ADOPTION AND PROFITABILITY OF MAIZE PRODUCTION IN GANGACHARA UPAZILA UNDER RANGPUR DISTRICT

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DECEMBER, 2021

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REGISTRATION NO : 19-10302

A Thesis Submitted to the Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

IN

AGRICULTURAL STATISTICS

SEMESTER: JULY-DECEMBER, 2021

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CERTIFICATE

This is to certify that thesis entitled," ***ADOPTION AND PROFITABILITY OF MAIZE PRODUCTION IN GANGACHARA UPAZILA UNDER RANGPUR DISTRICT*** *" submitted to the Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE IN AGRICULTURAL STATISTICS,*** *embodies the result of a piece of bona fide research work carried out* ***MD. JAHANGIR ALAM****, Registration No.* ***19-10302*** *under my supervisior and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

Dated: December, 2021

Place: Dhaka, Bangladesh

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DEDICATED

TO

MY BELOVED

PARENTS

ABSTRACT

Maize is a newly introduced cereal crop in Bangladesh. Growers are still in hesitation in adoption of this crop because of its production technique, processing and consumption as food. The main purpose of this study was to determine on Adoption and Profitability of Maize Production in the study area. The study was conducted in Gangachara upazila under Rangpur district. Data were collected from 80 respondent farmers selected following disproportionate random sampling technique. A pre-tested interview schedule was used in collection of data during July to August, 2022. Collected data were compiled, coded, analyzed and interpreted as per objectives of the study. Results indicate that 70 percent farmers were young and middle-aged farmers where 38.75 percent illiterate and 80 percent belonged to Nuclear family size, 82.5 percent having small farm size, 46.25 percent high farming experience and 66.25 percent low extension contact. Adoption of maize variety score ranged from 5.38 to 99.95 percent with an average of 76 percent. Majority of the respondents (61.25%) had high adoption. Overall BCR of maize was found as 1.36 where Palwan, Bahuboli 555, Dalia 5455, Kabri 50 are different maize varieties included. Level of education and farm size of the respondent showed negative significant relationship with adoption of maize production while annual family income and organizational participation of the respondent showed positive relationship with adoption of maize production. Storage facility at farmers' level due to high moisture content, availability of credit, difficulty in consumption as food due to lack of processing facility and poor technical information were the major problems faced by the maize growers. The respondents being living in the Char land demonstrated lower socio-economic conditions but adopted maize production comparatively high level and functional training may be arranged by the concerned authority.

ACKNOWLEDGEMENT

All praise is due to Allah, the Merciful, the Almighty, who made it possible and allow me to continue my studies in Agricultural Statistics and to successfully finish the research and writing of my thesis for the Master of Science in Agricultural Statistics degree.

I now want to express my sincere gratitude to my **supervisor, Md. Zakir Hossain, Professor**, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, for his inspirational leadership, insightful criticism, and helpful advice throughout the thesis preparation and research process. This task would not have been finished without his astute intellectual advice, precise constructive criticism, and help. I would like to express my appreciation to my esteemed **co-supervisor, Zulfikar Ahmed Reza, Professor**, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, for his suitable direction, motivational cooperation, and encouragement throughout the research process and thesis preparation.

I also like to thank my supervisor, Md. Zakir Hossain, who is a professor in the department of agricultural statistics at Sher-e-Bangla Agricultural University, for his openness, enlightening suggestions, and encouragement as my thesis was being developed. I owe a great deal of gratitude to each and every one of my esteemed instructors for their important advice, support, and collaboration during the course of my studies.

I'd want to convey my appreciation to the 80 farmers who participated actively in this survey and, more significantly, helped me understand their efforts and actions linked to maize production.Their amazing assistance throughout the data gathering procedure is much appreciated.

Insufficient words exist to adequately express my thanks to my parents for their unwavering commitment and unwavering support, as well as for their sacrifice and steadfast efforts to help me realize my goal of pursuing a higher education. They provided me with motivation on a constant basis even throughout my most challenging academic periods.

December, 2021

Md. Jahangir Alam

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ACRONYMS AND ABBREVIATIONS

BARI : Bangladesh Agricultural Research Institute

BINA : Bangladesh Institute of Nuclear Agriculture

BBS : Bangladesh Bureau of Statistic

FAO : Food and Agricultural Organization

NGO : Non-governmental organizations

BDT : Bangladeshi Taka

BER : Bangladesh Economic Review

DAE : Department of Agricultural Extension

SAAOs : Sub - Assistant Agriculture Officers

et al. : and others (at elli)

HYV : High Yielding Variety

kg : Kilogram

mt : Metric Ton

NGO : Non-Government Organization

t : Ton

$: Dollar

SPSS : Statistical Package for the Social Sciences

CIMMYT : The International Maize and Wheat Improvement Center

MoA : Memorandum of Association

BRAC : Bangladesh Rural Advancement Committee

BADC : Bangladesh Agricultural Development Corporation

IPM : Integrated Pest Management

RDRS : Rangpur Dinajpur Rural Service

CHAPTER I
INTRODUCTION

1.1 General Background of the Study

Maize is one of the oldest crops in the world and is well known for its versatile nature with highest grain yield and multiple uses. It is widely utilized as one of the main components of fish and poultry feed. The starch from maize is also used in the textile and other industries. It is consumed all around the country in a variety of ways. Due to its higher nutritional intake, it may be a source of nourishment for those who are undernourished as well as an additional food to help Bangladesh's growing population maintain food security. Moreover, the dry maize plant is an excellent source of fuel for rural homes. The government's push to promote a rice-based Green Revolution technology prevented Bangladesh from successfully expanding maize during the 1960s, but in recent years, maize production and yield have grown rapidly. The area under maize cultivation has grown to approximately 1165594 acres, producing 4015306 metric tons of grain annually in 2019–20, up from just 1018282 metric tons produced on 409070 acres in 2010–11. (BBS 2010–2020.)

Being an agricultural country, the majority of Bangladesh's population relies on agriculture, either directly or indirectly. The country's Gross Domestic Product (GDP) benefits greatly from agriculture. When industrialization starts happening the activities of the population starts diversification towards different sectors. Because of this, the agriculture sector's contribution to GDP is gradually declining, and it now accounts for 13.35 percent of GDP, with 7.06 percent coming from crops and horticulture, 1.47 percent from animal sources, 1.62 percent from forestry and related services, and 3.49 percent from fishing (BBS 2018-19). Still agriculture continues to be a crucial part of the economy and is regarded as its most significant sector. Bangladesh is endowed with extremely fertile land where a variety of crops may grow readily. This country produces several different kinds of crops. These crops may have been divided into two groups: food crops and cash crops. These three varieties of paddy—Aus, Aman, and Boro—as well as another key cereal crop—wheat—are produced in this country. It is becoming more and more popular, and farmers are cultivating more land with the crop. Utilizing better seeds, fertilizers, irrigation, etc. is essential to the production of maize. The Government of Bangladesh has, therefore, provided top most priority to the agriculture sector specially on food crop to increase the

production of cereals by giving subsidy to the farmers on different inputs such as fertilizer, irrigation etc. to achieve self-sufficiency in food.

Because of its broad genetic variability, maize can survive in any environment. In Bangladesh, it is grown both in the winter and the summer, though the former is the predominate season. The sowing time of the winter maize is mid-October to December and reaping time is April to May. A limited number of socio-economic investigations were conducted on maize cultivation in Bangladesh, which revealed that it is a more profitable crop than rice and mustard. Rahman and Rahman (2014) and Rahman et al. (2012) found that the technical and economic efficiency of maize farmers is significantly higher than that of rice and wheat farmers, in addition to maize cultivation being profitable. Although Rahman et al. (2012) observed that the gross return is the primary factor influencing the decision to produce winter maize in Bangladesh, it is unknown whether or not maize production is competitive on a worldwide scale. This is because conventionally maize was imported to Bangladesh, which drains valuable foreign currency reserves to pay for import. Therefore, if maize is globally competitive, then an increase in the production of maize can successfully substitute its import and save foreign currency. Further the nature of responsiveness of the maize farmers to changes in input and output prices is not known. This information is important because Bangladeshi farmers not only need to be more efficient in their production activities, but also to be responsive to market indicators, so that the scarce resources are utilized efficiently to increase productivity as well as profitability in order to ensure supply to the urban market and increase farmers' welfare. Furthermore, the government of Bangladesh is seeking to diversify its agricultural sector to other cereals than rice (i.e., wheat and maize) as well as non-cereals (e.g., potatoes, vegetables, and spices, etc.). In fact, the seventh Five Year Plan (2016-20) emphasized set specific objectives to attain self-sufficiency in food-grain production and increased production of other nutritional crops and promote crop diversification. Subsequently the eight Five Year Plan (2021-25) also emphasized crop diversification.

Increasing agricultural productivity is crucial in order to avoid ongoing food shortages and avoid draining our foreign cash reserves to buy food grains. Although substantially all of the available arable land is currently being used for crop production, increasing agriculture production through expanding the cultivated area is no longer feasible. So, the most logical way is to raise the yields by adopting cropping intensity. These can be possible by practicing crop diversification, modern technology, high yielding variety (HYV), short

duration crops and taking benefit of huge extension network. During last few years' farmers have widely adopted cultivation of HYV maize in their farming system. It is now extensively used as poultry and animal feed. Roasted and fried maize are also consumed by the people. An enormously large number of small enterprises can be developed in maize growing regions to produce and sell this product and to create new opportunities of rural employment. Farmers of Bangladesh were not experienced in commercial cultivation of maize now a day they have been influencing of Govt. Organization and private organization to adopt maize production technology. Maize can play an important role along with other cereals in meeting future need of growing population. It has also some other benefits such as low production cost, high farm return, increase employment opportunity supply poultry feed and industrial raw materials etc.

Maize cultivation in Bangladesh has been increased through various intervention of the MoA, BARI, Crop Diversification Program, BRAC, BADC and so many private organizations. At present various type of hybrid are available in Bangladesh such as Palwan, Dalia 4455, Bahuboli 555, Robi, Denali, Samrat, Bahadur, Mukut, Kabri, Miracle, Durjoy, Muduk etc. cultivation of hybrid maize has gained extensive popularity resulting increase of area and production. Maize productivity in the country seems to be highest in the Asian region with an average yield of 5.73 tons/ha. This is due to favorable growing conditions during the maize season (October to March) and the increased use of hybrid seeds coupled with a number of improves production practices by the growers (Gonzalezetal-2001). The popularity of maize among the farmers of Bangladesh is sharply increasing day by day. At present DAE, some NGOs and International organization like CIMMYT, FAO etc. have taken strong interest to support the maize production activities in the country. Public sector procurement of maize has been introduced like rice and wheat in order to encourage farmers in maize cultivation.

1.2 Statement of the Problem

The success of any technology depends on its dissemination among the potential users which ultimately is measured by the level of adoption of that technology. There are no studies that specifically focused the adoption and financial feasibility of maize producing technology in Bangladesh's northern areas. So, the present condition of maize production technologies in terms of dissemination and profitability is still unexplored. Bearing the above situation in mind, a study entitled "Adoption and Profitability of Maize Production

in Gangachara Upazila under Rangpur District" was conducted to find out the existing maize production technologies, their extent of adoption and profitability, and impediments in adopting those technologies. The purpose of this study was to have answers to the following research questions:

i. What is the extent of adoption of maize production by the growers?
ii. What is the socioeconomic status of the maize growers?
iii. Is there any relationship between the socioeconomic characteristics of the farmers and their adoption of maize production?
iv. What are the constraints faced by the farmers in adopting maize production?

