

# ADOPTION OF UREA SUPER GRANULE BY THE BORO-RICE GROWERS

By  
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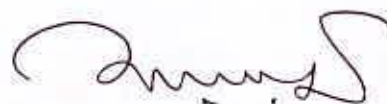
A thesis  
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## *CERTIFICATE*

This is to certify that thesis entitled, “**Adoption of Urea Super Granule by the Boro-Rice Growers**” submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL EXTENSION AND INFORMATION SYSTEM, embodies the result of a piece of bona fide research work carried out by Mr. Noor Mohammad Mamun, Registration No. 25138/00284 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

**Dated:** 14. 2. 07

**Place:** Dhaka, Bangladesh



(Professor Mohammad Hossain Bhuiyan)

**Supervisor**

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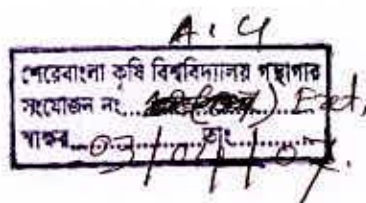
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# **ADOPTION OF UREA SUPER GRANULE BY THE BORO-RICE GROWERS**

## **Thesis Abstract**

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The main purpose of this study was to determine the adopter categories and measure the relationship of the adoption of Urea Super Granule with the selected characteristics of the farmers. The characteristics are: age, education, family size, farm size, annual income, extension contact, cosmopolitaness, organizational participation, agricultural knowledge, and attitude towards Urea Super Granule. The study was conducted in a Block of Manikgonj Upazilla named Mulzan. Out of one thousand one hundred and sixty three farmers 232 farmers were randomly selected and 167 respondents adopted Urea Super Granule (USG). The findings revealed that 24.85% had high adoption whereas, 57.32% and 24.85% farmers had medium and low adoption respectively. In the study area USG has introduced 8 years earlier. Considering the period of USG the respondents were distributed in the line of adopter categories forwarded by Rogers (1995). In Bangladesh context the percentage distribution among adopter categories was found a little bit different such as; Innovators 1.91%, Early Adopters 12.1%, Early Majority 34.39%, Late Majority 36.3% and Laggards 15.3% whereas, Rogers distribution was Innovators 2.5%, Early Adopters 13.5%, Early Majority 34%, Late Majority 34% and Laggards 16%.

# Chapter I

## Introduction

### 1.1 General Background

Bangladesh is predominantly an agricultural country. In her 14, 7570 square kilometer area approximately 140 million people live with high density. The population is increasing at a birth rate of 1.8, which causes the decrease of farm size in a horrid manner. The extra population is a threat to the total production. At present the contribution of agriculture to the total GDP (Gross Domestic Production) is around 27%. Before liberation in this country food deficit was a common phenomenon. After liberation different research organizations developed HYV of rice. As a result the food deficit has been gradually decreased. Before liberation the government had to spend a lot of money for the import of rice. But nowadays the production of rice is quite satisfactory. To increase this production the research organizations and the Department of Agricultural Extension (DAE) are playing the most important role.

The total food deficit was approximately 15 lac ton in the year 2003-04 (Economic Survey, 2003-04). In the year 2001-02 Bangladesh imported 5707 metric ton rice, which cost nearly TK.65641000 (BBS 2003). In Bangladesh rice is grown in three seasons namely; Aus, Aman and Boro. Among those three seasons Aman and Boro rice occupies bigger position with regard to production. In the year 2003-04 rice was cultivated in 76.27% of total cultivable land (Year Book of Agricultural Statistics of Bangladesh 2004). The area of rice was composed of 11.11% Aus, 52.46% Aman and 36.43% Boro (Year Book of Agricultural Statistics of Bangladesh 2004). The total rice production of

that year was 26189 thousand M. tons (Year Book of Agricultural Statistics of Bangladesh 2004). Land under Boro rice cultivation was 974000 acres and the production was 12837000 M tons (Year Book of Agricultural Statistics of Bangladesh 2004). In 2004-05 the production has increased and it was 25183.1 thousand M tons, whereas the production of Boro rice was 13837.1 thousand M tons which is more than the half of the total rice production ([www.moa.gov.bd/statistics](http://www.moa.gov.bd/statistics)). In fact Boro rice has the higher production than the other two rice growing seasons. It also requires more fertilizers and care.

Balanced fertilization is the key to enhance the rice production. Nitrogenous fertilizer is playing the pivotal role in this aspect. Modern rice varieties like, the HYVs need more fertilizers. It is widely recognized that nitrogen fertilizer use in Bangladesh needs special emphasis. Nitrogen deficit is found in almost all types of soils of Bangladesh for the low level organic matter content. Unfortunately the efficiency of nitrogen fertilizers in wet land rice cultivation is very low and it is only 30% of the applied nitrogen (Prasad and De Datta, 1979).

Urea is the major nitrogenous fertilizer used in Bangladesh for rice cultivation. The total production of Urea was 198620 thousand M tons in 2003-04 and 235 thousand M ton Urea was imported (Year Book of Agricultural Statistics of Bangladesh 2004). In 2004-05 the total domestic production of Urea was 1878 thousand M tons whereas the demand was 2600 thousand M tons. The quantity of imported urea was 567 thousand M tons ([www.moa.gov.bd/statistics](http://www.moa.gov.bd/statistics)). At present the farmers pay 1000 taka per hectare for Urea during rice cultivation and the farmers vastly use it. But about 60-70 percent of urea is

lost due to broadcasting in prilled form (Hasan, 2000). This loss occurs in the form of ammonia volatilization, de-nitrification, run-off and leaching. This loss increases the production cost and also pollutes the environment as well. To reduce this considerable loss Urea Super Granule (USG) has been introduced which is locally known as "Gutee Urea". This is recommended for the deep placement in the rice field.

This urea is an innovation, which enhances the efficiency of urea and also reduces the cost of fertilizer in rice field. In Bangladesh research on USG started in early eighties. The efficiency of USG compared to prilled urea in increasing the yield of Boro rice by roughly 20 percent was demonstrated in a number of studies conducted by different organizations in the country (Paul, 2000). Similarly it also exhibited the increase in yield of transplanted Aman rice in a case study in Tangail district (Haque, 1998). USG is a granule of 0.9 mm diameter and applicable where line sowing is done.

Soil science division of BRRI (Bangladesh Rice Research Institute) conducted several researches on Urea Super Granule (USG) in wet land rice. The relative advantage of USG compared with the Prilled Urea (PU) has been revealed in those researches in last two decades. They are briefly mentioned below,

- About 70 percent uptake is ensured by USG application as compared to Prilled urea.
- 20-25 percent yield increase with an average production of 1220 kg/ha.
- 30 -35 percent savings of urea is ensured.
- Enriches the quality of rice grain and straw.

- Due to the deep placement it ensures the soundness of environment.
- Crop grows uniformly throughout the crop cycle without any deficiency of nitrogen.

This granule urea (3 granules) has to apply in the place between 4 seedlings of rice, which have a spacing of 8 inches X 8 inches. The granule has to place nearly 3-4 inches depth of the soil and while applying this fertilizer it has to be assured that the field is irrigated with a depth of 1 inch. Within the 3-7 days of transplanting the application should be done and the field should have enough moisture, so that the fertilizer can easily release the nitrogen.

**Table 1.1 A sample of harvest result of Field Days Jointly organized by DAE and ATDP/IFDC during Boro season in 1998-99.**

| Name of district and sample size | Quantity applied (kg/ha) |            | Percent Urea savings<br>USG | Quantity applied (kg/ha) |             | Yield difference (kg/ha) | Percent yield increase |
|----------------------------------|--------------------------|------------|-----------------------------|--------------------------|-------------|--------------------------|------------------------|
|                                  | USG                      | PU         |                             | USG                      | PU          |                          |                        |
| Dhaka (7)*                       | 171                      | 231        | 26                          | 8256                     | 7194        | 1062                     | 15                     |
| <b>Manikgonj (3)*</b>            | <b>174</b>               | <b>312</b> | <b>44</b>                   | <b>6997</b>              | <b>5940</b> | <b>1057</b>              | <b>18</b>              |
| Narayangonj (1)*                 | 173                      | 220        | 21                          | 7487                     | 5487        | 2000                     | 36                     |
| Munsigonj (1)*                   | 172                      | 222        | 23                          | 8500                     | 6500        | 2000                     | 31                     |
| Mymensingh (18)*                 | 167                      | 240        | 30                          | 8755                     | 6889        | 1866                     | 27                     |
| Jessore (14)*                    | 165                      | 230        | 28                          | 6945                     | 6256        | 689                      | 11                     |
| Comilla (2)*                     | 163                      | 238        | 32                          | 8063                     | 6215        | 1848                     | 30                     |
| Chandpur (4)*                    | 160                      | 226        | 29                          | 9563                     | 7875        | 1688                     | 22                     |
| Tangail (24)*                    | 161                      | 248        | 35                          | 7598                     | 6580        | 1018                     | 15                     |
| Jamalpur (28)                    | 161                      | 247        | 35                          | 8232                     | 7182        | 1050                     | 15                     |
| Bogra (7)*                       | 160                      | 250        | 37                          | 8361                     | 6798        | 1563                     | 23                     |
| Gaibandha (4)*                   | 161                      | 294        | 45                          | 9507                     | 7910        | 1597                     | 20                     |
| Joypurhat (6)*                   | 161                      | 299        | 46                          | 7287                     | 6005        | 1282                     | 21                     |
| Rajshahi (6)*                    | 155                      | 230        | 33                          | 6491                     | 5788        | 703                      | 12                     |
| Average                          | 167                      | 241        | 31                          | 8040                     | 6612        | 1428                     | 22                     |

Source: Hasan, 2000

\* Parenthesis indicates the no. of field days in each district

Table 1.1 shows the superiority of USG application over the broadcast of prilled urea (PU) in wet land rice field. The table also has proved the potentiality of USG in Boro season. The location of this research, in Manikgonj district the application of USG showed a significant yield increase.,

The DAE continues to play a pioneering role in disseminating this new technology among the farmers throughout the country. With the proven success of USG in terms of increase efficiency of nitrogen and production increase, DAE launched a multifaceted approach to appraise the farmers about the benefits and necessity of USG particularly in irrigated rice cultivation. With assistance of different organizations, NGOs; DAE is transferring this innovation among the farmers of the country. Also some collaborative projects like IRRI-PETRA, ATDP encourage the farmers to use USG. In the year 2000 the government sanctioned a special allotment of 150,000 tons prilled urea to manufacture the USG (Hasan, 2000). During the Boro season of 1999-2000 year BRAC distributed 1793 M tons USG among the farmers in almost all over the country (Abubakar, 2000). The table 1.2 shows the progressive achievement of USG in the country from 1996-2000.

**Table 1.2 Progressive achievement of USG in Bangladesh**

| Period                                 | July 95-<br>June96 | July 96-<br>June97 | July 97-<br>June98 | July 98-<br>June99 | July 99-<br>June2000 |
|----------------------------------------|--------------------|--------------------|--------------------|--------------------|----------------------|
| Number of machines installed           | -                  | 2                  | 20                 | 212                | 537                  |
| Number of districts covered            | 1                  | 3                  | 6                  | 43                 | 47                   |
| USG sold (M ton)                       | 0.32               | 98                 | 1639               | 15691              | 75000                |
| Area covered (ha)                      | 2                  | 610                | 10,180             | 108,434            | 500,000              |
| Employment generation<br>(person/year) | 0.05               | 273                | 1619               | 2,912              | 13,362               |

Source: Hasan, 2000.

The above table also shows that the farmers adopt the innovation by the time being. In fact to adopt a new innovation individuals take time to assess its benefits and

compatibility. Many innovations are continuously being improved using farming experience and new research findings. Some are adopted more rapidly than others because farmers perceive them to have favorable characteristics that are important for their decision to adopt.

Whenever an innovation is generated then efforts have been made to adopt the innovation. To meet up the increasing need of this country and to increase the agricultural production new technologies are always encouraged and emphasis given to adopt them by the farmers. To gear up the production of rice farmers are being encouraged to adopt balanced fertilization. USG is an innovation related to the production of rice and it has already been proved that this nitrogenous fertilizer is effective in nutrient uptake and increase production and also reduces the production cost of rice.

As USG is an innovation it should have attributes of; (a) relative advantage, (b) compatibility, (c) complexity, (d) trialability and (e) observability (Rogers, 1983). Since its release in the year 1998 DAE, different NGOs and other local and overseas institutions have taken initiatives to diffuse USG among the farmers through various extension programs. The farmers are also adopting this innovation by the passes of time. Considering the above facts and findings the researcher has become eager to undertake the present study, the purpose of which is to determine the categories of USG adopters. But very few researches have been done on USG and so far in Bangladesh only one research has been done on adopter categories (Khan, 2002).



## 1.2 Statement of the problem

The sustainable increase in production of rice can be ensured to a great extent by the proper management of fertilizers. Among all the fertilizers urea is considered as the most important one in rice production. But the efficiency of prilled urea is a bit low whereas the efficiency of USG is comparatively better. This urea slowly releases the nitrogen that enhances the yield of rice as the plant can uptake adequate nitrogen due to less loss (Ramaswamy, 1987 and Rao and Ghai 1987). So it is evident that this fertilizer has positive impact on the production of rice. Therefore, it is necessary to have clear understanding about the adoption and the adopters of USG.

The success of any innovation depends on its adoption by the potential users, which in turn helps to identify the adopters and how they adopt the new technologies. It is to be anticipated that certain sustainable development can take place in the agriculture of Bangladesh if the technologies can be transferred properly. In other words increasing the rate of adoption and increasing the number adopters of innovations can ensure improvement.

