fit (F-value)

F value finds out how much the explanatory variable does actually have significant influence on the dependent variables. The F-value of tomato production was 80.25 and highly significant at 1 percent level implying that all the included explanatory variables were significant for explaining the variation

7. 3.12 Returns to Scale

It is the situation at which output changes when all inputs are changed proportionally. Returns to scale of tomato production were computed by adding co-efficient of regression of tomato production. The sum total of all the production co-efficient of the equation for tomato production was 2.74. This indicates that the production function explores increasing returns to scale.

7.4 Resource Use Efficiency in Tomato Production

In order to test the resource use efficiency the mathematical formula is-

$$\frac{\mathbf{MVP}}{\mathbf{MFC}} = \mathbf{1}$$

To accomplish the aim of profit maximization i.e., for efficient allocation of resources, the value of the added product should be greater than the cost of added amount of the resources in producing it.

Table 7.2 showed that the ratio of MVP and MFC of Seed (5.18), Land preparation (2.42), Fertilizer (12.62) manure (7.86) and Irrigation (30.88) for tomato production was positive and more than one indicated that in the study area these inputs for tomato production were under used. So, farmers should increase the use of these inputs to attain efficiency level.

Table 7.2 Estimated Resource Use Efficiency in Tomato Production

Variables	Co-efficient	GM	MVP	MFC	$\frac{MVP}{MFC}$	Comment
Seed	.052	732.59	5.18	1	5.18	Underutilized
Land Preparation	.063	1895.57	2.42	1	2.42	Underutilized
Fertilizer	.204	1178	12.62	1	12.62	Underutilized
Manure	.178	1650.11	7.86	1	7.86	Underutilized
Hired Labour	.227	18858.13	.877	1	.877	Over utilized
Irrigation	.307	724.66	30.88	1	30.88	Underutilized
yield		72874.6				

Source: Field Survey, 2019

The ratio of MVP and MFC of hired labour was found to be 0.877 for tomato production and less than one indicated that these variables were over used (Table 7.2). So, farmers should decrease the use of this independent input for tomato production to attain efficiency considerably.

7.5 Conclusions

The overall result from Cobb-Douglas production function model for tomato production was satisfactory as indicated by the estimated R^2 and F-value. The estimated values of the model, confirm that the selected variables had significant effects on the gross return of tomato production.

CHAPTER 8

PROBLEMS OF TOMATO PRODUCTION

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8.1 Introduction

Tomato is one of the most important vegetables crops receiving much attention to the researchers throughout the world. Tomato farmers are facing production and financial uncertainty where management of these risks is greatly influenced by their attitudes towards risk. So, the objective of this study is to identify the risk attitude and profitability of tomato farmers in Bangladesh.

8.2 Economic Problems

8.2.1 High Wage of Hired Labour

Tomato production is labour intensive as additional labour days are required to cultivate one hectare of vegetables in one season. About 84 percent from Narsingdi Sadar and 77 percent from Raipura and total about 81 percent farmers reported this problem. Because of a general improvement in wage rates in the country, farmers have to pay huge amount of money for labour and it is the most important economic problem as said by the respondents. (Table 8.1)

8.2.2 High Price of Tunnel Materials

A major part of expenses of tomato farmer was incurred in purchasing tunnel materials called mancha preparation. Recently tunnel material price has gone up and it is disrupted the tomato production in the study area. Table 8.1 shows that total 65 percent of farmers reported this problem where 60 percent from Narsingdi Sadar and 59 percent from Raipura.

8.2.3 Low Price of Output

Table 8.1 shows that 55 percent farm owners reported this problem among which 51 percent and 60 percent included to Narsingdi Sadar and Raipura respectively. At the beginning of the sale price became so high but at later it became so low.

Table 8.1 Problems Faced by the Tomato Farmers

Problems	Narsingdi Sadar		Raipura		All		Rank
Economic Problems	No.	%	No.	%	No.	%	
High wage of hired labour	38	84.44	35	77.78	73	81.11	1
High price of tunnel materials	27	60	32	71.11	59	65.56	2
Low price of output	23	51.11	27	60	50	55.56	3
High prices of input	19	42.22	22	48.89	41	45.56	4
Technical Problems							
Shortage of labour in peak period	33	73.33	37	82.22	70	77.78	1
Lack of cooperation by block supervisor	23	51.11	25	55.56	48	53.33	2
Lack of quality seed	15	33.33	19	42.22	34	37.78	3
Lack of technological knowledge	10	22.22	7	15.56	17	18.89	4
Natural Problems							
Non-suitable temperature	43	95.56	39	86.67	82	91.11	1
Seasonal change	27	60	24	53.33	51	56.67	2
Attack of insect and disease	22	48.89	23	51.11	45	50	3
Marketing Problems							
Selling problems	33	73.33	36	80	69	76.67	1
Storage problems	29	64.44	31	68.89	60	66.67	2
Transportation problem	13	28.89	11	24.44	24	26.67	3