1.3 Objectives of the Study

The following objectives were set forth in order to proper direction to the study:

i. To determine the extent of adoption of maize production by the farmers.
ii. To assess the profitability of maize production in the study area.
iii. To investigate the relationship between the socioeconomic characteristics of the farmers and their adoption of maize production.
iv. To find out the constraints faced by the farmers in adoption of maize production.

1.4 Justification of the Study

Maize cultivation is getting popularity among the farmers of Bangladesh. Introduction of new hybrid varieties coupled with growing market demand as also poultry feed has opened a tremendous potentiality of maize. The government is also supporting this growth. Needless to said that this study is required to identify the trends in the diffusion of technology for producing maize in order to develop long-term production strategies. As no research in the field diffusion-adoption of this technology has been identified so far, the researcher deemed it a timely necessity to undertake the present study entitled “Adoption and Profitability of Maize Production in Gangachara Upazila under Rangpur District"

1.5 Scope of the Study

The study will provide a clear picture of adoption and profitability of maize production in the study area. However, the present was supposed to provide the following scopes.

- The main focus of the study was to determine adoption and profitability of maize production technologies. The findings of the study will be specifically applicable to

Gangachara Upazila under Rangpur District. However, the findings will also have implications for other areas of the country having relevance to the socio-cultural context of the study area.

- The researcher believes that the findings of the study, will shed light on the innovation diffusion phenomena. The policy makers and planners who are creating and revising extension programs specifically for maize farming will be particularly interested in these.
- The findings are anticipated to assist field professionals from various faction building departments and organizations in creating efficient extension strategies for working with rural inhabitants.

Considering the above facts, the present study will provide immense benefits to policy makers, researchers and academicians.

1.6 Assumptions of the Study

"An assumption is the supposition that an apparent fact or principle in true in the light of the available evidence'' (Good and Halt, 1952). An assumption is taken as a fact or belief to be true without proof. In this study, the researcher proposed some assumptions in mind while carrying out this study. The assumptions of the present study were as follows:

1. The responses furnished by the respondents were reliable. They expressed the truth about their opinion and interest.
2. The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by him from the respondents where free from bias.
3. The respondents included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.
4. Views and options furnished by maize growers included in the sample selected those of the population of the study

1.7 Limitations of the Study

The present study was undertaken with a view to having an understanding on the level of adoption of maize growers of Gangachara Upazila under Rangpur District. In order to manageable way, it became necessary to impose some limitations in regard to certain aspect of the study. Considering the time, money and other necessary resources available to the researcher, the following limitations have been observed throughout the study:

1. The study was confined to Gangachara Upazila under Rangpur District.
2. The study focused on farmers extend of adoption of maize production technologies.
3. The researcher relied on the data furnished by the maize growers from their memory during interview.
4. Facts and information collected by the researcher were applicable to the present situation in the selected area.

1.8 Hypothesis of the Study

Hypothesis is a proposition or principle which is assumed in order to draw logical or empirical consequences, and by this method to test its accord with facts which are known or may be determined (Ray and Mondal, 2011). In any event, however, it leads to an empirical test. The following null hypotheses was put forward:

$H_{0:}$ "There is no significant relationship between selected socioeconomic characteristics of the respondents and their adoption of maize cultivation".

CHAPTER II
REVTEW OF LITERATURE

The purpose of this Chapter is to review of the literature that is pertinent to the current topic. To accomplish the above goal, the researcher carried out a comprehensive search of the existing literature. The link between the characteristics of maize growers and their uptake of maize technologies, however has largely eluded study. The researcher attempted to conduct a literature search on the adoption of innovations by growers based on several studies that have been done in this area. As a result, the results of these research, as well as some other minor studies, have been discussed in this chapter. These studies were concerned with the degree of technology adoption by maize growers.

2.1 Theoretical Concept of Adoption and Agricultural Technology

Available literature reviews relating to theoretical concept of adoption and agricultural technology have been given below:

2.1.1 Adoption

Adoption is the decision to fully use an invention as the best available course of action (Rogers, 1995). Adoption relates with human behavior, whereas diffusion is primarily focused on the process' spatial component. Adoption is the process by which someone adopts and applies a new idea (Ray, 2003).

2.1.2 Stages of adoption

The final step in accepting an innovation is adoption, which results from a series of events. A farmer normally goes through five consecutive stages, according to Rogers (1962), including awareness, interest, trail, evaluation, and adoption. The stages of knowledge, persuasion, choice, and confirmation functions were reconstructed by Rogers and Shoemaker (1971). Later, in 1995, Rogers looked at adoption as a result of the five steps of information, persuasion, decision, implementation, and confirmation.

2.1.3 Agricultural technology

Feder et al. (1982) divided adoption into three categories: individual, farm-level versus aggregate-level; single (e.g., fertilizer) versus package (e.g., fertilizer + improved seed variety + good management practices); and divisible (e.g., new crop cultivar) versus indivisible (e.g., harvester). This classification was made in light of the various actors, sizes

of technologies, timing, and scale of operation. Adesina and Baidu-Forson, 1995; Fuglie and Kascak, 2001; Arellanes and Lee, 2003; Moser and Barrett, 2003; among others—are just a few studies that have looked at the adoption of agricultural technologies and discovered common characteristics that affect acceptance. These factors include the size of the farm, the kind of land tenure, the availability of credit and extension services, the availability of labor and land, the composition of the population (gender, age, and education), and the farmer's attitude toward risk and uncertainty. Despite the presence of these elements, acceptance of improved agricultural technologies typically develops initially slowly and then quickly to a maximum level, leading to higher production (Griliches, 1957). The findings of several empirical studies, such as those by Marra et al. (2002) and Moschini et al. (2000), highlighted the potential of improved agricultural technologies to increase productivity, income, and total economic growth.

The potential benefits of a new technology can only be realized when it is adopted and used; the adoption decision involves a critical comparison of perceived benefits and costs associated with the technology (Uaiene, 2011). A better understanding of the diffusion, adoption, and impact of improved technologies will guide producer groups, research institutions, and policy makers in making prudent and informed decisions about allocating resources for technology development.

2.1.4 Studies on adoption of agricultural technologies

The revolutionary Griliches study served as the starting point for the history and economics of the diffusion and uptake of agricultural innovations (1957). Different researchers have examined the adoption process and models, with Rogers' diffusion of innovations theory—which encompasses the fields of economics, technology, education, political science, public health, history, and communications—being the most well-known and widely applied (Dooley, 1999).

Sarker, M. M. R., Khan, M., Parvin, M. M., Jury, F. H., & Fagun, A. N. (2022). Climate change is expected to have significant environmental, economic, and social consequences for coastal farmers whose livelihood is dependent on nature. Agriculture is their main occupation and climate has a great impact on agriculture. As the economy of Bangladesh mainly hangs on agriculture so the impact is shown in the economy of this country. The factors that influence the adoption of climate-smart agriculture technology (improved stress-tolerant cultivars) in rice production in Bangladesh. Climate-Smart Agriculture

refers to agricultural strategies that increase efficiency, improve resilience (adaptation), and reduce greenhouse gas emissions (mitigation).

Adoption of more advanced agricultural methods has been linked to the success of the Green Revolution, which was started in Mexico in the 1940s by American scientist Norman Borlaug (Dethier and Effenberger, 2012). Increased use of high-yielding crop varieties and inputs like irrigation and fertilizer as a result of the Green Revolution led to higher food production. With the use of fertilizers and irrigation systems, which provide water for farming in places with little to no rainfall, improved high-yielding crop types developed during the revolution delivered high yields, freeing up additional land for food production (Briney, 2016).

Innovation and technology are frequently utilized synonymously in literary works. While the process by which a new technology or innovation is transmitted over time to members of society through specific media is known as diffusion, the rate at which a new or emerging technology is adopted depends on some key characteristics of the technology, including the perceived advantages relative to ones already in use and its compatibility with the needs and values of the society or potential adopter. Other key characteristics include simplicity (ease of understanding and use), trialability, and trialability (Rogers, 2008).

Parvin, M. M., & Sarker, M. M. R. (2021). This paper attempts to analyze the costs, revenues and production problems of tomato in two districts namely Cumilla and Rangpur in Bangladesh. It is necessary to enunciate that through purposive sampling technique, the data were collected from 240 tomato cultivators of Cumilla and Rangpur districts. The essentials of tomato's production include human labour, fertilizer, bamboo stick, thread, seed/seedlings, ploughing, irrigation, insecticides/pesticides, hormone, etc. It is also indispensable to count the transport costs here. The mentioned factors were collectively considered to estimate the cost of production of tomato. All the data were analyzed statistically and economically while their results have been substantiated through consecutive tables. Farmers are facing different types of problems and this research highlights this issue. Up-to-date policy and well-organized extension services have, therefore, to be ensured to augment the income as well as the employment opportunities of the tomato growers.

Roy, M., Alam, M. T., & Hossain, M. S. (2017). Maize cultivation has been gaining popularly in the rangpur district of Bangladesh in recent years. The study is mainly an

attempt to explore the reasons for the growing popularity of maize cultivation in the Gangachara upazila (Sub-district) of Rangpur district. It also examines the future viability of maize cultivation in this area. For data collection, three-stage cluster sampling method has been used to determine the setting of the study selecting 110 farmers who have been involving themselves in maize cultivation for at least ten years, by replacing traditional crops like tobacco and boro rice. Benefit-cost (ratio) analysis is carried out in the study for its purpose and it is found that the cultivation of maize is more profitable than that of boro rice and tobacco. Furthermore, water table data analysis in the study also reveals that the ground water level is depleting in the study area in rabi season and causing groundwater scarcity.

In their study, Hazell and Lutz (1998) found that agricultural innovation is driven by novel ways that increase factor productivity while preserving the resource base, and that agricultural development is broad-based, market-oriented, participative, and decentralized. There is growing interest in agro-ecological approaches, which concentrate on providing favorable conditions for plants and animals as part of a larger ecosystem, to reduce excessive dependence on external inputs (Altieri, 1995). Currently, scientific discoveries made by researchers at universities or businesses are linked to new breakthroughs or technology. But historically, most innovations were the work of practitioners. Although the importance of research labs in creating new ideas has significantly expanded over time, field experience is still a major source of inspiration for breakthroughs.

Technology can be regarded of as the method through which people alter nature to suit their needs and desires. This viewpoint is similar to Hornby's (2000) assertion that technology can be characterized as the scientific study and application of mechanical arts and applied science, as well as their practical task application in industries. Agriculture has changed significantly over the past 100 years as a result of technological advancement (Schultz, 1964; Cochrane, 1979). In order to increase agricultural output and reduce poverty while preserving the agro-ecosystems that provide for livelihoods, technological advancements must be researched and adopted (Kassie et al., 2011; Asfaw et al., 2012).