The government is emphasizing on producing more crops, especially rice. But how it can be possible? The answer is by adopting new technology. But a workshop conducted by Department of Agricultural Extension (DAE) has reported that farmers adopt only 30 percent of the modern rice varieties of rice (DAE 2000). So now it is the high time to disseminate new technologies to the farmers through different organizations. Modern rice production techniques should be adopted and the rate of adoption has to be increased as well. To increase the rate of adoption DAE can play the vital role. Also the DAE workers have to keep in mind the Rogers Theory "Not all individuals in a social system adopt an innovation at the same time."

Rogers conducted his research in USA and he proposed a categorization of adopters of new technologies in 1962. According to his categorization, there are five types of adopters in a social system. The *Innovators* are the first category, who is willing to take risk as well as leaders of the society. They are called “progressists,” “advance scout” etc. On the other hand the least innovative individuals are named *Laggards* by Rogers who are, “drones,” “dichards” etc. Rogers also mentioned the percentage of the adopter categories.

Rogers put his classification of adopters in advanced condition but in this country the adopters may not follow his classification. Also we have to consider that whether the characteristics of adopters are similar to what Rogers proposed or not. So far this research has not been conducted in this country. Till now Rogers’s adopter categories are being used in transfer of technology.

Apart, the adopters of Urea Super Granule (USG) also need to be determined to increase the use of this technology. This fertilizer saves the excessive loss of urea and also very effective to increase the rice production in Boro season. This will also help to develop a petite concept that in Bangladesh aspect the suitability of Rogers’s categorization. In order to know the adopter categories the following questions should be answered:

What are the farmers’ levels of adoption in respect of USG?

What are the adopter categories of the farmers in relation with the adoption of USG?

Do the adopters follow the distribution made by Rogers?

What are reasons for adopting the USG?

In view of the foregoing discussion the researcher undertook a study entitled “**Adoption of Urea Super Granule by Boro-rice Growers**”.

## **1.2 Objectives of The Study**

To attain the following objectives the researcher has decided to undertake this research:

### **Specific Objectives:**

1. To describe the extent of adoption of the USG.
2. To determine the categories of the USG adopters.
3. To explore the relationship between the selected characteristics of farmers with extent to adoption of USG.

The selected characteristics are

- a) Age
- b) Family size
- c) Education
- d) Farm Size
- e) Annual Income
- f) Extension contact
- g) Cosmopolitaness
- h) Organizational participation
- i) Agricultural knowledge
- j) Attitude toward the USG

## 1.4 Justification of the Study

Rice is grown in most of the cultivable land of Bangladesh and the farmers grow rice in their field consecutively. So after third or fourth cultivation the land faces nitrogen deficit. As a result the plants do not get the proper nutrients and ultimately the yield is reduced. Considering the production, Boro has a lion share on the total rice production. Most of the farmers grow HYVs in Boro season, which requires more urea and irrigation. USG can play a significant role in the production of Boro rice. This fertilizer reduces the fertilizer cost and labor of the farmers and helps to increase the yield as well. So the adoption of this technology will definitely have a positive impact on the production of rice.

The main focus of this research is to determine the adoption of the USG and the categories of USG adopters. Empirical evidences show that the perceived attributes of innovation and farmers' characteristics affect their adoption and diffusion to a great extent in a social system. Unfortunately very few studies have been done in this aspect though many innovations have already released by National Agricultural Research System (NARS). Subsequently no specific research has been conducted on the adopters or the categories of adopters of new innovations. In this study the researcher tried to determine the adopters and their classification in aspect of Urea Super Granule (USG) adopters. This would help both the researcher and the extension specialists to have an idea about the categories of adopters in Bangladesh and it will help for further research on this aspect.

For conducting this research Manikgonj district has been selected where USG was introduced in the year 1999. It has been proved suitable for the application in the rice field and it is also contributing the increase of the production of Boro rice. So, it should

be recognized that the findings of the study will be apposite for the study area. However the findings may be applicable in other part of the country having the similar condition. Thus the findings will be helpful for the planners to make policy of disseminating the USG to the farmers and also it will facilitate a concept of adopting agricultural innovations by the farmers. Apart, this will assist the extension worker to organize their techniques and strategies of transferring agricultural technologies. Further, there is a great scope for investigation on adopter categories, because very little is known about this so far in Bangladesh.

## **1.5 Assumptions and Limitations**

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Good and Hatt, 1945). That means the assumption is taken as a fact or belief to be true. While undertaking this research, the researcher possessed the following assumptions in mind:

1. The respondents included in the sample are proficient to furnish proper response to the queries included in the interview schedule.
2. The researcher was competent enough as an interviewer and well adjusted to social environment of the study area. Also the data collected by him would be free from any kind of biasness.
3. The questions included in the questionnaire were reasonably adequate to measure the adoption of USG and to categorize the adopters of USG.
4. The responses furnished by the respondents were reliable, valid and they expressed the truth about their condition and opinion.

5. The views of the respondents included in the sample would be representative of the whole population of the study area.
6. The adoption of USG was linearly related with the selected characteristics of the farmers.
7. The USG adopters would follow the distribution of adopter categories mentioned by Rogers.
8. The findings would be useful for further dissemination not only of USG but also the other agricultural innovations to the extension planners.

While conducting this research, considering the time and other necessary resources available to the researcher and to make the research meaningful the following limitations were recognized:

1. The research was cramped to a block of Manikgonj Sadar Upazilla.
2. The study investigated only the USG adopter categories.
3. The respondents were only the Boro rice grower.
4. The researcher had to depend on the data furnished by the selected Boro rice growers.
5. In some cases the researcher faced unexpected interference from the over interested side-talkers while collecting data from the target respondents. However, he tried to overcome the problem as far as possible with sufficient tact and skill.
6. Reluctance of the farmers to provide information was overcame by establishing rapport.
7. The characteristics of the farmers in the study area were many and varied but only 10 characteristics were selected for the investigation.

However the findings of the research will particularly be applicable to the block of Manikgonj Sadar Upazilla. The findings may also be suitable where the situation is similar to the study area.

## **1.6 Statement of Hypothesis**

Hypothesis simply means a mere assumption or some supposition to be proved or disproved. But for the researcher, hypothesis is a formal question that he intends to resolve. According to Kerlinger (1973) "A hypothesis is a conjectural statement of the relation between two or more variables. Hypotheses are always in declarative sentence form, and they relate, either generally or specifically, variables to variables". Hypotheses may broadly be divided into two categories namely; Alternate hypothesis and Null hypothesis. The former one is that the researcher wants to prove and the latter one he wants to disprove.

The following research hypotheses were put forward to test the relationship between each of the 10 selected characteristics of the farmers and their adoption of USG. However for the purpose of statistical test it becomes necessary to formulate null hypothesis. The null hypotheses were as follows:

There is no relationship between 10 selected characteristics (independent variables) of the farmers and their adoption of USG (dependent variable).

The distribution of the USG adopters does not follow the categories made by Rogers.

## **1.7 Definition of Terms**

A number of key terms have been used throughout the study are defined below to avoid confusion and misunderstanding.

### **Adopter categories**

The individuals in a social system do not adopt an innovation at the same time just after hearing. Rather, they adopt an innovation over a period of time and they can be classified on the basis of when they first use the innovation. The classification of the adopters regarding an innovation is called adopter categories. Rogers (1983) made the categories of adopters and they are Innovators, Early Adopters, Early Majority, Late Majority and Laggards. In this study the USG adopters are categorized in the light of Rogers's categories.

### **Adoption**

Adoption means the use of an innovation make by the individuals. "Adoption" may be defined as the continued use by individuals or groups of a recommended idea or practice over a reasonably long period of time (Dasgupta, 1989). In this study adoption is defined as the use of USG by the Boro rice growers.

### **Innovativeness**

Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system. Innovativeness is a relative dimension, in that one has either more or less of it than others in a social system (Rogers, 1983).

### **Urea Super Granule (USG)**

Urea Super Granule is kind of urea fertilizer and made by the Briquetter machine from ordinary urea fertilizer. The size of each granule is 0.9 millimeter in diameter. This urea



has to apply in the rice field where the seedlings are transplanted in line and a granule is placed among the place of four seedlings with 3-4 inches depth. And the field has to be well irrigated while applying this urea.

#### **Age**

The age of the respondent farmer was defined in years.

#### **Education**

The level of education of the respondents was mentioned. While interviewing they were asked to mention their level of formal education.

#### **Family Size**

The total number of family members of the respondents including him was expressed in number.

#### **Farm Size**

It refers to the total area on which a farmer's family carries farming operation. The area was estimated in terms of full benefit of the farmer's family.

#### **Annual Income**

It refers the total annual income of the respondent farmer's family. It included both the agriculture and non-agriculture source. It was expressed in Taka.

#### **Extension Contact**

It is the degree of an individual's exposure to or contact with different communication media, sources and personnel being used for the disseminating the new technologies among the farmers.

#### **Cosmopolitaness**

The cosmopolitaness of the farmers refers their extent of visit outside their own village or social environment.

### **Organizational Participation**

It refers the respondent farmer's involvement in different social or political organizations either as an ordinary member, executive member or the executive committee within a specified period of time.

### **Agricultural Knowledge**

This indicates the agricultural knowledge of the respondents. The farmers were asked ten questions related to farming and according to their answer they were marked. In fact, it is the basic understanding of the farmers in different aspects of agricultural subject matters.

### **Attitude toward the Use of USG**

Attitude means one's feeling, belief and action toward an object. The attitude toward USG means their feelings, beliefs and action toward the use of USG in Boro rice field.

## Chapter II

### Review of Literature

Reviews of literatures relevant with the major objectives of this study are conveniently presented in this chapter. An elaborate search has been done to collect the reviews pertinent with the study. The study was done mainly to determine the adoption of Urea Super Granule and to categorize the adopters of Urea Super Granule (USG) in Boro season. So, adequate numbers of literatures were not available as research on adopter categories is a rare study. However the researcher has tried his best to collect related reviews from different books, journals and thesis. This chapter has several sections and subsections.

#### 2.1 Adoption, Diffusion and Adoption process

Adoption is a decision to make full use of innovation as the best course of action available (Ray, 1991). When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption.

Diffusion is the process by which an innovation is communicated through certain channels overtime among the members of social system (Ray, 1991).

Rogers and Shoemaker (1971) stated the adoption process as; the traditional view of the innovation decision process, called "adoption process" was postulated by a committee of rural sociologists in 1955 as consisting of five stages:

**Awareness stage:** The individual learns of the existence of the new idea but lacks detailed information about it.

**Interest stage:** The individual develops interest in the innovation and seeks additional information about it.

**Evaluation stage:** The individual makes mental application of the new idea to his present and anticipated future situation and decides whether try it or not.

**Trial stage:** The individual applies the new idea on a small scale in order to determine its utility in his own situation.

**Adoption stage:** The individual uses the new idea continuously on a full scale.

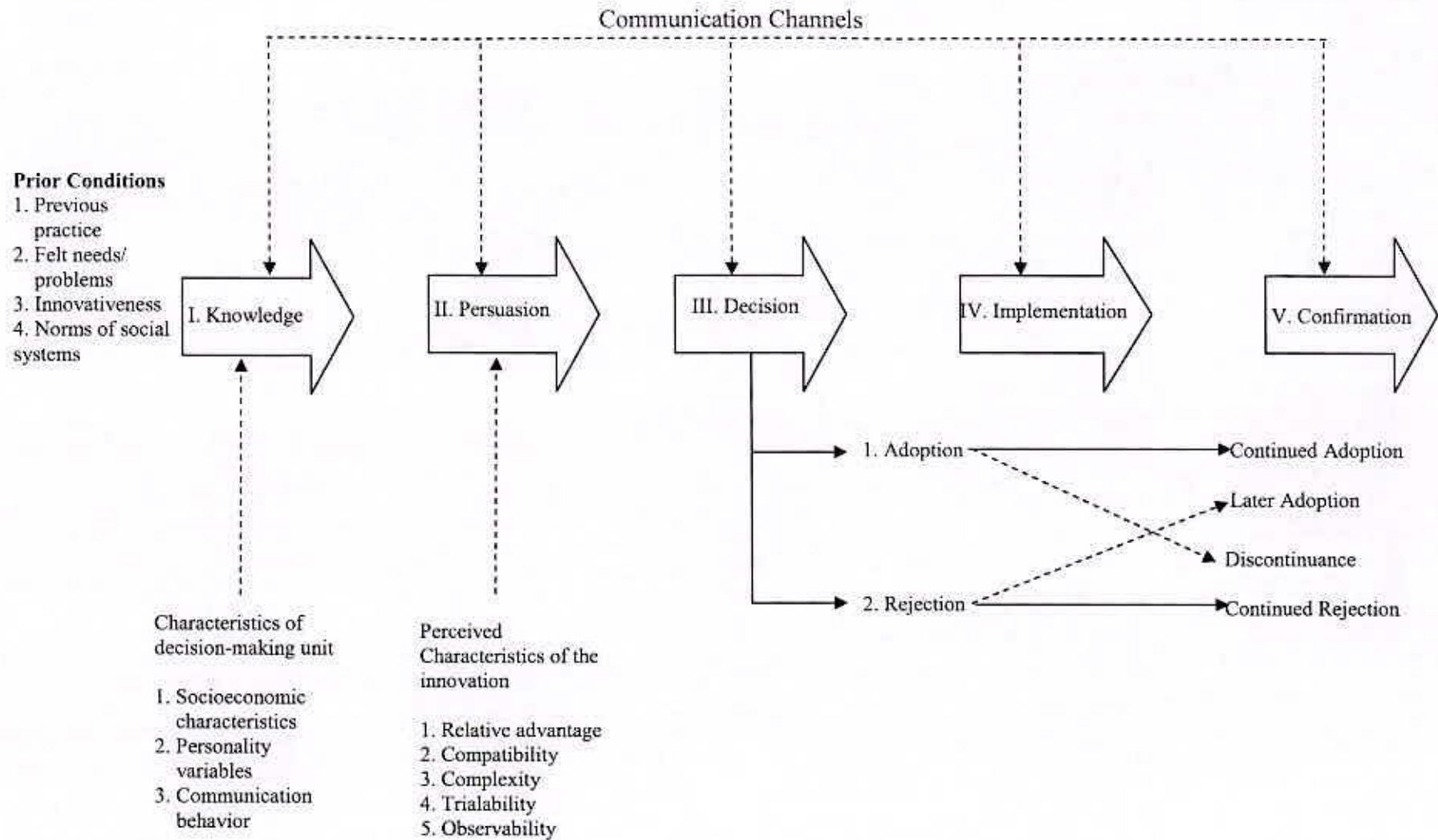
### **2.1.1 Innovation Decision Process**

The innovation decision process is the process through which an individual (or other decision making unit) passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implement of new idea and to confirmation of this decision. This process consists of series of actions and choices over time through which an individual or organization evaluates a new idea into ongoing practices. The behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. It is the perceived newness of the innovation and the uncertainty associated with the newness that is a distinctive aspect of innovation decision making. An individual's decision about an innovation is not an instantaneous act. Rather, it is a process that occurs overtime and consists of a series of actions (Rogers, 1983). The model of the innovation decision process is depicted in Fig. 2.1.1

The present conceptualization consists of five stages (Rogers, 1983):

1. Knowledge occurs when an individual (or other decision making unit) is exposed to the innovation's existence and gains some understanding of how it functions.