Source: Field Survey, 2019

8.2.4 High Prices of Input

Table 8.1 shows that 46 percent farmers faced the problem of higher input price. Among different regions of farmers, 42 percent of the farmers from Narsingdi Sadar followed by 49 percent of farmers from Raipura faced the problem of high input price during tomato cultivation.

8.3 Technical Problem

8.3.1 Shortage of Labour in Peak Period

Production of tomato largely depends on the use of adequate skilled and quantity of labour. In the study area, the Shortage of hired labour was found high during the harvest season. Table 8.1 shows that about 78 percent of all farmers complained that they did not get adequate amount of labour during the period of land where were found 73 percent in Narsingdi Sadar and 82 percent were found in Raipura.

8.3.2 Lack of Cooperation by Block Supervisor

In the study area farmers complained that they did not get help from the block supervisor and also reported that they did not get proper help by the agricultural assistance from their region. Table 8.1 shows that 51 percent of Narsingdi Sadar farmers and 56 percent of Raipura farmers did not get cooperation by the block supervisors. In total about 53 percent of all farmers reported that they did not get support by BS in proper time. As a result, in the study area lack of cooperation by block supervisor ranked 2nd most concerning problem among the all technical problems.

8.3.3 Lack of Quality Seed

Table 8.1 shows that, 33 percent farmers from Narsingdi Sadar and 42 percent farmers from Raipura reported problem of lack of quality seed. In the study area all about 38 percent of farmers faced this problem.

8.3.4 Lack of Technological Knowledge

In the study area table 8.1 shows that, 22 percent farmers from Narsingdi Sdar and 16 percent farmers from Raipura reported problem of lack of knowledge of improved

technology. About 19 percent of all farmers faced this problem. Here, lack of knowledge of improved technology ranked 4th among all the technical problems.

8.4 Natural Problems

8.4.1 Non suitable Temperature

In the recent year, temperature is increasing day by day which is creating problems for farmers during crop production. In the study area, Table 8.1 shows that, 95 percent farmers from Narsingdi Sadar and 87 percent farmers from Raipura reported that they observed this problem. About 91 percent of all farmers reported this problem. This ranked 1st most acute problem among all the natural problems.

8.4.2 Seasonal Change

Unexpected seasonal change is a severe problem for agricultural sector. Table 8.1 shows that, 60 percent farmers from Narsingdi Sadar and 53 percent farmers from Raipura reported this problem. About 57 percent of all farmers reported this problem and it ranked 2nd among all the natural problems.

8.4.3 Attack of Insect and Disease

Table 8.1 shows that, 49 percent farmers from Narsingdi Sadar and about 51 percent farmers from Raipura reported that they observed insect and diseases problems. About 50 percent of all farmers reported this problem and it ranked 3rd acute problem among all the natural problems.

8.5 Marketing Problems

8.5.1 Selling Problems

Selling problem ranked most acute problem among all the Marketing problems. According the study area table 8.1 shows that, 73 percent of farmers from Narsingdi Sadar 80 percent farmers from Raipura reported that they did not sell their product flexibly because of creation of owner and other middle men complexity into the market. All about 77 percent of farmers reported this problem.

8.5.2 Storage Problems

Storage problem ranked 2nd most acute problem among all the Marketing problems where large farmers faced this problem after harvesting period. In the study area, table 8.1 shows that, 64 percent farmers from Narsingdi Sadar and 69 percent farmers from Raipura reported that they did not get proper storage facility. All about 67 percent of all farmers reported this problem.

8.5.3 Transportation Problem

In the study area transportation problem also a major problem as table 8.1 shows that, 29 percent farmers from Narsingdi Sadar and about 24 percent farmers from Raipura reported that they did not get proper transportation facility. About 27 percent of all farmers reported this problem. Transportation problem ranked 3rd among all the Marketing problems

8.6 Solutions for the Problems

After studied the mentioned area the above problems were found and the following possible solutions could be taken according to farmers' opinion.