According to Gebru et al. (2012) both the hard and soft systems of technologies are essential and better to supplement each other. The ability of the extension workers to effectively transfer the technology to the local population has a role in whether or not it will have the desired impact in rural areas. The ability of the extension workers to effectively disseminate

the technologies and the caliber of the technologies themselves would lead to change. Agricultural extension primarily aims to provide farmers with critical knowledge and abilities that will help them make important decisions that will ultimately result in higher productivity (Tsion et al., 2010). The goal of Extension is to increase access to education for all. In extension education, helping individuals help themselves is prioritized (Patton, 1987; Sanders and Mauder, 1966). Therefore, extension is an ongoing process of obtaining and disseminating important information to people while also helping them to develop the knowledge, skills, and attitudes required to make use of it.

The creation and transfer of agricultural technologies that address the technological needs of all agro-ecological zones, improve farmers' access to inputs and credit, and enhance the effectiveness of the market and distribution systems are necessary to raise the standard of living for rural households and to ensure food security at the household and national levels (Gebru and Fekadu, 2012). Thus, one of the main justifications for the foundation of agricultural institutions in Bangladesh. Farm level performance of technologies, especially those developed at universities, is a relatively unexplored field with little to no literature available in the public domain. This results from the fact that the researchers were unable to draw general conclusions, yet their efforts in the process were fruitless.

A number of theoretical frameworks have been proposed about farmers' choices to use new technologies (Feder and Slade, 1984; Abadi and Pannell, 1999; Negatu and Parikh, 1999; Islam, 2002). According to Feder and Slade's (1984) model of technology diffusion based on human capital, farmers with large tracts of land and higher levels of education have a better understanding of new agricultural technology and are therefore more likely to implement it into their farming practices more quickly. Islam (2002) expanded on this idea by adding social capital as a fixed factor in the choice to adopt new technology. According to his concept, farmers that have a larger work force and neighbors who use better technology get more information and adopt new technology more quickly.

According to Negatu and Parikh (1999), technology is transferred from sources such as extension agents and the media to the farmer depending on the farmer’s characteristics, farmers factor endowments and determined by the prevailing agro-ecological, socioeconomic and institutional factors.

The poor have benefited directly from new agricultural technology, which has increased farm household incomes, as well as indirectly from increased employment, wage rates for

laborers who are essentially landless, and decreased prices for basic foods (Pinstrup-Andersen et al., 1976; Hossain et al., 1990; Winters et al., 1998; de Janvry and Sadoulet, 2002; Irz et al., 2001).

The adoption of enhanced rice varieties has a considerable positive influence on household income and a negative impact on poverty status, according to Hossain et al. (2006) and Mendola (2007) in Bangladesh and Wu et al. (2010) in China. In a study, Rahman (1995) demonstrated the beneficial effects of agricultural technology adoption on the eradication of rural poverty.

Feder et al. (1985) found that adopting agricultural technology has a favorable impact. Dixon et al. (2006) and Wanyama et al. (2010) reported that adoption of improved production practices may help the farmers to get higher amount of yield and had impact on household food security and income.

According to Rahman and Haque (2013), in the production of wheat, the majority of farmers (69.1%) applied triple super phosphate (TSP) below the recommended dose while 81.8% applied muriate of potash (MoP) over the recommended dose. This means that most farmers are not using fertilizer at recommended doses. In their study on the adoption of agricultural innovations in developing nations, Feder et al. (1985) cited a number of research that suggested that farmers with higher levels of education accept contemporary technology earlier and use them more skillfully throughout the adoption process. Moreover, the peculiarities of the technology play a significant role in the impact of farm size.

Shakib and Afrad (2014) discovered that the adoption of contemporary aquaculture technology was positively and significantly correlated with information sources, farm size, fish farming area, yearly family income, commercialization, social participation, and innovativeness.

In regions where they are economically and technically superior to indigenous varieties, the new high-yielding varieties (HYV) are being adopted at extraordinarily quick rates. The adoption of new HYVs of grain has not been seriously hampered by farm size or tenure. In the early years after the introduction of HYVs, smaller farmers and renters frequently lag behind larger farmers, but these lags typically diminish within a few years. Both farm size and tenure have not been significant contributors to differential productivity growth. The

introduction of HYVs has resulted in an increase in the demand for labor. Landowners have gained relative to tenants (Ruttan, 1977).

According to Afolami et al. (2015), the adoption of improved cassava varieties has an influence by raising the annual revenue and annual consumption expenditure of households that produce the crop in Nigeria.

The majority of adoption research to date has viewed the choice to adopt in binary terms (adoption or non-adoption). But for many different types of breakthroughs, the intriguing query might be connected to the level of usage. Empirical study should acknowledge that many innovations with varying degrees of complementarity are frequently launched at the same time. Once the process is sufficiently advanced, differences in the rates at which different socioeconomic groups embrace Green Revolution technologies are frequently found to vanish (Feder et al., 1981).

In essence, several empirical and real-life evidences attributed a number of factors to the adoption of technology as whole, out of these the present research explores extent among other variables. Similarly, given the newness of farm level performance of university produced technologies as a research area of interest, the present research shall set the ball rolling by exploring the current situation.

Kassie et al. (2011) described that adopting better groundnut varieties (technology) considerably boosts agricultural income and lowers poverty. The favorable and large impact on crop income was in line with how new agricultural technology were thought to contribute to the reduction of rural poverty by raising farm household income. This paper advocates for increased funding for agricultural research in order to address significant development concerns. However, in order to reach the poor with superior technologies, legislative support is needed for enhancing extension efforts, availability to seeds, and commercial channels that mimic uptake.

According to Nguezet (2011), adoption of enhanced NERICA types increased household per capita income and expenditure by an average of 46.0 percent and 49.1 percent, respectively. This decreased the likelihood that adoptive households would be below the poverty line. According to the study, increasing NERICA dissemination funding combined with complementing policies could boost household incomes and lower poverty rates among rice farmers.

2.2 Relationship between Socioeconomic Characteristics of the Respondents with Their Adoption of Agricultural Technology

Available literature reviews relating to relationships between farmers' socio-economic characteristics and adoption have been given below:

2.2.1 Age and adoption

Knowler and Bradshaw (2007) discovered no connection between respondents' ages and CA adoption. Studies in the literature have produced contradictory findings.

According to Veeranna's (2000) research, the majority (66.0%) of respondents had a medium degree of adoption, followed by low (22.0%) and high (12.0%) levels. 61.3 percent of the population has adopted. Age and knowledge of scientific goat rearing techniques are two characteristics that have a good and extremely significant association with the adoption of such techniques.

According to Rahman (2001), there is no connection between age and the adoption of Aalok-6201 hybrid rice production practices. In their individual research, Podder (1999) and Hossain (1990) discovered outcomes that were comparable.

A research by Hussen (2001) found that the adoption of contemporary sugarcane growing practices by sugarcane growers was significantly correlated with their age. In his research, Rahman (1995) similarly came to a similar conclusion.

Islam (2003) did research on the Sandip farmers' acceptance of contemporary agricultural methods. He discovered that the farmers' ages did not influence whether or not they used contemporary farming technologies.

Ali (2004) found that there was no relationship between age of the farmers and adoption of aquaculture technologies by them.

2.2.2 Family size and adoption

Mishra and Pandey (2004) found no association between adoption of zero tillage and the family's ability to access labor.

According to Hoque's research, family size of producers had a negative and substantial link with their adoption of better sugarcane cultivating practices.

Research on the adoption of specific BINA technologies by the farmers in the Boira union in the Mymensingh district was done by Chowdhury in 1997. He noticed that the number of farmers' families and their adoption of particular BINA technologies had a favorable and significant link. In their different research, Okoro and Obibuaka (1992), Pathak and Sasmal (1992), and Sarkar (1997) noted similar results.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok-6201 hybrid rice in Sadar upazila of Mymensingh district. He found that family size of the farmers had no significant relationship with their adoption of Aalok-6201 hybrid rice.

2.2.3 Education and adoption

According to Langyintuo and Mekuria (2005), crop rotation adoption and use intensity are positively correlated with education level. This shows that farmers are more inclined to use crop rotation if they have a greater degree of education.

In five villages of the Cumilla district, Sarker (1997) conducted a study to ascertain the association between particular potato growers' characteristics and their adoption of better potato cultivation practices. He discovered that the adoption of better potato farming procedures by growers was significantly correlated with their level of education.

Chowdhury (1997) discovered a strong correlation between farmers' education levels and their adoption of particular BINA technologies. Islam (1993), Hoque (1993), and Pal (1993) all discovered comparable findings (1995).

In Sadar upazila in the Mymensingh district, Rahman (2001) carried out a study on the knowledge, attitudes, and adoption of the farmers about Aalok-6201 hybrid rice. He discovered a strong correlation between the farmers' adoption of Aalok-6201 hybrid rice and their academic background.

Under the PETRRA project of RDRS, Sardar (2002) studied how farmers adopted IPM practices. He discovered that farmers' adoption of IPM practices was positively and significantly correlated with their level of education.

Islam (2003) carried a research on the use of organic manures. He discovered a strong and favorable correlation between farmer education and the adoption of organic manures.

2.2.4 Farm size and adoption

The adoption of better potato farming practices was significantly positively correlated with the size of the potato growers' farms, according to Sarkar (1997). Chowdhury also published findings on the deployment of a few BINA technologies (1997).

Islam, M. K., & Hossain, M. E. (2013). The study aims at investigating the determinants of farm-level adoption pattern of hybrid rice varieties. Empirical data were collected from 200 farmers via questionnaires. Among the respondent farmers, the majority (56.50%) have adopted hybrid rice variety. In this paper a Logistic Regression Model is employed to explain the contribution of the determinants of HYRV adoption decision in Bangladesh. The effects of variables on the adoption decision are determined within the model. Results from our final model indicate that variables- age, education level, experience, training, farm size, family income, fertilizer cost and extension service are significantly associated with the decision of the farmers to adopt hybrid rice variety. Findings show that education level, experience, training, farm size, extension service have positive effect and age, fertilizer cost and family income have negative effect on adoption rate.

Hussen (2001) investigated whether farmers in Jamalpur district's Dewangonj upazila were using contemporary sugarcane farming techniques. The size of the farmers' farms and their adoption of contemporary sugarcane farming techniques, he noted, were significantly positively correlated.

In Sadar upazila of the Mymensingh district, Rahman (2001) conducted a study on the knowledge, attitudes, and adoption of the farmers regarding Aalok 6201 hybrid rice. He discovered that the size of the farm was significantly and favorably related to their adoption of the Aalok 6201 hybrid.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that the farm size of the farmers and a positive significant relationship with their adoption of IPM practices.

2.2.5 Annual family income and adoption

According to Chowdhury (1997), adopting particular BINA technologies was positively and significantly correlated with respondents' yearly income. Sarker (1997) and Alam (1998) found findings that were comparable (1996).

A research on the application of contemporary agricultural methods by Sandwip farmers was done by Islam in 2002. He saw that the farmers' annual revenue had little to do with whether or not they used contemporary agricultural methods.

In a study on IPM techniques, Sardar (2002) found that farmers' organizational involvement had no discernible impact on the adoption of IPM techniques.