2. Persuasion occurs when an individual (or other decision making unit) forms a favorable or unfavorable attitude towards the innovation.
3. Decision occurs when an individual (or other decision making unit) engages in activities that leads to choice either adoption or rejection of the innovation.
4. Implementation occurs when an individual (or other decision making unit) puts an innovation into use.
5. Confirmation occurs when an individual (or other decision making unit) seeks reinforcement of an innovation decision already made but he or she may reverse his or her previous decision if exposed to conflicting messages about the innovation.



**Fig2.1.1 A Model of Stage in the Innovation-Decision Process (Rogers, 1983)**

## **2.2 Adopter Categories**

The five adopter categories as set forth by Rogers (1983) include the following:

### **Innovator: Venturesome**

Venturesome is almost an obsession with innovators. They are very eager to try new ideas. This interest leads them out of local circle of peer networks and into more cosmopolite social relationship. Communication patterns and friendship among an innovator is venturesome. The innovator plays a gate-keeping role in the flow of new ideas into a social system. They are 2.5% in the society.

### **Early Adopters: Respectable**

Early adopters are a more integrated part of the local system. Early adopters are respected and this category has the greatest degree of opinion leadership in most social system. Potential adopters look to early adopters for advice and information about the innovation. The early adopters are considered by many as “the individual to check with” before using the new idea. This adopter category is sought by change agents to be a local missionary for speeding the diffusion process. The early adopters are approximately 13.5% in the society.

### **Early Majority: Deliberate**

The early majority adopts new ideas just before the average number of a social system. The early majority interacts frequently with their peers but seldom hold relationship position. They provide inter connectedness in the system’s network.

The early majority may deliberate for sometime before completely adopting new idea. Their innovation decision period is relatively longer than that of the innovator and the early adopters. They are approximately 34% in the society.

**Late Majority: Skeptical**

The late majority adopt new ideas just after the average number of a social system. Adoption may be both in economic necessity and the answer to increasing network pressures. Innovations are approached with a skeptical and cautious gesture and the late majority does not adopt most others in their social system have done so. They are approximately 34% in the society.

**Laggards: Traditional**

Laggards are the last in the social system to adopt an innovation. They possess almost no opinion leadership. They are localite in their outlook of all adopter categories: many are near isolates in social network. Decisions are often made in term of what has been done in previous generations and these individuals interact primarily with others who also have relatively traditional values. When laggards finally adopt an innovation, it may already have been superseded by another recent more idea that is already being used by innovators. Laggards tend to be frankly suspicious of innovations and change agents. They are approximately 16% in the social system.

Khan (2002) conducted a study on the adoption and adopter categories of Binasail rice variety (a rice variety released by BINA). In his study he found Innovators were 5%, Early Adopters were 12 %, 36 percent Early Majority, another 36% Late Majority and 11% Laggards. He conducted the study in Ghagra Union of Mymenshingh district and the total number of respondents was 106.

livari, and Janson (2003) conducted a study on Analysis of Electronic Commerce Adopter Categories in Retailing: The Case OF Automobile Dealerships. Based on a qualitative



analysis of semi-structured interviews of seven automobile dealerships in the City of Oulu, Finland, they uncovered four themes — strategic understanding of electronic commerce, technological understanding of electronic commerce, maturity of the website supporting electronic commerce, and electronic commerce developmental strategy — which allowed to make sense in a succinct way of the similarities and differences among seven automobile dealerships. Locating the seven dealerships on these four themes (dimensions) yielded quite consistent patterns, and led to identify adopter categories of electronic commerce. They suggested three major adopter categories: “procrastinators,” “followers,” and “visionaries.” “Followers” are divided further into “opportunists,” “waverers,” and “striders.”

Shetty (1968) conducted a research to identify the adopter categories three innovations; they were improved seed, chemical fertilizer and Japanese method of rice cultivation. The study conducted in two villages of Mysore in India. He found the following adopter categories:

**Table 2.2 Percent distribution of adopter categories for three innovations.**

| Adopter categories    | Improved seed | Chemical Fertilizer | Japanese Method of rice cultivation |
|-----------------------|---------------|---------------------|-------------------------------------|
| Innovators            | 3.4           | 2.3                 | 22.1                                |
| Early Adopters        | 11            | 10                  | 19.8                                |
| Early Majority        | 27.3          | 28.4                | 32.1                                |
| Late Majority         | 48.3          | 53.2                | 17.3                                |
| Laggards              | 10            | 5.1                 | 8.6                                 |
| Total No. of adopters | 201           | 130                 | 81                                  |
| Total no. of farmers  | 270           | 270                 | 270                                 |

## **2.3 Relationship between Farmers' Characteristics and Adoption**

### **2.3.1 Age and Adoption**

According to Khan (2002), there was no significant relationship between farmers' age and adoption of Binashail rice. The study was conducted in Ghagra Union of Mymensingh District.

Paul (2000) observed that there was no significant relationship between farmers' age and the adoption of urea super granule in Abhaynagar upazilla of Jessor district.

Hossain (1999) conducted a study to determine the farmers' perception of the effects of agrochemical on environment. He found insignificant relationship between farmers' age and adoption of agrochemicals.

Chowdhury (1997) observed that the age of the farmers had no significant relationship with their adoption of selected BINA technologies even at 0.05 level of probability.

Islam (1993) found that there was no relationship between the age of the farmers and adoption of improved practices of potato cultivation.

Pathak and Sasmal (1992) observed that there was positive relationship between the age of the farmers and their adoption of jute technologies. Similar results were also found by Singh and Rajendra(1990) Ali *et al.* (1986) and Hossain (1991).

Bavaltti and Sundarswamy (1990) found that the age of the farmers was not related with their adoption of dry land farming practice, rather it had a negative trend.

Gogoi and Gogoi (1989) found in a study that age of the farmers had a negative effect on the adoption of recommended plant protection practices.

Sheoran and Ramkumer (1988) conducted a study named correlates of adoption of dairy innovations of IRDP beneficiaries in India. They revealed that the age of the IRDP beneficiaries had positive relationship with the adoption of dairy innovations.

Ramegowda and Shiddaramaiah (1987) made an investigation on the rate of diffusion and innovativeness of farmers in adopting MR-301 paddy variety. The study stated that there was no significant relationship between the age of the farmers and their innovativeness.

Nadagundi (1985) in his study found that there was no significant relationship between the age of the farmers and their adoption behavior.

### 2.3.2 Education and Adoption

Khan (2002) found in his study that farmers' education had significant relationship with their adoption of Binashail rice variety.

Paul (2000) conducted his study to determine farmers' attitude towards Urea Super Granule and found the positive relationship between farmers' education and their attitude toward USG.

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Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practice in five villages of Comilla district. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices.

Chowdhury (1997) observed a significant relationship between the education of the farmers and their adoption of selected BINA technologies. Similar results were found by Pal (1995), Islam (1993) and Ali et al. (1986).

According to Hasan (1996), education had no significant relationship between farmers' education and their adoption of some selected agricultural technologies. Similar result was found by Hossain (1999) and Islam (1996).

Hossain (1991) in his study found a significant relationship between the education of wheat growers and their adoption of improved farm practices in Jamalpur district.

Bavaltti and Sundarswamy (1990) found no significant relationship between education of the farmers and the adoption of dry land farming practice.

Katarya (1989) observed that, education of the farmers was positively related to the adoption of wheat technology.

Ramegowda and Shiddaramaiah (1987) found that education of the farmers had no effect on their innovativeness.

Hoque (1984) concluded that education of cane growers significantly influenced the adoption of improved practices in sugarcane cultivation in some selected areas of Jessor district.

Hossain (1983) reported in his study that the education of the T-Aman growers of Bhabakhali Union of Mymenshingh district had no relationship with their adoption of HYV paddy.

Patil (1981) found a significant relationship between adoption of recommended hybrid maize cultivation practices and educational level of the maize growers.

Gangadharappa (1981) in his research on trained and untrained farmers found positive relationship between farmers' education and their adoption behavior.

Krishna (1969) conducted a research on the adoption of hybrid maize in Carim Nagar, India. He found a significant negative relationship between the education of the respondents and their adoption of hybrid maize.

Rogers and Hoveland (1960) in their research on comparative study of changes in farmers' attitude towards fertilizer in two counties of Ohio and Miami, the treatment

county was exposed to a fertilizer demonstration program for one year; whereas Champaign, the controlled county was not exposed. The study in both the counties indicated that the education was a necessary precondition for forming positive attitude and farmers having higher education tend to adopt farm innovation earlier.

#### **4.3.3 Family Size and Adoption**

According to Khan (2002) there was no significant relationship between farmers' family size and their adoption of Binashail rice variety.

Paul (2000) observed that respondents' family size had no relationship with the attitude to the use of Urea Super Granule.

Hossain (1999) conducted a study to determine the farmers' perception of the effect of agrochemicals on environment. He found no relationship between the farmers' family size and their adoption of chemical fertilizers.

Chowdhury (1997) observed there was a significant and positive relationship between family size of the respondents and their adoption of selected BINA technologies at 0.01 level of probability. Sarker (1997), Hasan (1996), Okoro *et al.* (1992) found the similar result.

Islam (1996) conducted a study on farmers' use of indigenous technical knowledge (ITK), in the context of sustainable agricultural development. He found significant and

negative relationship between the family size of the farmers and their extent of use of ITK. Similar result was found by Hoque (1993) and Hasan (1996).

#### **2.3.4 Farm Size and Adoption**

According to Khan (2002) there was significant and positive relationship between farmers' farm size and their adoption of Binashail rice variety.

Paul (2000) observed that respondents' farm size had a positive and significant relationship with the attitude to the use of Urea Super Granule.

Hossain (1999) found that respondents' farm size had a positive and significant relationship with the adoption of agrochemicals.

Islam (1996) conducted a study on farmers' use of indigenous technical knowledge (ITK), in the context of sustainable agricultural development. He found significant and negative relationship between the farm size of the farmers and their extent of use of ITK. Similar result was found by Pal (1995), Sarker (1997), Chowdhury (1997) and Hoque (1993).

Hossain (1991) found that there was no significant relationship between the farm size of the farmers and their adoption of improved farm practices.

Bavaltti and Sundarswamy (1990) found no significant relationship between land holding of the contact wheat growers and their adoption of improved farm practices

Gogoi and Gogoi (1989) observed that the size of the operational land holding of the farmers had a significant and positive effect on their adoption of plant protection practices.

Talawar and Hirevenkanagoudar (1989) found the size of the land holding of farmers had no relationship with their adoption of poultry management practices.

After conducting a study Katarya (1989) concluded that the farm size of the farmers had no relationship with their adoption of wheat production technology.

Hossain (1983) found that size of the farm of T-Aman growers of Bhabkhali Union of Mymensingh district had a negative relationship with their adoption of HYV T-Aman variety.

Pathak and Mujumdar (1978) made a multiple regression analysis on the adoption behavior of jute farmers. In their study they found farm size had a positive effect on their adoption behavior.

Patil (1981) observed a significant association between the land holding status and adoption of recommended hybrid maize cultivation.

Karim *et al.* (1987) carried out a study on the attitude of farmers towards the use of urea in jute cultivation and found that farm size of the farmers had significant and positive relationship with their attitude towards the use of urea.



### **2.3.5 Annual Income and Adoption**

According to Khan (2002) there was significant and positive relationship between farmers' annual income and their adoption of Binashail rice variety.

Paul (2000) observed that respondents' annual income had no relationship with the attitude to the use of Urea Super Granule.

Chowdhury (1997) conducted a research on the adoption of selected BINA technologies by the farmers of Boria Union of Mymensingh district. He observed that annual family income has a significant positive relationship with their adoption of those selected technologies.