8.6.1 Economic Solutions

Tomato is one of the most potential sub-sectors of vegetable in Bangladesh. Thus for the national interest, the government should provide financial support to the farmers. About 75.56 percent farmers told about this as the first solution of economic problems. Again, about 72.22 percent reported that government should fix a price limit for tomato farmer to get rid the problem of price fluctuation of tomato.

8.6.2 Technical Solutions

About 81.11 percent of the respondents suggested that government and NGOs should take steps for training on increasing tomato production by dint of using modern equipment where they rank 1st solutions of their technical problems. Again, 58.89 percent think that extension workers should pay an immediate attention to this matter for the improvement of traditional method of tomato production.

8.6.3 Natural Solutions

For solving natural problems, about 91.11 percent farmers agreed to comply with the prevention strategy that the government has come up with. To overcome disease and irrigation problem, about 51.11 percent suggested teaching the scientific use of chemicals and supplementary supply of artificial irrigation in dry season by extension workers.

Table 8.2 Solutions Recommended by the Tomato Farmers

Problems	Narsingdi Sadar		Raipura		All		Rank
Economic Solutions	No.	%	No.	%	No.	%	
Govt. Financial Support	33	73.33	35	77.78	68	75.56	1
Govt. Price Fixing	27	60	38	84.44	65	72.22	2
Technical Solutions							
Training Facilities	33	73.33	40	88.89	73	81.11	1
Traditional Method improvement	23	51.11	30	66.67	53	58.89	2
Natural Solutions							
Prevention Strategy	43	95.56	39	86.67	82	91.11	1
Scientific Use of Chemicals	22	48.89	24	53.33	46	51.11	2
Marketing Solutions							
Storage Facility	39	86.67	38	84.45	77	85.56	1
Processing Facility	29	64.44	37	82.22	66	73.33	2
Transportation Facility	13	28.89	19	42.22	32	35.56	3

Source: Field Survey, 2019

8.6.4 Marketing Solutions

About 85.56 percent suggested that government should increase and create the storage facility as it is rotational crop. Again, About 73.33 percent respondent suggested that Good processing facility should be encouraged as it has high demand

all over the world. Also, About 35.56 percent suggested about transportation facilities.

8.7 Conclusion

From the above discussion Most of the farmers were reported that high labour price was the main constraint for their tomato production. And this problem occupies first position according to ranking position. But I think there is some inconsistency from the respondent. My opinion is that tomato diseases and cloggy weather in the winter season were the main constraints hampering tomato production. If proper insecticide and direct entry of tunnel material at the right time were provided then the production can be increased significantly and thus the farmers may be benefited.

CHAPTER 9

SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

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SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

9.1 Introduction

This chapter highlights on the summary in the light of the discussions made in the earlier chapters. Conclusion is done on the basis of empirical result. Policy recommendations are given for improvement of the existing inefficiency of tomato production in Bangladesh.

9.2 Summary

Tomato is become important vegetable in Bangladesh owing to its higher yield, nutritional value and versatile uses. Demand of tomato in Bangladesh is experiencing day by day due to increasing population. Higher cultivation of tomato depends on the expansion of High Yielding Varieties (HYV) and hybrid variety of seed, improved management and timely supplying of inputs. The rate of adoption of modern technology and sustainability of tomato production depend largely on its marketing and economic profitability. The efficient use of resources is an important factor of increased production in agriculture. Tomato grows within a short time period where intercropping is possible with other crops. Unfortunately, till today, tomato has achieved the status of only a very minor crop in Bangladesh.

The field study was conducted in the Narsingdi Sadar and Raipura Upazilla of Narsingdi district during the period from April 2019 to June 2019 to find out the profitability and resource use efficiency of tomato production. Simple random sampling technique was used for data and information from a total of 90 farmers (Chinishpur-30, Karimpur-30 and Mortjal-30) who are cultivating different varieties of tomato, especially, varieties released from BARI. All the collected data were summarized and scrutinized carefully to eliminate all outstanding errors. Data were presented mostly in the tabular form where descriptive statistics like average,

percentage etc. were followed to analyse the data to achieve the objectives of the study. Functional analysis was used to arrive at expected findings. A Cobb-Douglas production function was used also to estimate the factors affecting the yield of tomato.