2.2.6 Farming experience and adoption

In his research, Hoque (1993) discovered a negative, statistically significant link between farming experience and the adoption of better sugarcane growing techniques.

In his study, Sarker (1997) found that people's use of communication channels to access agricultural information was unrelated to their farming experience.

In his study, Alam (1996) found no correlation between farmers' knowledge of homestead deforestation and their level of farming experience.

Sarker (1997) discovered that potato growers' adoption of better potato cultivation practices was not significantly correlated with their farming experience.

2.2.7 Training experience and adoption

Begum (2001) observed an insignificant positive relationship between the training received and adoption of cauliflower production technology in homestead area by the rural housewives in Savar upazila of Dhaka district.

Sonia (2009) conducted a study on adoption of vegetable cultivation in Patuakhali district and found an insignificant relationship with training experiences.

2.2.8 Extension contact and adoption

Hussen (2001) found that he extension media contact had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Aurangozeb (2002) observed that there was significant relationship between contact with extension media and adoption of integrated homestead farming technologies.

Sardar (2002) concluded that the extension contact had positive significant relationship with their adoption of IPM practices.

Hossain (2006) observed that the extension contact of the farmer had significant relationship with their adoption of improved practices in soybean cultivation.

Islam (2008) found that there was no significant relationship between extension contact and adoption of integrated nutrient system.

2.2.9 Organizational participation and adoption

Chowdhury (1997) discovered a strong correlation between organizational engagement and farmers' use of insecticides.

In Sadar Thana of the Rangpur district, Ahaduzzaman (1999) completed a study on the adoption of contemporary Taman technologies by rice farmers. He discovered a significant positive relationship between the rice farmers' organizational involvement and their adoption of contemporary Taman technologies.

When Ghose (2001) finished her research on the adoption of better agricultural practices by sugarcane farmers in the non-mill zone area of Shibganj upazila, she discovered a negligible correlation between the growers' organizational participation and the adoption of better practices.

2.3 Conceptual Framework of the Study

Adoption is the decision to fully utilize innovation as the best available path of action (Ray, 1991). Adoption is a phenomena that occurs when someone adopts a new idea as their preferred method of action. The two topics that the current study attempted to concentrate on were the farmers' adoption of maize production technology and their chosen qualities. A dependent variable may be modified and influenced by the interplay of several environmental factors. All of the features cannot be covered in a single study. The structural arrangement for the dependent and independent variables was done while keeping in mind the conceptual framework of Rosenberg and Hovland (1960).

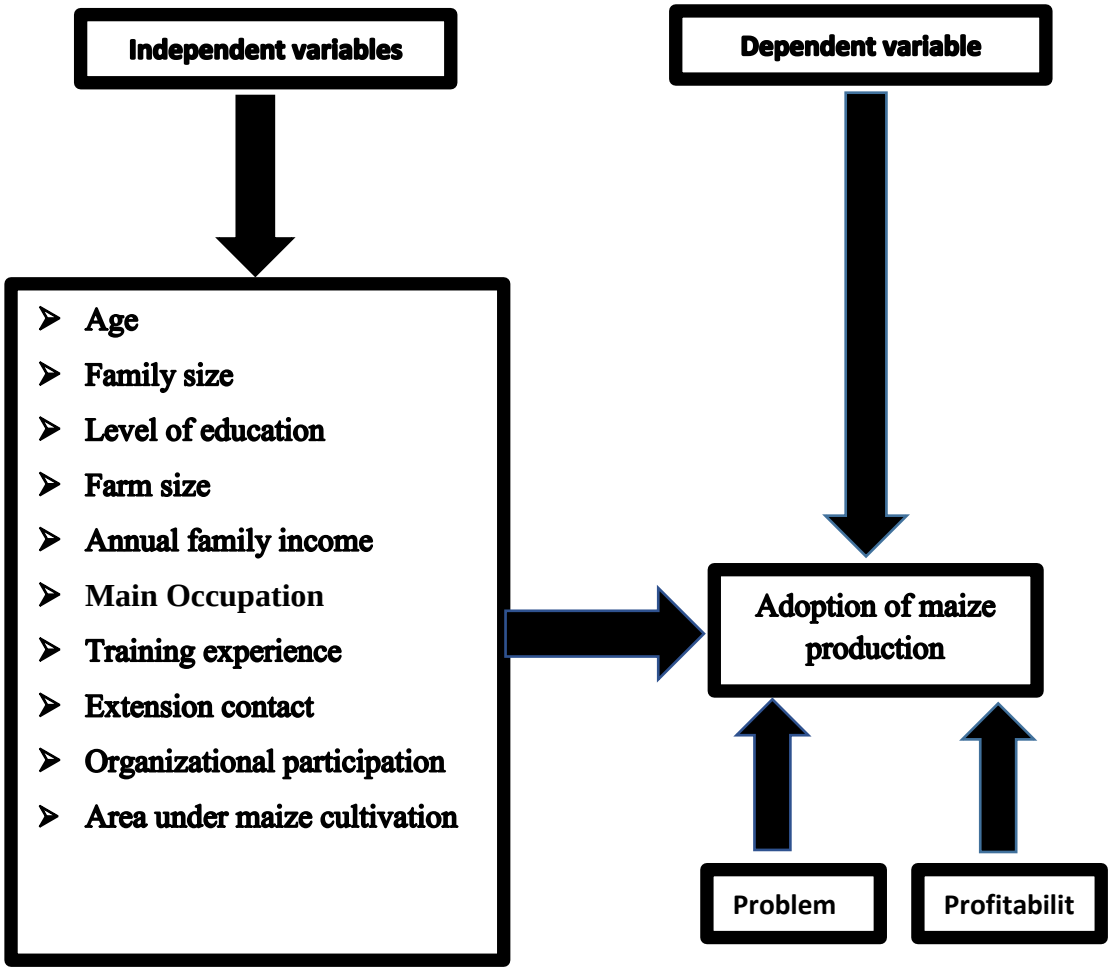

Figure 1. Conceptual framework of the study

This study anticipated that farmers' adoption of modern maize cultivation technologies would be a dependent variable that was influenced by a number of the farmers' characteristics as independent variables, including age, education, family size, farm size, exposure to extension services, cosmopolitanism, area under maize cultivation, annual income, and knowledge of maize cultivation. Figure 1 shows the conceptual model for the investigation.

CHAPTER III
METHODOLOGY

Methodological issue is one of the prime considerations for conducting research with valid and reliable findings. In actuality, it serves as the base around which the research process is built. In light of this, the researcher took great care to employ the proper techniques. The research design, unit of analysis, study site, population and sampling technique, research instrument, data collecting, measurement of data processing, and analysis are all explained in this chapter. The method and operational process, variable operation, and usage of statistical tests are all discussed in the future sections of this Chapter, though.

3.1 Research Design

A research design is a detailed blueprint for the investigation that will be conducted. The conceptual framework that guides research and serves as a manual for data collection, measurement, and analysis is known as the research design. A research design is an arrangement of parameters for data collecting and analysis that seeks to balance procedural economy with relevance to the study goal. The goal of study design is to ensure that the necessary data is efficiently and precisely collected in accordance with the difficulties at hand. The framework for data gathering and analysis is provided by a study design. The design of this research is a simple feature. The interaction between individual characteristics of the respondents with their knowledge was the ultimate goal. The design of this research was to focus the interaction between these issues, which is furnished below in Figure 2.

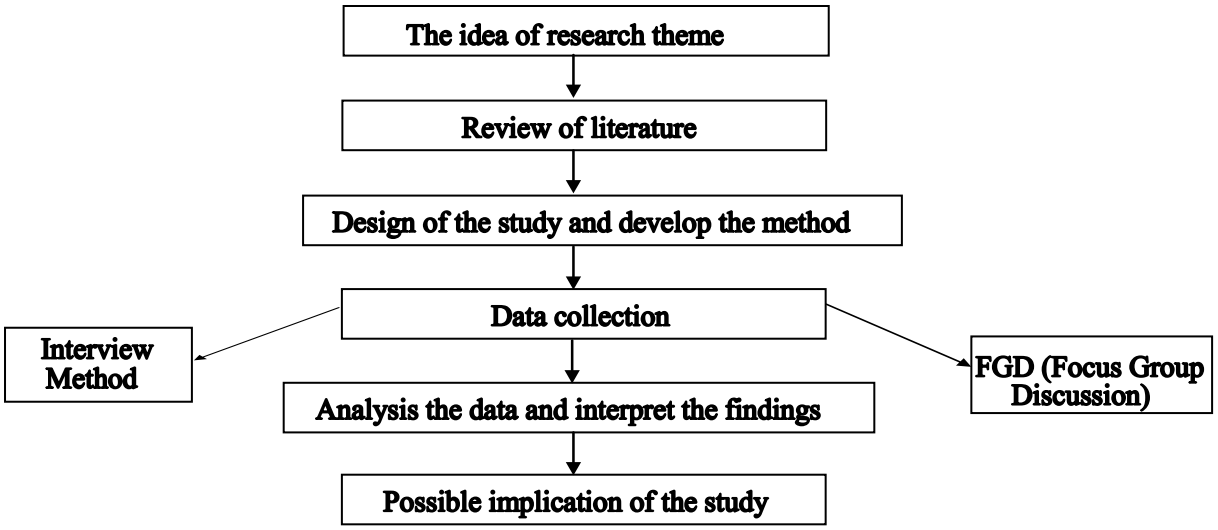

Figure 2. Research design of the study

3.2 Unit of Analysis

The unit of analysis is the most basic part of the event to be studied. It influences the research design, data collection and data analysis decisions. Family members of the farmers who had direct involvement in maize production were the main unit of analysis of the present study.

3.3 Locale of the Study

The upazila is the second lowest tier of administrative government in Bangladesh. The districts of Bangladesh are divided into sub-districts called Upazilas (Sarker, 2010).

Gangachara upazila under Rangpur district was the locale of the study (Figure 3). This upazila is situated at 14km northernmost of Rangpur town and according to the intensity of the maize cultivation was selected as the study area. Six villages are Aminganj, Minar Bazar, Binbiniarchar, Kanchonchar, Motukpur and Mohisamuri were randomly selected based on the intensive cultivation of maize. The selected villages were located in the different unions of the upazila.