Hossain (1991) found that there was no significant relationship between the annual income of contact growers and their adoption of improved farm practices in wheat cultivation.

Gogoi and Gogoi (1989) observed that the annual income level of the farmers had no significant effect on their adoption of plant protection practices.

Katarya (1989) concluded in his study that the income of the farmers had positive and significant relationship with their adoption of wheat production technology.

Karim *et al.* (1987) revealed in his study that the income of the farmers had significant and positive relationship with their attitude to the use of urea in jute cultivation.

Hoque (1984) concluded in his study that there was a negative relationship between annual income of the farmers and their adoption of improved practices of sugarcane cultivation.

Hossain(1983) in his study found a positive relationship between income of the farmers and their adoption of HYV rice as T-Aman.

Hossain (1981) stated in his study that there was no significant relationship between annual income of the farmers and their adoption of improved farm practices.

Sobhan's (1975) study indicated that income of the farmers had no significant influence on the adoption of winter vegetable cultivation.

Rogers (1962) found in his study a positive relationship between income of the farmers and their innovativeness.

### **2.3.6 Extension Media Contact and Adoption**

Khan (2002) found in his study that the exposure to mass media had a significant and positive relationship with the adoption of Binashail rice variety.

Paul (2000) observed that respondents' extent of media contact had significant relationship with the attitude to the use of Urea Super Granule.

Chowdhury (1997) stated in his study that there was a significant and positive relationship between exposure of the respondents to the extension media and their adoption of selected BINA technologies.

Noor (1995) in his study showed that extension media contact had positive significant relationship with the attitude toward the cultivation of HYV of potato.

Parveen(1993) observed in her study that the extension media contact of the women farmers had significant relationship with their attitude toward homestead agricultural products.

Verma and Kumar (1991) found that there was positive and significant relationship between extension contact and attitude towards buffalo management in adopted and non-adopted villages of India.

Karim *et al.* (1987) revealed in his study that the media contact of the farmers had significant and positive relationship with their attitude to the use of urea in jute cultivation.

Hoque (1984) concluded in his study a positive relationship between extension media contact of the farmers and their adoption of improved practices of sugarcane cultivation.

Hossain(1983) in his study found a positive relationship between extension media contact of the farmers and their adoption of HYV rice as T-Aman.

Hossain (1981) stated in his study that there was no significant relationship between extension media contact of the farmers and their adoption of improved farm practices.

Sobhan's (1975) study indicated that extension media contact of the farmers had significant and positive influence on the adoption of winter vegetable cultivation.

### **2.3.7. Cosmopolitaness and Adoption**

Khan (2002) found in his study that there was significant and positive relationship between farmers' cosmopolitaness and their adoption of Binashail rice variety at 0.001 level of probability.

Paul (2000) observed that respondents' cosmopolitaness had significant relationship with the attitude to the use of Urea Super Granule.

Chowdhury (1997) observed there was a significant and positive relationship between cosmopolitaness of the respondents and their adoption of selected BINA technologies.

Noor (1995) in his study showed that cosmopolitaness of the farmers had positive significant relationship with the attitude toward the cultivation of HYV of potato.

Hossain (1991) found that there was significant and positive relationship between the cosmopolitaness of the farmers and their adoption of improved farm practices.

Gogoi and Gogoi (1989) observed that the cosmopolitaness of the farmers had no significant effect on their adoption of plant protection practices.

Hoque (1984) concluded in his study no relationship between cosmopolitaness of the farmers and their adoption of improved practices of sugarcane cultivation.

### **2.3.8 Organizational Participation and Adoption**

Khan (2002) found in his study that the organizational participation had significant and positive relationship with the adoption of Binashail rice variety at 0.05 level of probability.

Paul (2000) observed that respondents' organizational participation had significant relationship with the attitude to the use of Urea Super Granule.

Chowdhury (1997) concluded in his study that there was no significant relationship between organizational participation of the respondents and their adoption of selected BINA technologies.

Hossain (1991) in his study on the adoption behavior of the contact wheat growers found organizational participation of the respondents had positive and significant effect on their adoption of improved farm practices.

Karim *et al.* (1987) revealed in his study that the social participation of the farmers had no significant relationship with their attitude to the use of urea in jute cultivation.

Hoque (1984) concluded in his study a positive and significant relationship between organizational participation of the farmers and their adoption of improved practices of sugarcane cultivation.

Hossain(1983) in his study found no significant relationship between organizational participation of the farmers and their adoption of HYV rice as T-Aman.

Sobhan (1975) stated on the basis of his study that the organizational participation of the farmers had no significant effect on the adoption of winter vegetable cultivation.

Rahman's (1973) study in two villages of Mymenshingh district indicated a positive relationship between social participation of T-Aman rice growers and their adoption of improved farm practice.

### **2.3.9 Agricultural Knowledge and Adoption**

Khan (2002) found in his study a significant and positive relationship with the agricultural knowledge of the farmers and their adoption of Binashail rice variety.

Paul (2000) observed that the agricultural knowledge of the farmers was significantly related with the attitude to the use of Urea Super Granule at 0.05 level of probability.

### **2.3.10 Attitude towards Urea Super Granule and Adoption**

Paul (2000) stated in his study that majority of the farmers showed favorable attitude toward USG. The formation of attitude depended on several factors. Among them the most important are education, cosmopolitaness, organizational participation, extension media contact, agricultural training experience and agricultural knowledge.

## **2.4 The Conceptual Framework of the Study**

The conceptual framework of Rosenberg and Hoveland (1960) was kept in mind while framing the structural arrangement for the dependent and independent variables. This study was concerned with the classification of Urea Super Granule (USG) adopters on the basis of their adoption period. The adopters were categorized on the basis of their adoption year. In 1999 the USG was first introduced in the location of the study.

The study was focused to the concept that whether the adopters followed the classification introduced by Rogers (1983) or not. Adoption of USG may be influenced by many factors and also adoption will vary on the basis of technology. So it is impossible to study with too many technologies and influencing factors in a single research. It was therefore, necessary to limit the independent and dependent variables. Independent variables which included age, education, family size, farm size, annual income, extension contact, cosmopolitanness, organizational participation, agricultural knowledge and attitude toward Urea Super Granule (USG) and the dependent variable was Adoption of USG. Based on this discussion and the review of literature the conceptual framework of this study has been formulated and shown in the Fig 2.4.

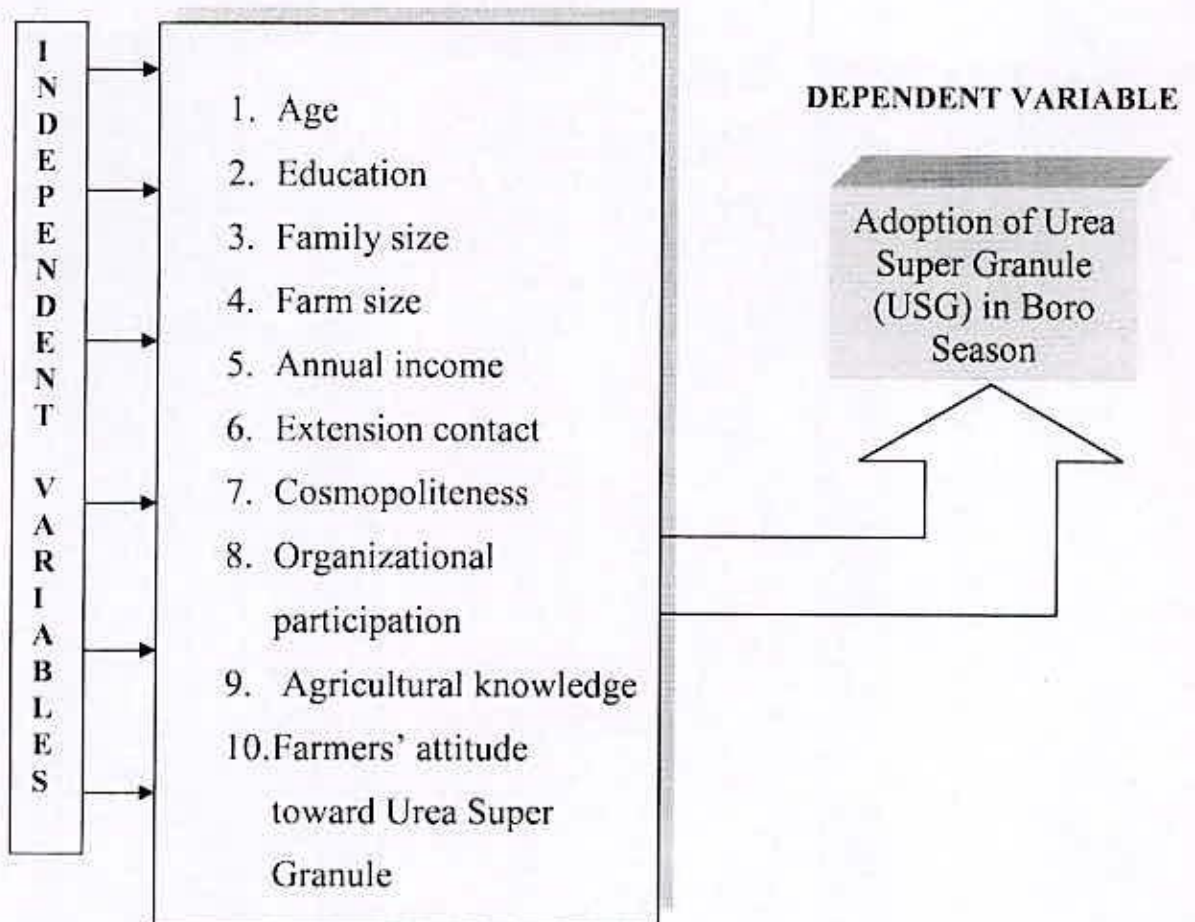


Fig.2.4: Conceptual framework of the study



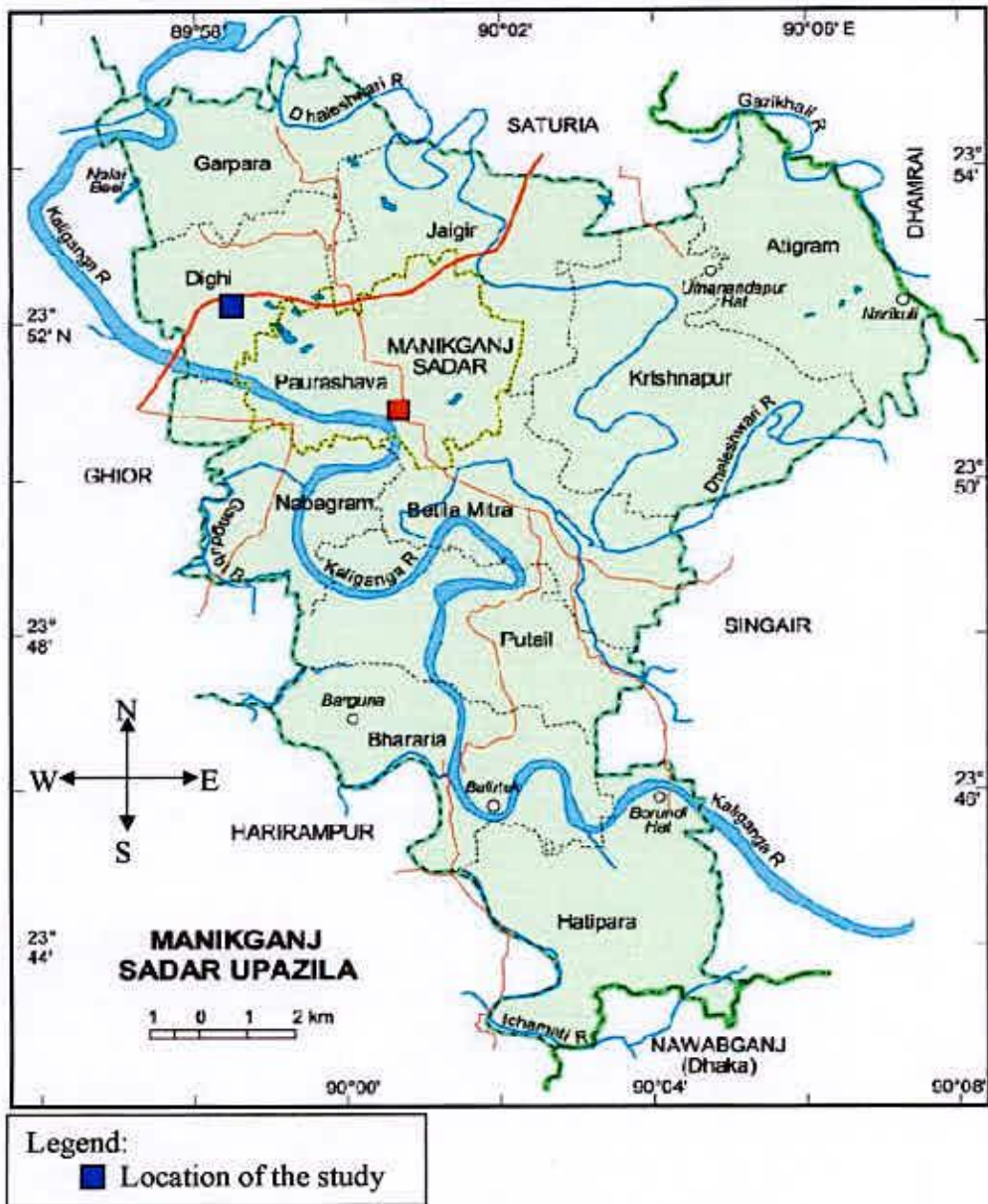
## **Chapter III**

### **Methodology**

Methods and procedures of collecting and analysis of data are very important in a research. Methodology should be appropriate so that the researcher will be able to collect necessary data and analyze them in an apposite way, which will help him to arrive at correct decision. Selection of methodology requires skill. In this research the researcher followed the instruction of the supervisor in selecting the methods and procedures which are discussed below.