It was revealed from the study that in Narsingdi, 51.07 percent of the sample populations were male and 49.93 percent were female. About 50 percent population was under 35-50 years age group. The sex ration in was found 106 and 94 male per 100 women in Narsingdi Sadar and Raipura. The educational status of the tomato farmers was classified into five categories: Illiterate, Sign only, Up to primary, Up to SSC and HSC and above. Findings indicate that about 9 percent of the respondents had no formal education. High percentage of education level was found up to class 8 which was about 29 percent. The occupation of the study population showed that about 4 percent was engaged in agriculture, 23 percent was engaged in crop farming, 77 percent was engaged in vegetable farming as a main occupation. It was also revealed from the study that about 43.00 percent and 6.5 percent were engaged in agriculture as a subsidiary occupation. Farmers lived in both joint and nuclear family. The study indicated that, 34.00 percent respondent households were found to have family members range from 6-7 and 31 percent were found to have family members of more than 7. On the other hand, 42 percent respondent households were found to earn less than Tk. 150000 in a year, 52 percent were found to earn less than Tk. 250000 in a year and 6 percent were found to earn above 250000. Among the tomato producers, 47 percent got training on different agricultural technologies. 56 percent tomato producers were found to have membership in different NGOs and/or farmers' organizations.

Costs and returns calculation were done to identify the financial profitability of tomato farmers. Cost items were identified as land preparation, human labour, seed, urea, TSP, Mop, irrigation, insecticide, manure, hormone, munch and other accessories, interest on operating capital and land use cost. All these cost were accounted by based on one production period of tomato. Per hectare gross return was calculated at Tk. 933160. Total cost was calculated at Tk. 387523. Net return was calculated at Tk. 545637 per hectare, respectively. Benefit Cost Ratios (BCRs) was found to be 2.4. The net return of tomato was found to be positive and the BCR was greater than one indicated that the cultivation of tomato was profitable.

Production function analysis suggested that irrigation cost, human labour cost, fertilizer cost and manure cost had a positive and significant effect on the yield of tomato except for, land preparation cost, seed cost, insecticide cost and hormone cost. The Adjusted R^2 was found to be 0.8769 which expressed that about 87.69 percent of the total variation in yield of tomato could be explained by the included variables in the models. Again, the F-value of the estimated production function noticed to be significant at one percent level which implies good fit of the models. Therefore, all the explanatory variables calculated in the model were important for explaining the variation of tomato production. Efficiency analysis indicated that most of the farmers inefficiently used their inputs where some of them made excessive and some of them contributed lower use of inputs.

In the study area, farmers faced various problems in producing tomato. Constrains of tomato growing farmers have been broadly categorized into four: Economic Problems, Technical Problems, and Natural Problems and Marketing problems. High price of labour is the most severe problem among all the economic problems. About 81.11 percent of all farmers reported that they did not get labour support at proper rate in proper time. It was ranked 1st among all the economic problems. Highest 77.78 percent farmers reported the problem of shortage of labour as one of the major technical problem. Among the social problem temperature fluctuation ranked top and selling problem ranked top in case of marketing problem.

Tomato farmers who identified their own problems also suggested measures for the improvement of the existing tomato production and pricing system of farmers, such as; supply of credit on easy terms, supply of inputs and machinery, improvement of transportation facilities, formation of farmers' organization and improvement of market facilities.

9.3 Conclusion

Based on the findings, the core message of this study is that tomato is more suitable and profitable in the Narsingdi district. All of the factors namely seed cost, labour cost, fertilizer cost, insecticide cost, manure cost, ploughing cost and irrigation cost etc. are very important for tomato cultivation. Although farmers were not aware

about the right doses of inputs which could increase the return of production to some extent, so it is necessary to make the farmers aware about efficient use of resources. If modern inputs and production technologies were enough in time, yield and production of tomato would have been increased as well as income, improved livelihood and health condition of rural people would have been changed. It is therefore, recommended that irrigation facilities, effective policy and efficient extension services have to be ensured to increase socio-economic, income and employment opportunities of the tomato farmers. It is also recommended to bring more fellow land under tomato cultivation in the study areas. Due to increased domestic consumption of tomato as human food, the present and future potential market should be established through a well-planned tomato production program at national and international level.

9.4 Recommendations

On the basis of the findings of the study, the following selected recommendation may be made for the development of tomato production.

- As tomato is profitable business, government and concern institutions should facilitate adequate extension programme like training, advertising to expand their area and production..

- Farmers could be encouraged to employ more inputs in tomato production which are under-used and have positive significant impact on yield through extension programme. Over-used inputs should be limited in case of using.

- Government should initiate necessary measures like subsidy, monitoring facilities etc. to lower the price of inputs which have positive significant impact on yield and which are under-used. It will increase the net benefit of tomato farmers.

- Adequate training on recommended fertilizer dose, insecticides, hormones, water management practices, use of good seed, intercultural operations, etc., should be provided to the tomato farmers which will enhance production as

well as resource use efficiency by improving the technical knowledge of the farmers.