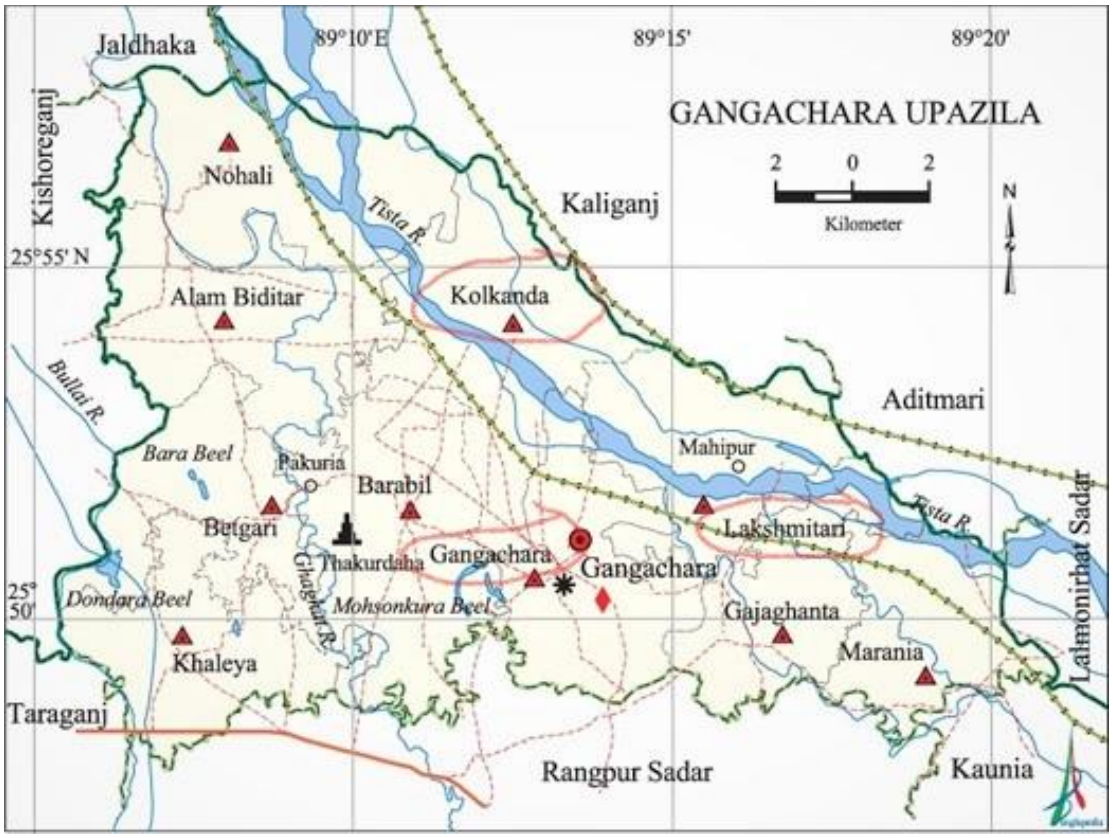

Figure 3. Map of Gangachara upazila under Rangpur district showing the study area

3.4 Population and Sampling Design

All the maize growers of the selected villages were the population of the study. Lists of the farmers of these villages were prepared with the assistance of Upazila Agriculture Office,

Gangachara under Rangpur. The total number of maize growers in these six villages were 629. Out of them 80 maize growers i.e. 13.5 percent were selected the sample of the study.

3.5 Measurement of Variables

For proper analysis of data and expression of results, measurement of variables plays a vital role. However, measurement of selected dependent and independent variables has been presented in the following sub-sections.

3.5.1 Age

Age of the respondent was measured by counting the years from time of his/her birth to the date of interview. A score of one (1) was assigned to each year of age. It was measured in complete years as reported by a respondent. For example, a respondent of 30 years of age scored 30. Based on their age, respondents were classified into three categories according to Islam (2013).

Categories	**Years**
Young	≤ 35
Middle	36 to 50
Old	≥ 51

3.5.2 Family size

Family size of a respondent is very important component for proper engagement in farm level agricultural activities. Family size of a respondent referred to the total number of members including the respondent him/herself, spouse, children and other permanent dependents who lived together as family unit. Respondents were classified into three categories on the basis of their family size according to Islam (2008).

Categories	**No. of Members**
Single family	<4
Nuclear family	4-7
Large family	above 7

3.5.3 Education

Education being a very vital characteristics of a respondent was included as one of the salient features. Education broadens the horizon of knowledge which makes a respondent a decision-maker on any innovation including maize cultivation. Education was measured as the ability of the respondent to read and write or the formal education received up to a certain standard. A score of zero (0) was given to a respondent who were illiterate and a score of one (1) was given for each year of formal schooling completed by the respondent e.g., one (1) for completing class one, two (2) for class two and so on. The respondents were classified into four categories according to Akanda (2017).

Categories	**Schooling Years**
Illiterate	0
Primary education	1-5
Secondary education	6-10
Higher level	>10

3.5.4 Farm size

Farm is the basic component of any agricultural production. Its volume affects the respondent's personal, economic and social life. Farm size of a maize grower referred to the total area of land, on which his family carried out farming operations, the being in terms of full benefit to his family. The farm size was measured in hectares for each maize grower using the following formula:

FS=A1 +A2+ A3-A4+A5+A6

Where,

FS = Farm Size

A1 = Homestead

A2 = Own land under own cultivation

A3 = Shared in land

A4 = Shared out land

A5 = Land Leased in

A6 = Others (Pond, Fruit Garden etc.)

Based on farm size the respondents were classified into three categories according to BBS (2018).

Categories	BDT
Small farm size	up to .99ha
Medium farm size	above 1 to 2.99ha
Large farm size	Greater than 3ha

3.5.5 Annual family income

Family annual income of a respondent was measured in terms thousands Bangladesh Taka (BDT) per year as given by the respondent. The possible sources of income considered in this present study were: agriculture, business, service and others. The earning from these sources were added together to obtain total annual income of a respondent. Based on the mean and SD, annual income of the respondents was classified into three categories according to Akter (2019).

Categories	BDT
Low income	up to 110000
Medium income	110001– 240000
High income	>240000

3.5.6 Farming experience

A grower's farming experience is regarded as a crucial instrument for farm production. A response with extensive farming experience can take into account a variety of production factors, including land selection, quality seed collection, season identification, market facility, crop production and protection methods, harvest time, and overall storage. By calculating the total years of direct participation experience of a responder, the respondent's farming experience was operationalized. Total agricultural experience was calculated based on how long the respondents had been engaged in farming. The scoring was determined by the respondents' real experiences. According to Akter, the respondents' annual income was divided into three categories based on the mean and SD (2019).

Categories	Years
Low experience	up to 10
Medium experience	11-20
High experience	> 20

3.5.7 Training experience

Training experience of a respondent was measured by the total number of days he received training on different subject matters from various organizations. A score of one (1) was assigned for each day of training participated by the respondent

3.5.8 Extension contact

Respondents contact with different information sources and media channel to a different extent in order to receive information and their exposures to variety of information sources usually guide them to adopt an innovation. Extension media contact of the respondents was measured by employing a 4-point rating scale as such Not at all=0, Rarely=1, Occasionally=2, Frequently=3.Based on the media contact of the respondents was classified into the following categories according to Runju (2019).

Categories	**Score**
Low	up to 5
Medium	6-10
High	above 10

3.5.9 Organizational participation

Organizational participation on the basis of participation by the respondent in different organizations during last seven years. This was multiplied by its duration i.e., number of years. Scores were assigned for participation of a respondent in an organization in the following manner.

Nature	**Score**
No participation	0
Participation as general member	1
Member of the Executive committee	2
Participation in executive committee as president or secretary	3

Organization participation (OP) score of respondents was computed by using following formula:

OP = P OM NY + 2PEM NY + 3 PPS NY

Where,

OP = Organizational participation

Pgm = Participation as general member

Pem = Participation as executive member

Pps= Participation as president or secretary of executive committee

N = Number of organizations

Y = Duration of participation in year

Organization participation score of a respondent was determined by summing the participation score in all the organizations.

3.5.10 Area under maize cultivation

Area is the most important factor to a farm family and its influences on maize production. Based on the area under maize production, the respondents were classified into following categories according to Runju (2019).

Categories	**Score**
Low	up to 0.3 ha
Medium	0.31 to 0.6 ha
High	above 0.6 ha

3.5.11 Extent of adoption

Wahab (1979) has constructed a multidimensional adoption scale to measure the rate of an adoption of a practice. The scale covers both duration as well as area dimensions under the use of the particular practice under measurement. The formula constructed by Wahab (1979) to compute the Adoption Quotient (AQ) for an individual has been adapted to express the AQ in percent (multiplying the AQ by 100). The AQ can range from 0 to 100, where 0 (zero) indicates no adoption of the practice and 100 indicates full adoption. The modified formula for calculating the AQ is presented below.

$$AQ = \frac{T2}{T3} \times \frac{T1}{T3} \times \frac{A1}{A2} \times 100$$

Where,

AQ= Adoption Quotient

T_1 = Year since the practice under study was introduced

T2 = Year since the user became aware of the practice

T3 = Year since the practice was adopted by the user

A1 = Actual area (ha) under the practice during the surveyed year

A2 = Potential area (ha) under the practice under study during the surveyed year

3.6 Profitability of Maize Variety

3.6.1 Profitability analysis of maize cultivation

Total cost, gross return, gross margin, net return, and benefit cost ratio calculations were made in order to determine the profitability of maize production. Family labor and land use costs were computed as fixed costs. The cost of clearing the land, the cost of seeds and seedlings, the cost of irrigation, the cost of pesticides and fertilizer, the cost of hired labor, and the cost of interest on operating capital were all regarded as variables and calculated based on current market prices. By combining fixed and variable costs, the total cost was approximated. When assessing gross return, maize production and pricing were considered. based on Anjum & Barmon (2017). To estimate the cost of maize cultivation, the following equations were used:

$TVC = \Sigma(XiPi)$

$TC = TVC + FC$

$Gross\ Margin = TR - TVC$

$Profit = TR - TC$

Where,

TR=Total return (BDT/ha)

TC = Total cost of maize production (BDT/ha)

TVC =Total Variable cost of maize (BDT/ha)

FC = Fixed cost of maize (BDT/ha)

Xi = Quantity of inputs (Kg/ha) except irrigation and pesticides; irrigation and pesticides used as (BDT/ha) for maize production

Pi = Price of inputs (BDT/kg) used for maize varaities

3.6.2 Benefit Cost Ratio (BCR)

Benefit cost ratio (BCR) is used to indicate the relationship between cost and benefit of any enterprise in monetary terms. Higher BCR indicates higher return from the production. To estimate the Benefit-cost ratio (BCR), the following equation was used:

Benefit cost ratio, BCR=TR/TC

Where,

TR=Total return (BDT/ha)

TC = Total cost of maize production (BDT/ha)

3.7 Development of Data Gathering Instrument

An interview schedule was prepared to collect quantitative data. To increase the interview schedule's content validity, a panel of judges was used. The interview schedule was pre-tested on people in comparable socioeconomic circumstances before being finalized. There were both open-ended and closed-ended interview questions. The instrument's material was altered in response to the advice and criticisms of specialists. The interview schedule's assertions and questions were clear-cut, easy for the responders to understand, and basic.

3.8 Collection of Data

Data were gathered for the study by the researcher conducting in-person interviews with respondents, and in order to create a rapport and obtain accurate information, Sub-Assistant Agriculture Officers assisted (SAAOs). The responses were kept as accurate as feasible by taking all reasonable efforts to prevent bias. Statements were taken down verbatim from respondents; no conclusions or remarks were made about them. They were told what the study's goals were. Local literate people and social leaders also assisted the researchers in educating the respondents about their goals. The researcher gradually and whenever it was necessary during the interview asked each question. When a respondent had trouble comprehending the questions, they were clarified and explained. Data were gathered during May and June 2021. Focus Group Discussions (FGDs) were held in two different locations to gather qualitative data and validate the findings.