#### **3.1 Locale of the study**

Dighi Union of Manikgonj upazilla was the location of the study. In this area people grow Boro Rice extensively. So this area was selected to conduct this research. This Union is adjacent to the Manikgonj town. The map of the Upazilla has been given as Figure 3.1.



**Fig3.1: Map of the Manikganj Sadar Upazilla**

### 3.2 Population and Sampling

The Dighi union comprised of 4 (four) blocks, such as Mulzan, Lautā, Dighi and Tora. The Mulzan block was randomly selected out of 4 (four) blocks. The total farm population in this block are 1163 (one thousand one hundred and sixty three). All these farmers constituted the population of this study. This block consists of 7 (seven) villages namely, Mulzan, Bagzan, Karchabadha, Gulatia, Chamta, Khagrakuri and Patrail. An up-to-date list of the farmers of this block was collected from the Upazilla Agriculture Office. Twenty percent of the 1163 farmers were selected randomly. Thus 232 Boro rice growers constituted the sample of the study.

A reserve list of the Boro rice farmers was also prepared so that if any selected respondent failed to interview then this list could be used. Number of Boro rice farmers of this list was one tenth of the sample size. The reserve list contained 23 (twenty three) Boro rice farmers. The distribution of the sampled Boro rice farmers and the reserve list were given in the table 3.2.

**Table 3.2. List of the farmers.**

| Name of the Villages | Total Number of Boro Rice Growers | Sample Drawn | Reserve List |
|----------------------|-----------------------------------|--------------|--------------|
| Mulzan               | 226                               | 45           | 5            |
| Bagzan               | 179                               | 36           | 4            |
| Karchabadha          | 161                               | 32           | 3            |
| Gulatia              | 108                               | 21           | 2            |
| Chamta               | 209                               | 42           | 4            |
| Khagrakuri           | 133                               | 27           | 2            |
| Patrail              | 147                               | 29           | 3            |
| Total                | 1163                              | 232          | 23           |

### 3.3 Instrument for Data Collection

For the collection of the data an interview schedule was prepared. It was prepared keeping the objective of the research in mind. The interview schedule contained both

open and closed form of questions. Direct and simple questions were included in the schedule for collecting data on the selected depended and independent variables. The draft schedule was prepared in English with the assistance of the supervisor and then translated in Bangla.

The interview schedule was pre-tested before final data collection. Ten farmers were interviewed for the pre-test where at least one farmer of each of the seven villages was interviewed. Based on the pre-test experience, necessary correction, addition, alternation rearrangements were made. Thus the interview schedule was prepared for the final use. The Bangla version of the interview schedule was multiplied as per requirement to collect data from the respondents. The English version of the interview schedule was enclosed in Appendix A.

### **3.4 Selection of variables**

The success of a research to a considerable extent depends on the exact selection of the variables. Selection of inappropriate variables may mislead the researcher and bring insignificant result. Keeping all this in mind the researcher required adequate time to select the dependent and independent variables. Before selecting the variables he visited the place of study and also talked to the farmers. Based on this experience and after discussing with the supervisor and reviewing the relevant research work the researcher selected the 10 independent variables and one dependent variable of the study.

### **3.5 Data collection**

Data were collected personally by the researcher himself through face to face interview with the randomly selected farmers of the seven villages. During data collection the researcher took help from the local leaders and the Sub Assistant Agricultural Officer

(SAAO) to be well acquainted with the respondents. The researcher made all possible efforts to collect pertinent and authentic information. Rapport was established prior to the interview and all the questions were rephrased. So no serious problem was occurred during the interview. The coordination and cooperation of the respondents were excellent. The data collection was started on January 18, 2006 and ended on March 7, 2006. As the time was harvesting period of the Boro rice most of the respondents were interviewed in the afternoon in their own houses or in the local tea stalls.

A single interview was carried out with each respondent, and thus great reliance was placed on the ability of farmers to recall the relevant information. The respondents were assured about the confidentiality of their information delivered to the researcher.

### **3.6 Processing of the Data**

The collected raw data were examined thoroughly to detect errors and omission. As a matter of fact the researcher made a careful scrutiny while completing the interview schedule to make sure that the information were entered as completed as possible and well arranged to facilitate coding and tabulation. Minor mistakes were detected, which were corrected very promptly.

Having consulted with the research supervisor, a detailed coding plan was made. All the responses in the interview schedule were given numerical values. Local units were converted to the standard units. All the individual responses of the questions of the interview schedule were transferred to a master sheet to facilitate tabulation. In case of qualitative data, appropriate scoring technique was followed to convert the data into quantitative forms. These were then tabulated.

## 3.7 Measurement of Variables

In order to conduct a study in accordance with the objectives it was necessary to measure the variables. The procedures of measuring the variables have been described below.

### 3.7.1 Independent variables

The measuring procedure of independent variables have been described below:

**Age:** The age of the respondents was measured in terms of actual complete years. A score of one was assigned for each of the year of age. For example if the respondent's age was 45 then he was given a score of 45. Based on the score of age the respondents were categorized into young aged, middle aged and old aged.

**Education:** Education of the respondents was measured in terms of the year of formal schooling completed by the respondents. That means a score of one was assigned for each year of formal schooling. For example, if a respondent passed SSC a score of 10 was taken for calculating his education score. 0 (zero) was assigned for no education and 0.5 (point five) was assigned for those who can sign only. Based on the level of education the respondents were categorized into no education, primary education, secondary education, higher secondary education and higher education.

**Family size:** The family size of the respondents was measured in terms of actual number of his family members including himself. The scoring was considered by the actual number mentioned by the respondents. For example if a respondent mentioned he had 4 members in his family then his family size score was 4. Based on the family size score the respondents were categorized into small, medium and large.

**Farm size:** It included the total cultivated area either owned by the respondents or obtained from others on share cropping (borga) system or taken from others as lease

where he was doing his farming operation during the period of the study. The farm size of the respondents was measured in Hectares using the following formula.

$$F = A_1 + \frac{1}{2}(A_2 + A_3) + A_4 + A_5 + A_6 + A_7$$

Where,

F = Total Farm size

A<sub>1</sub> = Own land under own cultivation

A<sub>2</sub> = Own land given to others as 'Borga'

A<sub>3</sub> = Land taken from others as 'Borga'

A<sub>4</sub> = Land taken from others on lease

A<sub>5</sub> = Homestead

A<sub>6</sub> = Pond

A<sub>7</sub> = Others

Actual size of the farm was considered as the score of the farm size. For example if any respondent had a farm of .02 ha then his score was 02. Based on the achieved farm size score the respondents were categorized into marginal, small, medium and large.

**Annual Income:** Annual income of a respondent was measured in Taka on the basis of his yearly earning. Then all the yield of crops in previous year was recorded. Then all the yields were converted into Taka according to prevailing market price. The price of other enterprises (poultry, dairy, fish) was also added to the price. Earnings from non-agriculture (service, business, labor etc) of a respondent and his dependents were also included in the income computation. A score one was assigned for each Tk 1000 to compute the family income scores.

**Extension Contact:** In this study extension contact of the farmers were measured by the number or frequency of contact with 17 extension communication media. Each respondent was asked to mention the number of contact he made with the different media. To compute the extension contact a scale was developed with 5 options were

available such as, Regularly, Often, Occasionally, Rarely and Not at All giving a score 4, 3, 2, 1 and 0 respectively. The scoring system is shown below

| Name of the extension media    | Scoring system                                                                                               |
|--------------------------------|--------------------------------------------------------------------------------------------------------------|
| Neighbors                      | 4= 24-30 day/month<br>3= 16-23 days/month<br>2= 8-15 days/month<br>1= 1-7 days/month<br>0= No contact        |
| Relatives                      | 4= 4 times or more/month<br>3= 3 times/month<br>2= 2 times/months<br>1= 1 time/month<br>0= No contact        |
| Village leaders                | 4= 12 times or more/year<br>3= 8-11 times/year<br>2= 4-7 times/ year<br>1= 1-3 times/year<br>0= No contact   |
| Ideal Farmers                  | 4= 12 times or more/year<br>3= 8-11 times/year<br>2= 4-7 times/ year<br>1= 1-3 times/year<br>0= No contact   |
| Agricultural input dealers     | 4= 10-12 times or more/ year<br>3= 7-9 times/year<br>2= 4-6 times/year<br>1= 1-3 times/year<br>0= No contact |
| Block Supervisor               | 4= 10-12 times or more/ year<br>3= 7-9 times/year<br>2= 4-6 times/year<br>1= 1-3 times/year<br>0= No contact |
| NGO workers                    | 4= 10-12 times or more/ year<br>3= 7-9 times/year<br>2= 4-6 times/year<br>1= 1-3 times/year<br>0= No contact |
| Agricultural Extension officer | 4= 7 times or more/year<br>3= 5-6 times/year<br>2= 3-4 times/year<br>1= 1-2 times/year<br>0= No contact      |



|                               |                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Upazilla Agricultural officer | 4= 7 times or more/year<br>3= 5-6 times/year<br>2= 3-4 times/year<br>1= 1-2 times/year<br>0= No contact             |
| Result Demonstration          | 4= 7 or more times in life<br>3= 5-6 times in life<br>2= 3-4 times in life<br>1= 1-2 times in life<br>0= No contact |
| Method Demonstration          | 4= 7 or more times in life<br>3= 5-6 times in life<br>2= 3-4 times in life<br>1= 1-2 times in life<br>0= No contact |
| Group Discussion              | 4= 10-12 times or more/ year<br>3= 7-9 times/year<br>2= 4-6 times/year<br>1= 1-3 times/year<br>0= No contact        |
| Field Day                     | 4= 7 or more times in life<br>3= 5-6 times in life<br>2= 3-4 times in life<br>1= 1-2 times in life<br>0= No contact |
| Daily Newspaper               | 4= 24-30 days/month<br>3= 15-23 days/month<br>2= 8-14 days/month<br>1= 1-7 days/month<br>0= No contact              |
| Leaflet                       | 4= 5 or more times in life<br>3= 3-4 times in life<br>2= 2 times in life<br>1= 1 time in life<br>0= No contact      |
| Radio                         | 4= 24-30 days/month<br>3= 15-23 days/month<br>2= 8-14 days/month<br>1= 1-7 days/month<br>0= No contact              |
| Television                    | 4= 4times/month<br>3= 3times/month<br>2= 2times/ month<br>1= 1times/6 month<br>0= No contact                        |

Contact score could range from 0-68 where 0 indicating no extension contact and 68 indicating highest extension contact. Based on the achieved extension contact score respondents were categorized into low contact, medium contact and high contact.

**Cosmopolitaness:** Cosmopolitaness of a respondent was measured by computing the cosmopolitaness score which was assigned on the basis of frequency of visit to 4 places. Based on the achieved cosmopolitaness score respondents were categorized into low cosmopolitaness, medium cosmopolitaness and high cosmopolitaness. The scoring system is given below:

| Place to visit                                                 | Scoring system                                                                                               |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Visit to the house of friends/relatives outside of the village | 4= 12or more times/ year<br>3= 9-11 times/year<br>2= 5-8 times/year<br>1= 1-4 times/year<br>0= 0 time/year   |
| Visit to Manikgonj town                                        | 4= 5 or more times/ month<br>3= 3-4 times/ month<br>2= 2 times/ month<br>1= 1 time/ month<br>0= 0 time/month |
| Visit to other upazilla                                        | 4= 12or more times/ year<br>3= 9-11 times/year<br>2= 5-8 times/year<br>1= 1-4 times/year<br>0= 0 time/year   |
| Visit to other district                                        | 4= 12or more times/ year<br>3= 9-11 times/year<br>2= 5-8 times/year<br>1= 1-4 times/year<br>0= 0 time/year   |

**Organizational Participation:** Organizational participation of a respondent was measured by computing an organizational participation score, which was assigned according to the nature of involvement and duration of involvement. The respondents were asked about their nature and duration of participation in 9 (nine) organizations and the scoring was done in the following way:

Organizational participation score =  $\sum P \times D$

Where,

**P**- Participation Score

**D**- Duration (no. of years)

Participation score was assigned in the following method

| <u>Nature of Participation</u>     | <u>Score</u> |
|------------------------------------|--------------|
| No involvement                     | 0            |
| Involvement as an ordinary member  | 1            |
| Involvement as an executive member | 2            |
| Involvement as President/Secretary | 3            |

If the individual is an executive committee member for four years his/her score of participation would be  $4 \times 2 = 8$ . One respondent could be involved in more than one organization. Thus his/her organizational participation score was obtained by adding the score of his/her participation in all the organizations. Based on the achieved organizational participation score respondents were categorized into no participation, low participation, medium participation and high participation.

**Agricultural Knowledge:** The knowledge of the respondents was measured by asking 10 (ten) selected questions and each of the questions was assigned 5 (five) marks. Appropriate answer was given full marks and partial answer was partially marked, whereas wrong answer was given 0 (zero). The agricultural knowledge score could range from 0 to 50. 0 indicated no knowledge and 50 indicated high knowledge. Based on the achieved score respondents were categorized into low knowledge, medium knowledge and high knowledge.