9.5 Limitations of the Study

There are some limitations of the study as the study examined on the farmers of the country through interview schedules.

- Most of the data collected through interview of the farmers so sometimes they were not friendly with the interviewer.

- The information collected mostly through the memories of the farmers which were not always correct.

- Tomato is sometimes grown without proper care & practices so the record of the expenses or profits were not remembered by the farmers.

- In the resource and time constraints, broad and in-depth study got hampered and irritated to some extent.

Due to lack of data resources and further study, it was not possible to assess the comparative advantage of tomato with other vegetables.

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APPENDICES

APPENDIX I

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INTERVIEW SCHEDULE ON

FINANCIAL PROFITABILITY AND RESOURCE USE EFFICIENCY OF TOMATO CULTIVATION OF SOME SELECTED AREAS IN NARSINGDI DISTRICT OF BANGLADESH

Sample No. ☐

Name of farmer: ……..

Village: ……. Upazila:……..

District: …….. Mobile No.:……..

1. Socio-economic profile of the farmer:

1.1: General information

a.	Age:		
b.	Educational Status: (put tick marks)		
	○ Illiterate ○ Can Sign Only ○imary ○condary ○ Higher Secondary ○ Degree		
c.	Main Occupation:	d.	Subsidiary Occupation:
e.	Farming experience: (year)		

1.2: Family Size

a.	Total family member:
b.	Male:
c.	Female:
d.	How many members involved in agriculture? _____

1.3: Opportunity cost of mortgaged or leased land during the cultivation period

_____ Tk.

1.4: Farm Size

Types of land		Area	
		Local Unit	**Hectare**
a.	Homestead land		
b.	Own cultivated land		
c.	Rent/ Mortgaged in		
d.	Rent/ Mortgaged out		
e.	Others		
Total			

1.5: Farmers Income Source

Agricultural source		Non-agricultural source	
Crop	Amount (Tk.)	Income source	Amount (Tk.)
a. Jute		a. Business	
b. Wheat		b. Service	
c. Rice		c. Driver	
d. Pulse crop		d. Shopkeeper	
e. Spices crop		e. Others	
f. Others			

2. Crop (Tomato) Cultivation Related Information:

2.1: General Information

a.	Tomato cultivated land (bigha)	
b.	Variety name	
c.	Seed (bulb) source:	
d.	Seed (bulb) amount (kg/bigha)	
e.	Seed (bulb) price (Tk./kg)	
f.	Seed planting month	

2.2: Details about Land Preparation

Particulars	**Rent (No.)**	**Medium (put tick mark)**	**Cost(Per tillage in 1 bigha)**	**Total (Tk.)**
Tillage No.		Power tiller/tractor		
Laddering No.		Power tiller/tractor		
Total				

2.3: Material Inputs Used

Particulars	Amount (kg)	Price (Tk./kg)	Total (Tk.)
Fertilizer:			
a. Urea			
b. TSP			
c. MOP			
d. Zink			
e. Gypsum			
f. DAP			
g. Organic fertilizer			
h. Others			
Irrigation			
Insecticides			
Growth hormone			
Total			

2.4: Human Labor Requirement

Name of items	Wage (Tk./man-days)	No. of labor		Working hour	Total Man-days	Total (Tk.)
		Own	Hired			
Land preparation						
Transplanting						
Fertilizer application						
Insecticides application						
Hoeing/Weeding						
Harvesting						
Others						
Total						

2.5: Amount of Tomato Production

Yield (mounds)	
Price (Tk./mounds)	
Highest Price (Tk./mounds)	
Lowest Price (Tk./mounds)	
Total (Tk)	
Price per unit (Tk./kg)	

3. Crop (Tomato) Cultivation Related Problems and Suggestions:

3.1: Mention some problems faced by you during tomato cultivation:

a.

b.

c.

d.

e.

3.2: What are your suggestion to overcome the above problems?

a.

b.

c.

d.

e.

Thank you for your kind co-operation

Date:

Signature of the interviewer

APPENDIX II

Table A: Area and Production of Tomato in Bangladesh, 2009-10 to 2017-18

Year	Area '000,(Acre)	Production '000, M. tons	Per acre Yield(kg)
2017-18	70	385	5539
2016-17	68	389	5686
2015-16	67	368	5451
2014-15	76	414	5471
2013-14	66	360	5454
2012-13	65	251	3862
2011-12	63	255	4035
2010-11	61	232	3798
2009-10	59	190	3220

Source: BBS, 2012, 2013, 2016, 2018, 2019.