3.9 Processing and Analysis of Data

After the completion of the survey, all scheduled interviews were compiled, and local units were changed to standard units. The qualitative inputs were converted into quantitative data using the appropriate scoring methodology. To handle and analyze the data, all of the

obtained information was categorized, processed, compiled, and tabulated in accordance with the study's goals. The data analysis was done with SPSS/PC + Statistics 10. Statistical measures including number, range, mean, and percentile were employed to describe the data, which were primarily presented in tabular form. Pearson correlation of coefficient was employed to demonstrate relationship between selected characteristics of the respondents and their adoption of maize production.

CHAPTER IV
RESULTS AND DISCUSSION

Results and discussion is one of the most important parts of a research report. The findings of the study are presented in this Chapter according to the objectives. Necessary explanations and their logical interpretations have also been made showing possible and rational basis of the findings whenever necessary. However, for convenience of the discussions, the findings of the study are systematically presented in this Chapter under the following sections:

4.1 Selected Characteristics of the Respondent Farmers

Selected characteristics of the respondents under consideration for study are age, family size, education, farm size, annual family income, main occupation, farming experience, training exposure, extension contact, organizational participation, Adoption of maize production technologies, Human labor cost of maize production (Per hectare), Cost of maize production (Per hectare), Returns from maize production (Per hectare), Constraints faced by the farmers in maize production have been described below.

4.1.1 Age of the respondent farmers

The observed age of the respondents ranged from 25 to 65 years with average of 44.80 years and SD of 11.83 Based on their age, they were classified into three categories as shown in Table 1.

Table 1. Distribution of the respondents according to their age

Age Category (Years)	Respondents		Mean	Average Mean	SD
	Number	Percent			
Young (25 to 35)	25	31.25	.31	44.80	11.83
Middle aged (36 to 50)	31	38.75	.38		
Old (above 50)	24	30	.30		
Total	80	100.0			

Results presented in Table 1 indicate that 38.75 percent of the respondents were middle aged with each of 31.25 percent in young aged and 30 percent old age categories. Thus, results indicate that two thirds (70%) of the farmers were young to middle aged categories. In general, middle-aged people are full of energy, possess stability and the decision makers

of the farm families but the young people are relatively unstable but full of energy. Usually, they don't take part in any decision-making process of the farm families though they are more interested in any innovation, e.g., new variety, new agricultural device etc. On the other hand, the old age people are generally dependent upon the middle aged and young family member. Almost similar findings were reflected in the studies of Hasan (2004) and Islam (2008) and Alam et al. (2016).

4.1.2 Family Size

Family size referred to the total members of the family including the respondents himself, spouse, children and other dependents and act together in a family unit. The family size of the respondents ranged from 3 to 13 with an average of 5.55 The family size of the respondents was classified into the following three categories as presented in Table 2.

Table 2. Distribution of the respondents according to their family size

Category	Respondents		Mean	Average Mean	SD
	Number	Percent			
Single family (<4)	6	7.5	.07	5.55	1.92
Nuclear family (4-7)	64	80	.80		
Large family (above 7)	10	12.5	.12		
Total	80	100.0			

Results presented in Table 2 reveal that the highest proportion (80 %) of the respondents belonged to nuclear category family while 7.5 percent had single family size and only 12.5 percent had large family. Results indicate that average family size (5.55) of the respondents in the study was higher than the national average of 4.06 (BBS, 2016). This finding has found to be similar with the findings of Islam (2008); Sardar (2002) and Rahman & Siddik (2018).

4.1.3 Level of education

The respondents' education level ranged from 0 to 17 class. Based on their education, they were classified into four categories as shown in Table 3.

Table 3. Distribution of the respondents according to their education level

Category	Respondents		Mean	Average Mean	SD
	Number	Percent			
Illiterate (0)	31	38.75	.38	4.91	4.99
Primary level (1 to 5 class)	20	25	.25		
Secondary level (6 to 10 class)	19	23.75	.23		
Higher secondary level (above 10 class)	4	5	.05		
Higher Studies	6	7.5	.07		
Total	80	100.0			

The mean and SD are 4.91 and 4.99, respectively. The distribution of the farmers according to their educations .Information contained in table 3 indicate that 25 percent respondents had primary level education that of 23.75 percent secondary level education, 5 respondents had higher secondary level education and higher studies level are7.5 percent while 38.75 percent respondents were illiterate. The literacy is an important factor, which determines adoption behavior of a farmer. Moreover, it allows one to have access to the printed media as well. Thus, farming community in the study area may be well considered as suitable for the adoption of spices technology. Almost similar findings were also reflected in the studies of Aurangozeb (2002), Sardar (2002) and Rahman and Siddik (2018).

4.1.4 Farm size

The farm size of the respondent farmers varied from 0.06 to 3.727 ha with an average of 0.73 hectares. Based on farm size the respondents were classified into three categories according to BBS (2009) as presented in Table 4.

Table 4. Distribution of the respondents according to their farm size

Categories	Respondents		Mean	Average Mean	SD
	Number	Percent			
Small farm size (up to .99ha)	66	82.5	.82	0.73	0.71
Medium farm size (above 1.01 to 3.0ha)	12	15	.15		

Large farm size (above 3.0ha)	2	2.5	.02		
Total	80	100.0			

Results presented in Table 4 reveal that very big majority (82.5%) of the respondents possessed small farm size while 15 and 2.5 percent possessed medium and large farm size, respectively. The average farm size of the respondents was 0.73 hectares, which was found larger than that of national average (0.81ha). This indicates that the farm holding size status of the respondents in the study areas is greater than that of typical farming community of Bangladesh.

4.1.5 Annual family income

Annual family income of the maize farmers ranged from 30000 to 700000 taka. Based on annual family income, respondents were classified into three categories (Table 5). The income category was conformity with Runju (2019).

Table 5. Distribution of the respondents according to their annual income

Category	Respondents		Mean	Average Mean
	Number	Percent		
Low income (up to BDT 110000)	46	57.5	.57	144337.5
Medium income (BDT 110001 to 240000)	20	25	.25	
High income (above BDT 240000)	14	17.5	.17	
Total	80	100.0		

Findings presented in Table 5 show that the majority (57.5 %) of the respondents had low income, while 25 percent for medium and 17.5 percent for high income. Most of the farmer of the study area are involved in maize and tobacco cultivation and their income was dependent upon the farming sources. They have rare diversified income sources like job/service, small business, and some other self-employed works. This finding has found to be similar with the findings of Reza (2007) and Hossain (2003).

4.1.6 Farming experience

Farming experience of the farmers ranged from 5-50 years with an average of 26.07 years. Based on the mean and SD, respondents were classified in to three categories as shown in Table 6

Table 6. Distribution of the respondents according to their farming experience

Category	Respondents		Mean	Average Mean	SD
	Number	Percent			
Low experience (1to 10 years)	13	16.25	.16	26.07	13.16
Medium experience (11 to 20 years)	30	37.5	.37		
High experience (above 20 years)	37	46.25	.46		
Total	80	100.0			

Results presented in Table 6 indicate that the majority (46.25%) of the respondents had high farming experience while 37.5 percent medium and 16.25 percent had low farming experience. The findings clearly indicate that most of the farmers had medium to high farming experience. Almost similar findings were also reflected in the studies of Hasan (2016).

4.1.7 Training experience and its source

Training makes one more efficient, active, confident, skilled and up to date in doing any work. Only 7.5 percent of the respondents received training from different organizations which were NGOs, Upazila Agriculture Office, Private Company as shown in Table 7.

Table 7. Distribution of the respondents according to their training experience and its source

Training offering organization	Respondents	
	Frequency	Percent
Upazila Agriculture Office	5	6.25
NGOs	0	0.0
Private Company	1	1.25
Didn’t receive training	74	92.5
Total	80	100.0

Information displayed in Table 7 also reveal that 6.25 percent respondents received training from Upazila Agriculture Office and 1.25 percent respondents received training from private company. A very big portion (92.5%) of them received no training. This might be due to that they live in char areas where communication is not good at all or they are not aware about training. It also could be that the extension personnel are not concerned. Almost similar findings were also reflected in the study of Rahim et al. (2018) and Hasan and Sultana (2012) reported as 20.0 percent and 14.7 percent, respectively.

4.1.8 Extension contact

The extension media contact score of the farmers ranged from 2-13 against the probable range of score from 0-15. Based on the mean and SD, respondents were classified in to three categories as shown in Table 8.

Table 8. Distribution of the respondents according to their contact with extension media

Categories	Respondents		Mean	Average Mean	SD
	Number	Percent			
Low extension contacts (1 to 5)	53	66.25	.66	6.10	2.29
Medium extension contacts (6 to 10)	23	28.75	.28		
High extension contacts (above 10)	4	5	.05		
Total	80	100.0			

Results presented in Table 8 indicate that the majority (66.25%) of the respondents had low extension contact while 28.75 percent of them showed medium extension contact and 5 percent had high extension contact. The findings clearly indicate that most of the respondent farmers had low extension media contact, which is encouraging for extension service providers for transferring any technology. Almost similar findings were also reflected in the studies of Aurangozeb (2002) and Sardar (2002) and Rahim et al. (2013)

4.1.9 Organization participation

Organizational Participation facilitates a person to work with group. It increases capability of undertaking responsibility, increasing leadership ability. Results shown Table 9 indicate the organizational participation of the respondents in the study area. The observed result indicates that the most of the respondents had no organizational participation at all.

Table 9. Distribution of the respondents according to organizational participations

Organizational participation	Respondents' frequency	Percent
No organizational participation	69	86.25
Had participation	11	13.75

Result presented in Table 9 that 86.25% had no organizational participation and 13.75% had organizational participation in farmer's society, youth committee, Women Association, masque committee, Village development committee, NGOs committee, market committee and other social organizations. Almost similar findings were also reflected in the studies of Hasan (2016) and only 8.0 percent of char people usually participate according to Paul & Islam (2015).

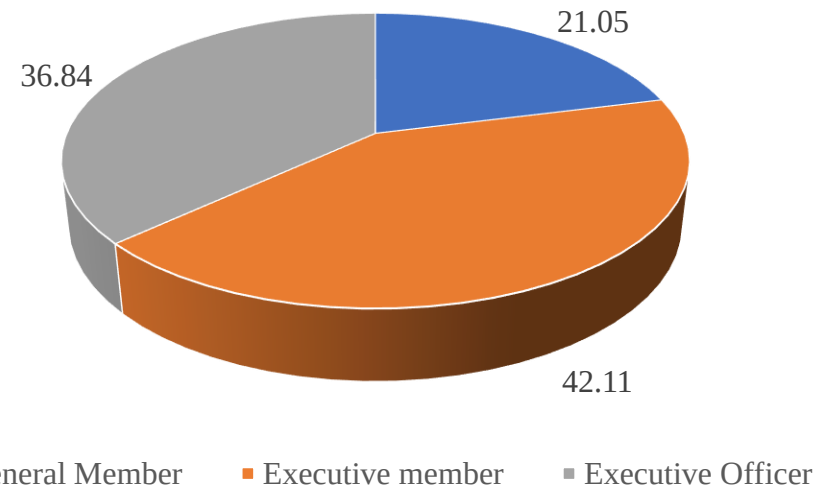

Figure 4. Distribution of the respondents based on their positions in organizations

Among the respondent farmers who had participation in different organization majority (42.11%) were in executive members followed by executive officers (36.84%) and general members (21.05%). Therefore, about four-fifth (78.95%) of them were in executive

committee (Figure 4). Generally, an individual having involvement in executive committee of any organization possess vast knowledge on versatile subjects. They take rational decision in any activity including adoption of any technology.