**Attitude towards Urea Super Granule:** Attitude of a respondent was used to refer his feeling and action toward the use of Urea Super Granule (USG). There were 12 (twelve) statements where 6 (six) statements were positive and 6 (six) were negative related to the use of USG. The positive and negative statements were arranged alternatively in the interview schedule so that the respondents' real attitude can be determined. The respondents were asked to indicate their opinion about each of the statements. A 5-point scale was used to measure their attitude. The five options are 'Strongly Agree', 'Agree', 'No Opinion', 'Disagree' and 'Strongly Disagree'. Scores were assigned to those five responses were 4, 3, 2, 1 and 0 respectively for the positive statements and a reverse score was given for the negative statements. The sum total of the scores obtained by a respondent was his score for this variable. Thus the possible range of the score was 0 to 48, where 0 indicating highly unfavorable attitude and 48 indicated highly favorable attitude toward the use of USG.

### **3.7.2 Dependent Variable**

#### **Adopter categories of Urea Super Granule**

The adoption of USG was the only dependent variable of this study. According to the information of Upazilla Agriculture Officer, Manikgonj upazilla the USG was introduced in 1999 in the sadar thana. Since then the farmers of the locality have been using this fertilizer. Out of the 232 respondents, 157 (67.67%) respondents adopted the Urea Super Granule. The respondents were asked two questions. Firstly, when (in which year) they first used the USG in their Boro Rice field and secondly whether they were still continuing. The scores were assigned against their statements assigning 1 for each year. This scoring was done to determine the adopter categories. Thus the respondent who was

using the USG for 8 years he scored 8 and who was using USG for 1 year he scored 1.

The scoring system is given below,

| <u>Adoption year</u>                 | <u>Score</u> |
|--------------------------------------|--------------|
| Applied in 1999 and still continuing | 8            |
| Applied in 2000 and still continuing | 7            |
| Applied in 2001 and still continuing | 6            |
| Applied in 2002 and still continuing | 5            |
| Applied in 2003 and still continuing | 4            |
| Applied in 2004 and still continuing | 3            |
| Applied in 2005 and still continuing | 2            |
| Applied in 2006 and still continuing | 1            |

Those who are not continuing the adoption they were scored on the basis of how many years they used the USG. It means if someone applied the USG in 1999 and discontinued in the next year his adopter category score was assigned 1. Then the mean and standard deviation of the scores have been determined. The adopters of USG were categorized on the basis of that mean and standard deviation. This procedure was invented by Rogers (1995). On the basis of the following method the adopters were categorized:

| Name of the Adopter category | Measurement                   |
|------------------------------|-------------------------------|
| Innovators                   | Below Mean- 2Sd               |
| Early Adopters               | Between Mean-Sd and Mean- 2Sd |
| Early Majority               | Between Mean-Sd and Mean      |
| Late Majority                | Between Mean and Mean + Sd    |
| Laggards                     | Above Mean+Sd                 |

Here the method reveals the adopters those who adopt the USG before the mean time minus two standard deviation named Innovator; those who adopt between the mean time minus two standard deviations and mean minus one standard deviation are called Early Adopters. Adopters belong to the time between mean minus one standard deviation and mean time are categorized as Early Majority and those who adopt the innovation in the time between mean and mean plus standard deviation are categorized as Late Majority. Finally the adopters who adopt an innovation after the time of the mean plus one standard deviations are mentioned as Laggards. The percentage of the five adopter categories constitutes a Bell-Shape curve. In this study this curve also has been made.

#### **Adoption of USG:**

Adoption of USG was measured by using the formula of adoption quotient. For doing this the area of Boro rice cultivated by using USG and the potential area of using USG were determined by asking question, how much land a respondent had for Boro rice cultivation and in how much land he had used USG? The USG used area was divided by the potential area and the proportion was multiplied by one hundred. The formula is stated below,

$$\text{Adoption of USG} = \frac{\text{USG used area (ha)}}{\text{Total potential area (ha)}} \times 100$$

The result of the above formula was the adoption score of the respective respondents.

### **3.8 Statistical Analysis**

Data collected from the respondents were compiled, tabulated and analyzed in accordance with the objective of the study. A statistical software package named SPSS was used to analyze the data. The standard deviation and mean of each variable was measured. Then the frequency was measured of each variable, which helped to categorize the variables. For exploring the relationship between the adoption of Urea Super Granule and the independent variables Karl Pearson Correlation Co-efficient 'r' was computed. Then the correlation co-efficient was compared with the 5% and 1% level of probability to identify the significance of the relationship. The correlation matrix has been given in the Appendix B. USG adopters were categorized by using the method used by E.M. Rogers (1995).

## Chapter IV

### Result and Discussion

Result and discussion is the focal point of whole research work. The quality of research largely depends upon how well the findings of the research are discussed and interpreted. In fact, the concerned scientist, researcher and students fix their attention in this chapter. So to make the results and discussion meaningful, acceptable and universal the collected data were coded, categorized, tabulated, analyzed, statistically tested and in accordance with the objective of the study. The results have been discussed in three sections such as (i) Selected characteristics of the farmers, (ii) relationship between selected characteristics and adoption of USG and (iii) the adopter categories.

#### 4.1. Selected Characteristics of the Farmers

In this section the selected characteristics of the farmers have been discussed. The selected characteristics were, i) Age, ii) Education, iii) Family size, iv) Farm size, v) Annual income, vi) Extension contact, vii) Cosmopolitanness, viii) Organizational participation, ix) Agricultural knowledge, x) Attitude toward the Urea Super Granule(USG) and xi) Adoption of the USG.

##### 4.1.1 Age

The age of the farmers ranged from 27 to 75 with an average of 44.51 and the standard deviation 9.28. Based on the age the farmers were categorized into young aged, middle aged and old aged that shown in Table 4.1.1



**Table 4.1.1 Categories of farmers on the basis of their age**

| Categories              | Farmers |         | Mean  | Standard deviation |
|-------------------------|---------|---------|-------|--------------------|
|                         | Number  | Percent |       |                    |
| Young (up to 35 yrs )   | 22      | 14.00   | 44.51 | 9.28               |
| Middle Aged (36-45 yrs) | 78      | 49.68   |       |                    |
| Old (46 and above)      | 57      | 36.32   |       |                    |
| Total                   | 157     | 100     |       |                    |

Data furnished in table 4.1.1 indicates that the highest percentage (49.68) of the farmers fell in the middle aged category, while 14 and 36.32 percent of the farmers belong to young and old aged categories respectively. This reveals that the adoption of Urea Super Granule (USG) in the study area was influenced mostly by middle aged and old aged farmers.

#### 4.1.2 Education

The education score of farmers ranged from 0 to 16 with an average 3.69 and standard deviation 4.54. On the basis of the education score the farmers were categorized into 5 categories such as no education, primary education, secondary education, higher secondary education and higher education. They are shown in Table 4.1.2.

**Table 4.1.2 Distribution of the farmers according to their level of education.**

| Categories                        | Farmers |         | Mean | Standard deviation |
|-----------------------------------|---------|---------|------|--------------------|
|                                   | Number  | Percent |      |                    |
| No Education(0-0.5)               | 93      | 59.25   | 3.69 | 4.54               |
| Primary Education(1-5)            | 14      | 8.92    |      |                    |
| Secondary Education(6-10)         | 37      | 23.53   |      |                    |
| Higher Secondary education(11-12) | 8       | 5       |      |                    |
| Higher Education(13 & above)      | 5       | 3.3     |      |                    |
| Total                             | 157     | 100     |      |                    |

The data shown in table 4.1.2 reveals that the largest portion (59.25) of the farmers have no formal education. Very few of them can sign only. Only 40.75% respondents had meaningful literacy. The highest proportion literate respondents (23.53%) had fallen under secondary education, whereas 8.3% of respondents had fallen HSC or above HSC category. Almost an equal proportion (8.92%) had primary education. From this table it is

quite evident that the educational status of the farmers was found to be smaller than that of national average educational status of Bangladesh. However, interestingly most of the respondents (67.67%) adopted USG although they had no education. That is education had no influence in adoption of USG.

#### 4.1.3 Family Size

Family size of the farmers ranged from 2 to 12 with an average of 5.48 and standard deviation 2.89. On the basis of the family size the respondents have been classified into 3 categories, such as small, medium and large (Table 4.1.3).

**Table 4.1.3 Distribution of the farmers according to their family size.**

| Categories        | Farmers |         | Mean | Standard deviation |
|-------------------|---------|---------|------|--------------------|
|                   | Number  | Percent |      |                    |
| Small (2-4)       | 63      | 40.1    | 5.48 | 2.89               |
| Medium (5-7)      | 70      | 44.6    |      |                    |
| Large (8 & above) | 24      | 15.3    |      |                    |
| Total             | 157     | 100     |      |                    |

Data presented in the above table shows that highest proportion (44.6%) of the farmers belong to the medium family size category. Almost equal proportion (40.1%) of the farmers had fallen under small family size. Only a small portion of the respondents (15.3%) had large family size with 8 and above. On an average family size family size 5.48 is very close to national average. The smallest is the beautiful. It is very easy to take decision in a small or medium family. So small and medium sized family influenced the respondents of the study area to adopt USG.

#### 4.1.4 Farm Size

The farm size of the farmers of the study area ranged from 0.04 hectares to 3.26 hectares. The average farm size was 0.79 ha and the standard deviation was 0.47. According to the farm size the farmers have been categorized in 4 categories such as marginal small medium and large (Table 4.1.4).

**Table 4.1.4 Distribution of the farmers according to their farm size.**

| Categories             | Farmers |         | Mean | Standard deviation |
|------------------------|---------|---------|------|--------------------|
|                        | Number  | Percent |      |                    |
| Marginal (0.02-0.2 ha) | 4       | 2.5     | 0.79 | 0.47               |
| Small (0.21- 1 ha)     | 119     | 75.8    |      |                    |
| Medium (1.01- 2 ha)    | 29      | 18.5    |      |                    |
| Large (more than 2 ha) | 5       | 3.2     |      |                    |
| Total                  | 157     | 100     |      |                    |

From the table 4.1.4 it is quite clear that a bulky proportion (75.8%) of the farmers of the study area had small farm owing 0.21-1 ha of land. More than one fifth (21.7%) of the respondents belong to medium (18.5%) to large farm size (3.2%) category. The average farm size of Bangladesh is 0.81 ha which nearly resembles to this study (0.79 ha). The farm size condition of Mulzan block of Manikgonj district seems to be better than the other part of the country. It could be concluded that farm size did not influence to adopt USG in Boro rice cultivation.

#### 4.1.5 Annual Income

The annual income scores of the farmers of this study ranged from 11 to 428 with an average of 109.61 and the standard deviation 69.88. On the basis of the income scores the farmers have been classified into 3 categories namely, low income, medium income, high income categories (Table 4.1.5).

**Table 4.1.5 Distribution of the farmers according to their Annual Income.**

| Categories                  | Farmers |         | Mean   | Standard deviation |
|-----------------------------|---------|---------|--------|--------------------|
|                             | Number  | Percent |        |                    |
| Low income (up to 75)       | 59      | 37.6    | 109.61 | 69.88              |
| Medium income (75.1-150)    | 69      | 43.9    |        |                    |
| High income (more than 150) | 29      | 18.5    |        |                    |
| Total                       | 157     | 100     |        |                    |

Data from the above table reveal that the highest proportion of the farmers (43.9%) had medium income, while 37.6 percent had low income and only 18.5 percent had high

income. In fact the majority proportion of the farmers of the study area constitute low to medium categories of income. The average income of the respondents is less than national average. It is evident from research study that income of the respondents influences the adoption of innovation.

#### 4.1.6 Extension Contact

One's contact with information source is perhaps the most important indicator of one's adoption behavior. The extension contact score of this study ranged from 17 to 53 against the possible range of 0 to 68 the average being 28.37 and standard deviation 7.16. Based on extension contact score the farmers were classified into 3 categories. They are; low contact, medium contact and high contact (Table 4.1.6).

**Table 4.1.6 Distribution of the farmers according to their extension contact.**

| Categories                | Farmers |         | Mean  | Standard deviation |
|---------------------------|---------|---------|-------|--------------------|
|                           | Number  | Percent |       |                    |
| Low contact(17-25)        | 75      | 47.8    | 28.37 | 7.16               |
| Medium contact (26-34)    | 50      | 31.8    |       |                    |
| High contact (35 & above) | 32      | 20.4    |       |                    |
| Total                     | 157     | 100     |       |                    |

Information presented in the table 4.1.6 reveals that every respondent farmer had extension contact obtaining score from 17- 53. More than one half of the respondents had medium to high contact. While, 47.8% respondents had low contact. The extension contact of the farmers helped them to be aware of USG and adoption of USG. It could be concluded that the DAE also maintained good contact with farmers and as a result majority of the farmers of the study area adopted USG.

#### 4.1.7 Cosmopolitaness

The cosmopolitaness of the farmers ranged from 3 to 16 against the possible score 0-16 with an average score of 8.48 and the standard deviation 3.04. According to the cosmopolitaness score farmers were classified into 3 categories. The categories are; low cosmopolitaness, meium cosmopolitaness and high comopolitaness (Table 4.1.7).

**Table 4.1.7 Distribution of the farmers according to their cosmopolitaness.**

| Categories                      | Farmers |         | Mean | Standard deviation |
|---------------------------------|---------|---------|------|--------------------|
|                                 | Number  | Percent |      |                    |
| Low cosmopolitaness (3-7)       | 65      | 41.4    | 8.48 | 3.04               |
| Medium cosmopolitaness (8-12)   | 72      | 45.9    |      |                    |
| High cosmopolitaness (above 12) | 20      | 12.7    |      |                    |
| Total                           | 157     | 100     |      |                    |

The data of table 4.1.7 show that the 58.6% farmers had medium (45.9%) to high (12.7%) cosmopolitaness, whereas 41.4% had low cosmopolitaness. Although the respondents had low level of education but their extension contact and cosmopolitaness are very much encouraging in respect of adoption of USG. Farmers of the study are found to be cooperative with the extension personnel of DAE. As a result 67.67% of the respondents adopted USG.