4.1.10 Area under Maize Cultivation

The mean and standard deviation of maize cultivation area were 0.37and 0.27, respectively. Based on innovativeness scores, the respondents were classified into three categories (Table 10).

Table 10. Distribution of the respondents based on their maize cultivation area

Category	Respondents		Mean	Average Mean	SD
	Number	Percent			
Small maize cultivation area (0.10 to 0.30ha)	37	46.25	.46	0.37	0.27
Medium maize cultivation area (0.31 to 0.60ha)	33	41.25	.41		
Large maize cultivation area (above 0.60ha)	10	12.5	.12		
Total	80	100.0			

Information presented in Table 10 indicate that the majority (46.25%) of the respondents had small area under maize cultivation while similar 41.25 percent of them had medium and 12.5 percent had large maize cultivation area. The findings clearly indicate that very big majority (87.5%) of the farmers had small to medium maize cultivation area. Almost similar findings were also reflected in the studies of Runju (2019).

4.1.11 Extent of adoption of maize cultivation

The observed range of extent of adoption quotient of maize cultivation by the respondent farmers ranged from 5.38 to 99.95 percent against possible range of 0 to 100.0 percent. The mean adoption score was 76.00 Based on observed range of extent of adoption, the respondents were classified into three categories presented in Table 11.

Table 11. Distribution of the respondents according to their extent of adoption of maize

Category	Respondents		Mean	Average Mean	SD
	Number	Percent			
Low adoption (up to 33)	6	7.5	.07	76.00	

Medium adoption (33.01 to 67)	25	31.25	.31		27.61
High adoption (above 67)	49	61.25	.61		9
Total	80	100.0			

Information contained in Table 11 reveal that majority 61.25 percent of the respondents had high level of adoption of maize cultivation compared to 31.25 having medium adoption of maize production while 7.5 percent had low level of adoption of maize production. Findings clearly indicate that almost all (92.5) of the respondents had medium to high adoption of maize production. Sharda et al. (2018) reported that 85.0 percent of the respondents had moderate to high adoption of kharif maize production technology. Almost similar findings were also reflected in the studies of Runju (2019) and Nahar (2013) in adoption of spices cultivation in Bogura district and BRRI dhan28 cultivation in the coastal area of Bangladesh, respectively.

4.1.12 Comparative adoption of different maize varieties

Farmers in the study area were cultivating different varieties. Among the varieties, Four major cultivated varieties. These are Palwan, Bahuboli 555, Dalia 4455 and Kabri 50. A comparative adoption of the four varieties were computed based on total average area covered as presented in Table 12.

Table 12. Distribution of the respondents based on their adoption of different maize varieties

Item	Adoption Quotient (AQ)	Mean cultivated area (ha)	Rank
Palwan	76.42	0.304	1st
Dalia 4455	72.35	0.535	2nd
Bahuboli 555	72.30	0.453	3rd
Kabri 50	70.26	0.385	4th

Findings contained in Table 12 show that among the four cultivated maize varieties in the study area, Palwan ranked first (with adoption quotient of 76.42%) followed by Dalia 4455 ranked second (with AQ of 72.35%), Bahuboli 555 ranked third (with AQ of 72.30%) and Kabri 50 ranked fourth position (with AQ of 70.26%). Almost similar findings were also reflected in the study of Podder (1999).

4.1.13 Production cost and profitability of maize production

The cost of maize production and its return mainly depends on the rate of inputs used (seed, fertilizers, pesticides etc.), land/soil type, number of irrigation needed, number of labor and their wage rate, management practices, marketing facilities of the maize products etc. As all these factors differed from one location to another across the study areas, the production cost and hence, the economic return for maize as assessed through the present study presumably varied widely. The production package and profitability analysis for maize variety in Gangachara Upazila under Rangpur district sites are presented in Table 13.

Table 13. Production cost and profitability of maize production

Cost items	Values
A) Variable cost (BDT/ha)	
i. Labor	43920
ii. Power tiller	7607.5
iii. Seeds	9150
iv. Manure:	2745
v. Fertilizers	43920
vi. Insecticides	4117.5
vii. Irrigation	7320
viii. Threshing	2836.5
Total variable cost (BDT/ha)	121616.5
B) Fixed cost(BDT/ha)	
i. Interest on capital	1239.825
ii. Land use cost	38439.333
Total fixed cost	39679.158
Total cost(A+B)	161295.658
Total Return (BDT/ha)	219653.334
Gross Margin (TR-TVC)	98036.834
Profit (TR-TC) (BDT/ha)	58357.676
BCR (TR/TC)	1.36

Table 13 shows that average yield of maize was 10.98 ton per hectare. The average return was BDT 219653.334 per hectare and total production cost was BDT 161295.658 per

hectare. The gross margin of maize production was BDT 98036.834 and profit was BDT 58357.676 per hectare. The argument for using the gross margin analysis is that the farm owners like to maximize return over variable cost. Moreover, in the context of short run analysis and farm planning, the gross margin analysis is widely used. Gross margin conceptually, is in line with the thinking of the farm owners. Benefit cost ratio is one of the profitability measuring analyses of any technology or variety. It indicates the differences between the cost and benefit. Usually, the higher the BCR, the higher the adoption of any crop variety. Results shown in Table 15 reveal that the BCR of maize is 1.36 which means that farmers get BDT 136 by investing BDT 100. The results of profitability analysis clearly indicate that maize production is profitable for farmers. Almost similar findings were also reflected in the studies of Alam et al. (2016).

4.2 Relationship between selected characteristics of the farmers and adoption

Pearson coefficient of correlation was computed in order to explore the relationships between the selected characteristics of the farmers and their adoption of maize cultivation technology. The null hypothesis was "there is no significant relationship between the selected characteristics of the farmers and their adoption of maize cultivation". Relationships between the selected characteristics of the respondents and adoption have been presented in Table 14.

Table 14. Relationship between selected characteristics of the farmers and their adoption of maize production

Dependent variable	Independent variables	Correlation of coefficient (r)
Adoption of maize cultivation technology	Age	-.211
	Family member	.193
	Level of education	-.269*
	Annual family income	.692**
	Farming experience	-.013
	Farm size	-.351**
	Area under maize cultivation	.065
	Organizational participation	.263*

**** Correlation is significant at 1% level, *Correlation is significant at 5% level**

The null hypothesis was "There is negative significant relationship between education and adoption Quotient of the farmers." The computed value of 'r' was -.269* for adoption (Table 14), of which adoption was negatively significant at 5% level of probability. So, the null hypothesis could not be accepted which indicates that there is a significant negative relationship between education and adoption of maize cultivation technology. It means that if there is any increase in educational level of the respondent there would decreased in their adoption of maize cultivation technology, i.e. the higher the educational level of the respondent, the lower adoption of maize cultivation technology. It indicates that adoption of maize cultivation technology the farmers depend on their education inversely. Education is the process of developing capabilities of the individuals so that they can adequately respond to their situation. This might be due to the reason that the educated farmers consider the diversified aspects of maize cultivation including its production, processing, preservation and marketing. They might find any drawbacks among these aspects, therefore, they don't whimsically get involved in maize cultivation. But Roy (1997), Kashem and Hossain (1992) found dissimilar results in their studies.

The relationship between annual family income and adoption of the respondents was found to be positively significant at 1% (Table 14) as the value of 'r' was .692**." So, the null hypothesis could not be accepted and concluded that adoption of the maize cultivation technology by the farmers is depended on their annual family income. It means that the higher the annual family income, the higher the maize cultivation technology, i.e. if there is any increase in the annual family income of the respondent there would increased in their adoption of maize cultivation technology.

The relationship between farm size and adoption of the respondents was found to be negatively significant at 1% (Table 14) as the value of 'r' was -.351**. The constructed null hypothesis was "There is no significant relationship between farm size of the respondents and their adoption of maize cultivation technology." So, the null hypothesis could not be accepted their farm size. It means that the higher the farm size, the lower the maize cultivation technology, i.e. if there is any increase in the farm size of the respondent there would decreased in their adoption of maize cultivation technology. Innovation always involves some sort of risk. Sometimes new variety used to fail in coping with new areas; hence there is a risk of failure. The farmers having large farm size can take this risk as trial basis and small farmer can't take risk for new varieties. In this case, it is different which might be due to the fact that the large farm holder doesn't directly involve in the farming

activities, heavily dependent on sharecropper and or hired labor. Again, the large farmers are usually educated persons may find some demerits of maize cultivation technology. and concluded that adoption of the maize cultivation technology by the farmers is depended on their farm size. It means that the higher the farm size, the lower the maize cultivation technology, i.e. if there is any increase in the farm size of the respondent there would decreased in their adoption of maize cultivation technology. Innovation always involves some sort of risk. Sometimes new variety used to fail in coping with new areas; hence there is a risk of failure. The farmers having large farm size can take this risk as trial basis and small farmer can't take risk for new varieties. In this case, it is different which might be due to the fact that the large farm holder doesn't directly involve in the farming activities, heavily dependent on sharecropper and or hired labor. Again, the large farmers are usually educated persons may find some demerits of maize cultivation technology. Another fact is that farmers don't find the quality seeds of modern maize varieties and depend on the seeds to be supplied from own produced seeds or old varieties. When the supply of seeds is limited, the small farmers can take the risk for new varieties, not the large farmers. The dissimilar findings were reported by Hedayet (2011) and Islam (2008) in their studies on adoption BRRI dhan47 and mung bean, respectively.

The relationship between Organizational participation and adoption of the respondents was found to be positively significant at 5% (Table 14) as the value of 'r' was .263*." So, the null hypothesis could not be accepted and concluded that adoption of the maize cultivation technology by the farmers is depended on their Organizational participation. It means that the higher the Organizational participation, the higher the maize cultivation technology, i.e. if there is any increase in the Organizational participation of the respondent there would increased in their adoption of maize cultivation technology.

4.3 Problem faced in cultivation of maize

It is very common that farmers faced different problems in cultivating any crops including maize. In this study 15 problems were identified in adopting the maize cultivation technology.

Table 15. Rank order of the problems faced by the maize growers

SI	Problem items	Extent of problem			
		High	Moderate	Low	Not at all
1.	Suitable land for maize cultivation	0	2	21	57
2.	Seed availability at farmers' level	1	4	21	54
3.	Availability of hybrid seed	0	1	10	69
4.	Input cost (seed, fertilizer, pesticide)	3	4	14	59
5.	Availability of credit	66	6	7	1
6.	Irrigation facilities	0	6	20	54
7.	Knowledge on maize production	3	5	10	62
8.	Technical information	8	10	14	48
9.	Labor	5	2	12	61
10.	Harvesting	1	0	10	69
11.	Crushing	2	7	10	61
12.	Cannot consume as food	20	40	9	11
13.	Storage facility at farmers' level	58	9	6	7
14.	Marketing of maize	1	4	11	64
15.	Others (if any)	0	0	3	77

Results presented in Table 15 indicate that lack storage facility at farmers' level was the top most problem followed by limited availability of credit ranked 2nd, lack of processing technique to consume as food ranked 3rd while poor technical information ranked as 4th and lack of availability of hybrid seed ranked as 5th problem.