#### 4.1.8 Organizational Participation

The computed organizational participation scores of the respondents ranged from 0 to 19 with an average of 0.93 and standard deviation 2.38. According to the scores of organizational participation the farmers were classified into no participation, low participation, medium participation and high participation (Table 4.1.8).

**Table 4.1.8 Distribution of the farmers according to their organizational participation.**

| Categories                      | Farmers |         | Mean | Standard deviation |
|---------------------------------|---------|---------|------|--------------------|
|                                 | Number  | Percent |      |                    |
| No participation (0)            | 109     | 69.43   | 0.93 | 2.38               |
| Low participation (1-5)         | 44      | 28.03   |      |                    |
| Medium participation (6-10)     | 2       | 1.27    |      |                    |
| High participation (11 & above) | 2       | 1.27    |      |                    |
| Total                           | 157     | 100     |      |                    |

The data of table 4.1.8 show that most of the farmers (69.43%) of the study area had no organizational participation remaining 30.57% of the farmers had low to high participation. Very negligible percent had medium and high participation with equal proportion (1.27%). Poor social participation was not an obstacle to adoption of in the study area. Conclusion could be drawn that there were no favorable condition for organizational participation in the study area.

#### **4.1.9 Agricultural Knowledge**

The agricultural knowledge of the farmers was assessed by asking them 10 questions and then marks were given to their answers. Their marks ranged from 21 to 44 against the possible range from 0 to 50. The average was 32.17 and standard deviation was 4.46. According to the obtained marks farmers were classified into 3 categories, which are low knowledge, medium knowledge and high knowledge (able 4.1.9).

**Table 4.1.9 Distribution of the farmers according to their agricultural knowledge.**

| Categories                   | Farmers |         | Mean  | Standard deviation |
|------------------------------|---------|---------|-------|--------------------|
|                              | Number  | Percent |       |                    |
| Low knowledge ( up to 25.50) | 7       | 4.45    | 32.17 | 4.46               |
| Medium knowledge (26-37)     | 131     | 83.43   |       |                    |
| High knowledge (above 37)    | 19      | 12.12   |       |                    |
| Total                        | 157     | 100     |       |                    |

The data from the above table reveals that almost all the farmers (95.55%) had medium to high knowledge, whereas only 4.45% had low knowledge. It could be concluded that good agricultural knowledge helped farmers to adopt USG in the study area.

#### 4.1.10 Attitude towards Urea Super Granule (USG)

The attitude of the farmers towards the Urea Super Granule ranged from 32 to 45 against the possible range of 0 to 48. The average was 40.16 and standard deviation was 2.65. According to the attitude scores farmers were classified into three categories such as less favorable, favorable and highly favorable (Table 4.1.10).

**Table 4.1.10 Distribution of the farmers according to their attitude towards Urea Super Granule (USG)**

| Categories                  | Farmers |         | Mean  | Standard deviation |
|-----------------------------|---------|---------|-------|--------------------|
|                             | Number  | Percent |       |                    |
| Less favorable (up to 36)   | 14      | 8.92    | 40.16 | 2.65               |
| Favorable (37-42)           | 117     | 74.52   |       |                    |
| Highly favorable (above 42) | 26      | 16.56   |       |                    |
| Total                       | 157     | 100     |       |                    |

The table 4.1.10 shows that highest proportion (74.52%) of the farmers had favorable attitude toward USG. The least (8.92) percent of farmers had less favorable attitude and 16.65 percent had highly favorable attitude towards USG. So it is clear that all the farmers had positive attitude toward USG, which helped them to adopt it.

#### 4.1.11. Adoption of Urea Super Granule (USG)

The adoption score of the urea super granule in this study ranged from 28.42 to 100 with an average of 59.56 and standard deviation 17.59. According to the adoption scores the farmers of the study area have been classified into three categories, which are low adoption, moderate adoption and high adoption (Table 4.1.11).

**Table 4.1.11 Distribution of the farmers according to their adoption of Urea Super Granule (USG)**

| Categories                | Farmers |         | Mean  | Standard deviation |
|---------------------------|---------|---------|-------|--------------------|
|                           | Number  | Percent |       |                    |
| Low adoption (up to 40.5) | 28      | 17.83   | 59.56 | 17.59              |
| Moderate adoption (41-72) | 90      | 57.32   |       |                    |
| High adoption (above 72)  | 39      | 24.85   |       |                    |
| Total                     | 157     | 100     |       |                    |

Data in the table 4.1.11 show that the highest proportion (57.32%) of the farmers had moderate adoption of USG. 24.85 percent of farmers had high adoption, whereas only 17.83 percent of farmers had low adoption. It could be concluded that farmers of the study area are innovative and accordingly majority of the farmers adopted USG within 8 years.

## **4.2 Relationship between Dependent and Independent Variables**

The purpose of this section is to explore the relationship between the selected characteristics of the farmers and the adoption of Urea Super Granule. The selected characteristics of the farmers constituted the independent variables and the adoption of USG is the dependent variable. To explore the relationship Karl Pearson Product Moment Correlation Co-efficient 'r' has been used to test the null hypothesis concerning the relationship between two variables. The summary of the results of the relationship between the independent and dependent variables are shown in the table 4.2.



**Table 4.2 Relationship between the independent and dependent variables**

| Selected Characteristics     | Correlation Co-efficient | Dependent Variable                       | Tabulated Value of 'r' (N 157 with N-2 df) |        |
|------------------------------|--------------------------|------------------------------------------|--------------------------------------------|--------|
|                              |                          |                                          | 0.05*                                      | 0.01** |
| Age                          | -0.006                   | Adoption of USG in Boro rice cultivation | 0.118                                      | 0.157  |
| Education                    | 0.097                    |                                          |                                            |        |
| Family Size                  | -0.014                   |                                          |                                            |        |
| Farm Size                    | -0.071                   |                                          |                                            |        |
| Annual Income                | 0.245**                  |                                          |                                            |        |
| Extension Contact            | 0.084                    |                                          |                                            |        |
| Cosmopolitaness              | 0.102                    |                                          |                                            |        |
| Organizational Participation | 0.119*                   |                                          |                                            |        |
| Agricultural Knowledge       | 0.231**                  |                                          |                                            |        |
| Attitude towards USG         | 0.435**                  |                                          |                                            |        |

\*\* Significant at 0.01 level of probability

\*Significant at 0.05 level of probability

#### 4.2.1 Age and Adoption

The relationship between the age of the farmers and their adoption of USG has been examined by testing the null hypothesis "There is no relationship between age and adoption of USG".

The calculated value of 'r' = -0.006 was found to be smaller than the tabulated value of 'r' (0.118) at 5% level of probability. So, no significant relationship was found between the age of the farmers and the adoption of USG.

Therefore the concerned null hypothesis could not be rejected. Subsequently the correlation coefficient shows a negative trend. That means age of the farmers had no influence on the adoption of USG.

Bavaltti and Sundarswamy (1990) and Gongoi and Gongoi (1989) found the similar result.

### **4.2.2 Education and Adoption**

The relationship between the education of the farmers and their adoption of USG has been examined by testing the null hypothesis "There is no relationship between education of the farmers and adoption of USG".

The calculated value of  $r = 0.097$  was found to be smaller than the tabulated value of  $r$  (0.118) at 5% level of probability. So, no significant relationship was found between the education of the farmers and the adoption of USG. Therefore the concerned null hypothesis could not be rejected. That means education of the farmers had no influence on the adoption of USG. The  $r$  value has depicted a positive trend.

Hasan (1996), Bavaltti and Sundarswamy (1990), Ramegowda and Shiddaramaiah (1987) and Hossain (1983) also found the similar result in their respective researches.

### **4.2.3 Family Size and Adoption**

The relationship between the family size of the farmers and their adoption of USG has been examined by testing the null hypothesis "There is no relationship between family size and adoption of USG".

The calculated value of  $r = -0.014$  was found to be smaller than the tabulated value of  $r$  (0.118) at 5% level of probability. So, no significant relationship was found between the family size of the farmers and the adoption of USG also a negative trend has been found between two variables.

So the concerned null hypothesis could not be rejected. That means family size of the farmers had no influence on the adoption of USG.

Hoque (1993), Hasan (1996) and Islam (1996) found the similar result.

#### **4.2.4 Farm Size and Adoption**

The relationship between the farm size of the farmers and their adoption of USG has been examined by testing the null hypothesis “There is no relationship between farm size and adoption of USG”.

The calculated value of ' $r$ ' = -0.071 was found to be smaller than the tabulated value of ' $r$ ' (0.118) at 5% level of probability. So, no significant relationship was found between the farm size of the farmers and the adoption of USG.

Thus the concerned null hypothesis could not be rejected and the two variables have shown a negative trend.

Hossain (1991), Bavaltti and Sundarswamy (1990) and Talawar and Hirevenkanagoudar (1989) also found the similar result.

#### **4.2.5 Annual Income and Adoption**

Relationship between the annual income of the farmers and their adoption of USG has been examined by testing the null hypothesis “There is no relationship between annual income and adoption of USG”.

The calculated value of ' $r$ ' = 0.245 was found to be greater than the tabulated value of ' $r$ ' (0.157) at 1% level of probability. It was therefore suggested that the annual income of the farmers had a positive and significant relationship with their adoption of USG.

So the null hypothesis in this aspect has been rejected.

Khan (2002), Chowdhury (1997), Katarya (1989) and Karim *et al.* (1987) had found the similar result.

#### **4.2.6 Extension Media Contact and Adoption**

The relationship between the extension contact of the farmers and their adoption of USG has been examined by testing the null hypothesis "There is no relationship between extension contact and adoption of USG".

The calculated value of ' $r$ ' = 0.084 was found to be smaller than the tabulated value of ' $r$ ' (0.118) at 5% level of probability.

So, no significant relationship was found between the extension contact of the farmers and the adoption of USG. Therefore the concerned null hypothesis could not be rejected. That is, the extension contact of the farmers had no influence on the adoption of USG. Hossain (1981) also found the similar result in his study.

#### **4.2.7 Cosmopolitaness and Adoption**

The relationship between the cosmopolitaness of the farmers and their adoption of USG has been tested by testing the null hypothesis "There is no relationship between cosmopolitaness and adoption of USG".

The calculated value of ' $r$ ' = 0.102 was found to be smaller than the tabulated value of ' $r$ ' (0.118) at 5% level of probability.

No significant relationship was found between the cosmopolitaness of the farmers and the adoption of USG. Therefore the concerned null hypothesis could not be rejected.

Gogoi and Gogoi (1989) and Hoque (1984) found the similar result.

#### **4.2.8 Organizational Participation and Adoption**

Relationship between the organizational participation of the farmers and their adoption of USG has been tested with the concerned null hypothesis "There is no relationship between organizational participation and adoption of USG".

The calculated value of  $r = 0.119$  was found to be greater than the tabulated value of  $r$  (0.118) at 5% level of probability.

It was therefore suggested that the organizational participation of the farmers had a positive and significant relationship with their adoption of USG. So the null hypothesis in this aspect has been rejected.

Khan (2002), Paul (2000), Hossain (1991) and Hoque (1984) also found the similar result.

#### **4.2.9 Agricultural Knowledge and Adoption**

Relationship between the agricultural knowledge of the farmers and their adoption of USG has been measured by testing the null hypothesis "There is no relationship between agricultural knowledge and adoption of USG".

The calculated value of  $r = 0.231$  was found to be greater than the tabulated value of  $r$  (0.157) at 1% level of probability.

It was therefore suggested that the agricultural knowledge of the farmers had a positive and significant relationship with their adoption of USG. So the null hypothesis in this aspect has been rejected.

Khan (2002) and Paul (2000) also found the similar result.

#### **4.2.10 Attitude toward the USG and Adoption**

Relationship between the Attitude of the farmers toward the USG and their adoption of USG has been measured by testing the null hypothesis "There is no relationship between Attitude of the farmers toward the USG and adoption of USG".

The calculated value of  $r = 0.435$  was found to be greater than the tabulated value of  $r$  (0.157) at 1% level of probability.

It was therefore suggested that the Attitude of the farmers toward the USG had a positive and significant relationship with their adoption of USG. So the null hypothesis has been rejected.

### 4.3 Adopter Categories

Not all individuals in a social system adopt an innovation at the same time. Rather, they adopt in a time sequence. On the basis of the time sequence the adopters of an innovation can be classified into some categories. Rogers (1983) determined five categories of adopters such as innovator, early adopter, early majority, late majority and laggards.

An individual does not adopt an innovation immediately after hearing or the introduction of the innovation. The adoption of an innovation requires a decision process by an individual. The final decision of adoption of an innovation usually involves a succession of actions and influences through time.

In this study, a distribution has been shown the Urea Super Granule (USG) adopters over a period of 8 (eight) years. Here it has to be mentioned that the USG was first introduced in the area of study (Manikgonj District) in 1999 with the help of Department of Agricultural Extension (DAE).