Maize as cereal crop is new to the farmers. Being bulky in production volume, it requires huge preparation to store with big storage facility. But at farmers' level, there is no such facility for its long time storage. Thus, it becomes the top most problem to the famer. Credit is another vital problem of maize production, because it requires huge inputs including

seeds, fertilizers, labors which are credit dependent. So, during the product time famers can't afford this credit requirement. Resultantly, credit becomes the 2nd most top problems encountered by the maize growers. Again, processing of maize for food preparation is not known to the farmers which is machinery dependent. These machineries are not available in Bangladesh, especially to the Char land dwellers. Therefore, it becomes 3rd top most problems to the maize growers. Almost similar findings were also reflected in the study of Hedayeta (2011). Moniruzzaman et al. (2009) in their study observed lack of capital and high price of fertilizers as the major problems faced by the growers in maize production.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This study was conducted at three unions of Gangachara upazila under Rangpur district. The main objectives were to: determine the extent of adoption of maize production by the farmers; assess the profitability of maize production in the study area; investigate the relationship between the socioeconomic characteristics of the farmers and their adoption of maize production; and find out the constraints faced by the farmers in adoption of maize production. Eighty respondents were selected from two unions following disproportionate random sampling technique. An interview schedule was used to collect data for the study. Data obtained from the respondents were compiled, coded and tabulated for analysis and interpretation with SPSS computer software.

5.1.1 Summary of major findings

Important findings according to the objectives of the study have been shown in the following headings.

5.1.2 Individual characteristics of the respondent farmers

Age of the respondents ranged from 25 to 65 years with an average of 44.80 years. 38.75 percent of the respondents were middle aged followed by 31.25 percent were young aged and 30 percent were old aged respectively. Education score of the respondents ranged from 0 to 17 with an average of 4.91 and 25 percent respondents had primary level education that of 23.75 percent secondary level education and 12.5 respondents had higher secondary level education, while 38.75 percent respondents were illiterate**.** Farm size of the respondents ranged from 0.06 to 3.727 ha with an average of 0.73 hectares**.** Majority of the respondents (82.5%) had small farm followed by 15 and 2.5 percent medium and large farm size, respectively**.** The mean and standard deviation of maize cultivation area were 0.37and 0.27, respectively. The majority (46.25%) of the respondents had small area under maize cultivation while similar 41.25 percent of them had medium while 12.5 percent of them had large maize cultivation area. Annual family income of the respondent maize farmers ranged from BDT 30000 to 700000 with an average BDT 144337.5 Majority (57.5%) of the respondents had low income, while 25 percent for medium and 17.5 percent for high

income. Only 7.5 percent of the respondents were trained by different organization which were NGOs, Upazila Agriculture Office, Private Company and 92.5 percent had no training exposure. Extension contact score of the respondents ranged from 2 to 13 with an average of 6.10. Majority of the respondents (66.25%) had low contact followed by 28.75 percent had medium and 5 percent of them had high extension contact.

5.1.3 Adoption of maize variety

Respondent farmers' adoption of maize variety score ranged from 5.38 *to* 100.09 percent with an average of 76 Majority of the respondents (61.25%) had high adoption followed by 31.25 and 7.5 percent medium and low adoption, respectively. The mean BCR of maize production was 1.36.

5.1.4 Problems faced by the respondent farmers

All the respondents faced medium problems and the rank order of 15 problems in ascending order were: ‘storage facility at farmers' level due to high moisture content’, ‘availability of credit’, ‘cannot consume as food’, ‘technical information’, ‘availability of hybrid seed’, ‘input cost’, Seed availability at farmers' level, Irrigation facilities, ‘knowledge on maize production’, ‘crushing’, ‘labor’, ‘marketing of maize’, ‘land for maize cultivation’, ‘harvesting problems’ and others.

5.2 Conclusions

Major findings of the present study and their logical interpretation of other relevant facts prompted the researcher to draw the following conclusions-.

i. About cent percent of the maize growers had low to medium income indicating that low to medium income which decreases their capabilities to purchase the required inputs, hire laborers and meet other production costs involved in their cultivation of a modern varieties. Thus, it may be concluded that credit can be an option to increase maize production area.

ii. Education of the farmers having negative relationship with their adoption of maize production technologies, one may conclude that maize production can be improved if educational levels of the growers could be upgraded.

iii. Adoption of maize production was moderate to high by vital portion (82.5%) of the farmers. It can be concluded that farmers are interested in maize cultivation.

iv. Mean BCR of maize production was found 1.36. It can be concluded that farmers are in problems to obtain the optimum production.

v. Introduction of maize to the farming system in a planned way has been a recent phenomenon. The negative significant relationship between age and adoption leads to a conclusion that relatively younger farmers are more innovative than the older farmers.

vi. Area under maize cultivation of the farmers showed a significant positive relationship with their adoption of maize production technologies. It was found that farmers having larger area under maize cultivation and farmers that Integrated Maize Developing Programmed will be effective if this reality is kept in mind of extension personnel's and to the programmed planners.

vii. The three top most problems were lack of storage facility, credit shortage and lack processing mechanism for consumption as food. Therefore, it can be concluded that the popularity of maize production would be decreased if these problems can’t be addressed properly.

5.3 Recommendations

Based on the above conclusions of the study, the following recommendations are put forward towards policy formulation.

5.3.1 Recommendations for policy formulation

i. Among the 4 maize varieties Bahuboli 555, Palwan **,** Dalia 4455, Kabri 50 showed Therefore, this variety can be introduced to the area for achieving maximum benefit by the growers.

ii. As lack of storage facility, credit shortage and lack processing mechanism for consumption as food were observed as vital problems encountered by the growers. Therefore, Bangladesh Agricultural Development Corporation (BADC) or relevant NGO or Company may purchase their product at a reasonable price.

iii. Credit organizations may come forward to provide short term credit to the maize growers.

iv. GO, NGO or Company may import the processing mechanism of maize to consume it as food by the rural people.

v. Department of Agricultural Extension (DAE) and NGOs can be involved in the conduction of training programs.

5.3.2 Recommendations for further study

A small piece of study as has been conducted cannot provide all information for the proper understanding of the farmers towards the maize cultivation. Therefore, the following recommendations were made for further study.

i. The present study was conducted at Gangachara Upazila under Rangpur district. It is recommended that similar studies may be conducted in other areas of Bangla desh having similar socio-economic conditions.

ii. This study investigated the relationship of fifteen characteristics of the farmer with their adoption of Maize variety. Therefore, it is recommended that further study can be conducted considering other characteristics of the farmers.

iii. The present study was concerned only with the extent of adoption of selected maize variety. It is therefore, suggested that future studies may include attributes in relation to adoption stages and adopter categories.

iv. Research also may be undertaken to identify the factors causing hindrance to the high adoption of maize variety.

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APPENDIX-A

English Version of the Interview Schedule Department of Agricultural Statistics Sher-e-Bangla Agricultural University Dhaka-1207

Interview Schedule For A Research Study On Adoption and Profitability of Maize Production in Gangachara Upazila under Rangpur District

Name of the respondent:

Mobile No:

Village: **Union:**

Upazila: **District:**

1. **Age:** How old you are you?.....Years, Young (Up to 35) ……., Middle (36 to 50) ……., Old (>50) ……Years.
2. **Family size:** How many members are there in your family? .....Persons Single Family (<4): ..... Nuclear Family (4 to 7): ..... , Large Family (>7)…….
3. **Level of education:** Illiterate …..…., Primary(1-5) ...…….., Secondary(6-10)……, Higher Secondary(>10)..……, Higher Studies…….

4.Farm size:

Mention the area of your land according to tenure and use

Sl. No.	Types of land	Total (decimal)	Total (hectare)
1	Homestead		
2	Own land under own cultivation		
3	Land Shared in		
4	Land Shared out		
5	Land Leased in		
6	Others/pond/garden		
	Total		

5. Annual Family Income:

Please mention about your annual income from the following sources

Source of income		Total production Kg/Mon	Price per unit Kg or Mon/ha.	Total price (Tk.)
Agriculture	Maize Rice Wheat Other vegetables Poultry Livestock Fisheries Others			
Sub-total				
Non-agriculture	Business Service Others			
Sub-total				
Total				

6. Main Occupation: .....

7. Farming Experience: ..... Years

8. Training exposure:

Have you received any training? i. Yes… ii. No …if yes

Subject of the training	Sponsoring agency	Duration (day)	Year	Utilization
a)				
b)				
c)				

High =3, Medium=2, Low=1, Not at all=0

9. Extension contact: Please indicate the extent of your contact with the following sources.

Sl. No.	Place of visit	Nature of visit			
		Frequently(3)	Occasionally(2)	Rarely(1)	Not at all(0)
1	Contact with extension officers UAO				
2	Contact with SAAOs				
3	Contact with seed dealers				
4	Contact with NGO worker				
5	Others				

Note: Frequently =15 days, occasionally =30 days, Rarely =6 months

10. Organizational Participation: Please mention your involvement with the following organizations during the last five years

Sl. No	Name of organization	Nature of involvement (duration)			
		Not involved	Ordinary member (Yr)	Executive committee member (Yr)	President or secretary (Yr)
1	Youth committee				
2	Women Association				
3	Village Development Samitee				
4	School/College governing board				
5	Market Committee				
6	NGO's Committee				
7	Masque				
8	Others (if any)				

11. Adoption of maize production technologies

Technologies	Year of introduction	Year of awareness	Year of adoption	Potential area	Actual area

12. Human labor cost of maize production (Per hectare)

Particulars	Requirement of labors		Unit cost	Total cost
	Family	Hired		
Land preparation				
Cleaning, seed sowing				
Fertilizers and insecticide application				
Irrigation				
Harvesting				
Carrying and drying				
Selling and storing				
Total				

13. Cost of maize production (Per hectare)

Cost items	Amount required	Unit cost	Total cost
A) Variable cost			
i. Labor			
ii. Power tiller			
iii. Seeds			
iv. Manure			
v. Fertilizers			
vi. Insecticides			
vii. Irrigation			
viii. Threshing			

Total variable cost			
B) Fixed cost			
i. Interest on capital			
ii. Land use cost			
Total fixed cost			
Total cost(A+B)			

14. Returns from maize production (Per hectare)

Particulars	Quantity	Price per unit	Total price
Yield (kg)			
Maize straw			
Total			

15.Constraints faced by the farmers in maize production

Sl. No.	Constraints	Extent of problem			
		H*	M	L	NAA
1	Availability of hybrid seed				
2	Technical information				
3	Availability of credit				
4	Seed availability at farmers' level				
5	Land for maize cultivation				
6	Irrigation facilities				
7	Input cost (seed, fertilizer, pesticide)				
8	Labor				
9	Knowledge on maize production				
10	Harvesting				
11	Marketing of maize				
12	Consumption				

13	Storage				
14	Marketing				
15	Others				

*High=3, Moderate=2, Low=1, Not at all=0

Thank you for your kind co-operation.

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