The adopters have been categorized on the basis of their adoption period and the mean and standard deviation were mentioned in the Table 4.3.1.1

**Table 4.3.1 Mean and standard deviation of the time of adoption.**

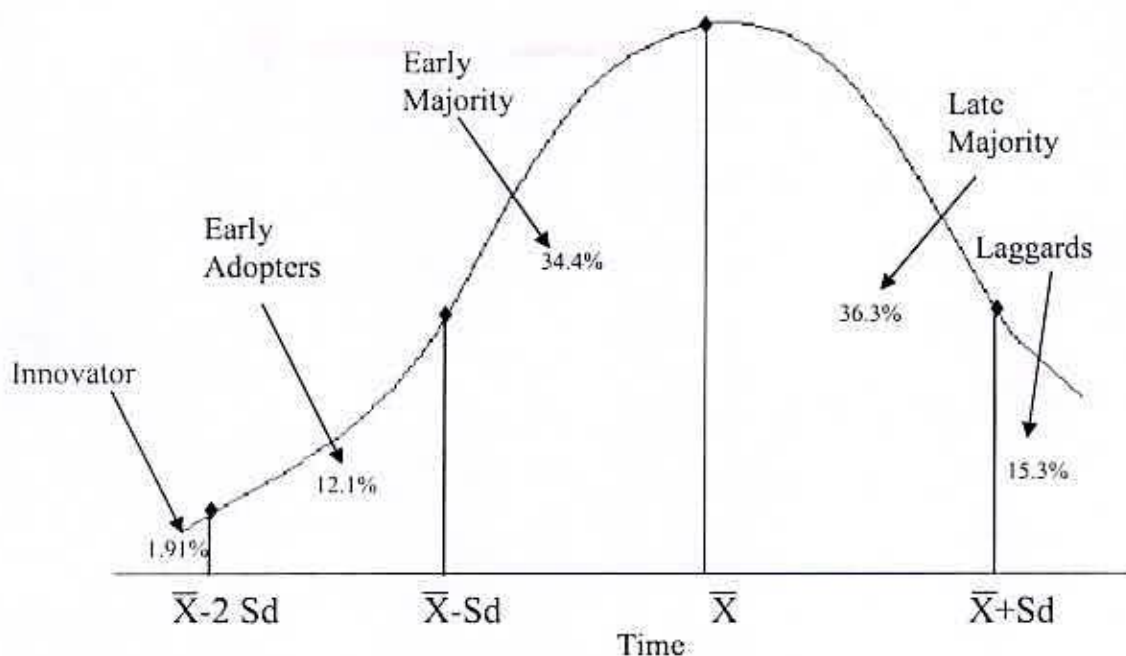
| Total no. respondents | Total no. of adopters | Mean | Standard deviation |
|-----------------------|-----------------------|------|--------------------|
| 232                   | 157                   | 4.97 | 1.977              |

The categories on the basis of above mean and standard deviation have been shown in the Table 4.3.1.2.

**Table 4.3.1.2 Classification of USG adopters based on their adoption period.**

| Name of the Category                                                              | Total No. of adopters<br>(n=157) |         |
|-----------------------------------------------------------------------------------|----------------------------------|---------|
|                                                                                   | Number                           | Percent |
| Innovators (introduction year, 1999)                                              | 3                                | 1.9     |
| Early Adopters (2 <sup>nd</sup> year of introduction, 2000)                       | 19                               | 12.1    |
| Early majority (3 <sup>rd</sup> to 4 <sup>th</sup> year of introduction, 2001-02) | 54                               | 34.4    |
| Late majority (5 <sup>th</sup> to 7 <sup>th</sup> year of introduction, 2003-05)  | 57                               | 36.3    |
| Laggards (8 <sup>th</sup> year of introduction, 2006)                             | 24                               | 15.3    |
| Total                                                                             | 157                              | 100     |

The data of the above table have been presented in a normal curve (fig 4.3.1). The distribution of adopters was partitioned into five categories by using the mean time and the standard deviation. In the figure the area lying to the left of the mean time of adoption minus two standard deviation ( $\bar{X} - 2Sd$ ) included the first 1.91% of the respondents who adopt the USG in the introduction year and they are called Innovators. The next 12.1 percent respondents are staying in the area between the mean minus two standard deviation and the mean minus one standard deviation ( $\bar{X} - Sd$ ) are named as Early Adopters. Then the area of the curve between mean time of adoption ( $\bar{X}$ ) and mean minus one standard deviation has included 34.4 percent adopters. They are called Early Majority. Then the area between mean time of adoption and mean plus one standard deviation ( $\bar{X} + Sd$ ) has included 36.3% respondents who are the Late Majority. The last 15.3 percent USG adopters are staying in the extreme right to the mean plus one standard are called the Laggards.



**Fig.4.3.1 Curve of different categories of Adopters**

The above figure has been developed with the exact percent of the USG adopters, which is nearly similar to the Bell Shape curve made by Rogers. However the findings of this study slightly differed from the study of Rogers, which has been shown in the following table (Table 4.3.1.3).

**Table 4.3.1.3. Table showing the comparison between the findings of Rogers and present study**

| Adopter categories | Findings of the Rogers | Findings of this study |
|--------------------|------------------------|------------------------|
| Innovators         | 2.5%                   | 1.91%                  |
| Early Adopters     | 13.5%                  | 12.1%                  |
| Early Majority     | 34%                    | 34.4%                  |
| Late Majority      | 34%                    | 36.3%                  |
| Laggards           | 16%                    | 15.3%                  |
| Total              | 100                    | 100                    |



## Chapter V

### Summary, Conclusion and Recommendation

#### 5.1 Summary

Bangladesh has a great potential in the sector of agriculture and the agricultural productivity of this country can be increased to a great extent by transferring the new technologies among the farmers. The rate of adoption of agricultural innovations has to be increased which will enhance the production. As, rice is the main food of this country so, the increase of rice production has to be ensured. The contribution of Boro rice is more than the Aus and Aman. So it is necessary to take initiative to increase the production of Boro rice. In this aspect fertilization has an operative role. Among all the fertilizers Urea is the most important. Unfortunately the efficiency of urea fertilizer as commonly applied in rice field is hardly 30 percent. And it is also a matter of fact that Bangladesh is not self-sufficient in urea production. So the efficiency has to be increased. Urea Super Granule (USG) was invented in this viewpoint and its effectiveness is already been proved.

USG has the potential to impact on rice production optimistically. This urea has certain attributes, which improve the efficiency of urea so that farmers need not to apply more than once in the rice field. The granules are 0.9 mm in size and need deep placement in the well-irrigated rice field. Thus the plants can uptake adequate nitrogen, which in turn boosts the production of rice.

On the other hand USG is a relatively new technology among the farmers. Lack of knowledge of the farmers about the USG and the lack of intensive extension approach to

transfer this technology hinder the rate of adoption of this fertilizer. For the farmers' interest this urea should be popularized. The adopters of USG can present an idea how the farmers adopt in and the different categories of USG adopters will also give a concept about the adopter categories of agricultural innovations.

### **Specific Objectives:**

1. To describe the adoption of the USG.
2. To determine the categories of Urea Super Granule (USG) adopters.
3. To explore the relationship between the selected characteristics of farmers with extent to adoption of USG.

The selected characteristics are

- a) Age
- b) Family size
- c) Education
- d) Farm Size
- e) Annual Income
- f) Extension contact
- g) Cosmopolitaness,
- h) Organizational participation,
- i) Agricultural knowledge,
- j) Attitude toward the USG

## **Hypothesis**

In this research, for the purpose of statistical test it becomes necessary to formulate null hypothesis. The null hypotheses were as follows:

There is no relationship between 10 selected characteristics of the farmers (independent variables) namely; age, education, family size, farm size, annual income, extension contact, cosmopolitaness, organizational participation, agricultural knowledge and attitude toward the use of USG and their adoption of USG (dependent variable).

The distribution of the USG adopters does not follow the categories made by Rogers.

## **Methodology**

Dighi Union of Manikgonj Sadra Thana was the location of the study. In this area people grow Boro Rice extensively so this area was selected to conduct this research. The Mulzan block was randomly selected out of the 4 (four) blocks where 1163 (one thousand one hundred and sixty three) farmers are living. Approximately 20% of the 1163 farmers were selected randomly. Thus 232 Boro rice growers constituted the sample. For the collection of the data an interview schedule was prepared. The Bangla version of the interview schedule was used to collect data from the respondents. Data obtained from the respondents were tabulated, coded compiled and analyzed to accomplish the objectives of the study.

Independent variables of this study are; age, education, family size, farm size, annual income, extension contact, cosmopolitaness, organizational participation, agricultural knowledge and attitude toward the use of USG and dependent variable is the adoption of USG. All these variables of the study were measured by computing appropriate scores. Various statistical measures such as mean, standard deviation, percentage and range were

used in describing both the independent and dependent variables. To explore the relationship between the independent and dependent variables Correlation Coefficient was measured. To categorize the adopters the method mentioned by E.M. Rogers was used.

## **Findings**

The major findings of the study are summarized below:

### **Farmers' adoption and adopter categories in respect of USG**

The adoption scores of USG ranged from 28.42 to 100 against the possible range from 0 to 100 with an average of 59.56 and standard deviation 17.59. The highest percentage (57.32) of the farmers had moderate adoption of USG. 24.85 percent of farmers had high adoption, whereas only 17.83 percent of farmers had low adoption.

The score against the time of adoption (innovativeness) regarding the USG ranged from 1 to 8 whereas the possible range was 1 to 8 with an average of 4.97 and standard deviation 1.977.

The USG was first introduced in the area of study in 1999. 1.91% of the farmers adopt it in the first year of introduction and they are considered as the Innovators. Then the next 12.1 percent adopted it in the year 2000 known as Early Adopters. From the third year of introduction (2001-2002) to fourth year of introduction 34.4% farmers adopted USG and they are considered as the Early Majority. From 2003 to 2005 (5<sup>th</sup> to 7<sup>th</sup> year of introduction) those who adopted USG are considered as Late Majority. Finally within the 8 years 15.2 percent farmers adopted the USG and are known as Laggards. This categorization has followed the categorization of Rogers closely.

## **Selected Characteristics of the Farmers**

### **Age**

The age of the farmers was found to range from 27 to 75. The average of age was 44.51 and the standard deviation was 9.28. The highest percentage (49.68) of the farmers fell in the Middle Aged category, while 14 and 36.32 percent of the farmers belong to Young and Old categories respectively.

### **Education**

The education of the farmers ranged from 0 to 16 and the average was 3.69. The standard deviation was 4.54. On the basis of the education score the farmers are classified into 5 categories. Largest portion (59.25) of the farmers has no formal education. On the other hand only 3.3 and 5 percent of the respondents have Higher Education and Higher Secondary Education respectively. The second highest percentage (23.53) of the farmers belongs to the category of Secondary Education, whereas 8.92 percent farmers belong to the category Primary Education. The result is almost similar to the national rate education.

### **Family Size**

Family range of the farmers ranged from 2 to 12 with an average of 5.48 and standard deviation was 2.89. The highest percentage of the farmers belonged to the Medium category and the percentage is 44.6 and the lowest proportion of the farmers attain in the category Large which percent is 15.3. On the other hand 40.1 percent farmers have their family size in between 2-4 members which is named as Small category.

### **Farm Size**

The farm size of the farmers of the study area ranged from 0.04 hectares to 3.26 hectares. The average farm size was 0.79 ha and the standard deviation was 0.47. According to the

farm size the farmers have been categorized in 4 categories. A bulky percentage of the farmers of the study area had Small farm and the percentage was 75.8. On the other hand very few of them had are Marginal and Large farm size. The percentages of these two categories are 2.5 and 3.2 respectively. Another 18.5 percent farmers had medium size farm. The average farm size of Bangladesh is 0.81 ha which nearly resembles to this study (0.79 ha).

#### **Annual Income**

The annual income scores of the farmers of this study ranged from 11 to 428 with an average of 109.61 and the standard deviation 69.88. The highest proportion of the farmers (43.9%) had medium income, while 37.6 percent had low income and only 18.5 percent had high income. In fact the majority proportion of the farmers of the study area constitute low to medium categories of income.

#### **Extension Contact**

The extension contact score of this study ranged from 17 to 53 against the possible range of 0 to 68. The average extension contact score was 28.37 and standard deviation was 7.16. Based on extension score the farmers were classified into 3 categories and most of the farmers had low to medium extension contact. 47.8 percent and 31.8 percent farmers had low and medium extension contact respectively, while 20.4% farmers had high extension contact.

#### **Cosmopolitaness**

Cosmopolitaness score of the respondents of the study area had a possible range of 0 to 20. The cosmopolitaness of the farmers in this study ranged from 3 to 16 with an average score of 8.48 and the standard deviation 3.04. According to the cosmopolitaness score farmers were classified into 3 categories. 45.9 percent farmers had medium

cosmopolitanism, whereas 41.4 percent had low cosmopolitanism and only 12.7 percent had high cosmopolitanism.

### **Organizational Participation**

The computed organizational participation scores of the respondents ranged from 0 to 19 with an average of 0.93 and standard deviation 2.38. According to the scores of organizational participation the farmers were classified into 4 categories. Most of the farmers of the study area had no organizational participation and the percentage is 69.43. Another 28.03 percent had low participation and 1.27 percent had medium and high participation

### **Agricultural Knowledge**

The agricultural knowledge of the farmers was assessed by asking them 5 questions and then marks were given to their answers. Their marks ranged from 21 to 44 with a possible range from 0 to 50. The average was 32.17 and standard deviation was 4.46. According to the obtained marks farmers were classified into 3 categories. The highest proportion of the farmers had medium knowledge and the percentage was 83.43, whereas 4.45% and 12.12% had low and high knowledge respectively.

### **Attitude toward the Use of USG**

The observed attitude of the farmers towards the Urea Super Granule ranged from 32 to 45 against the possible range of 0 to 48. The average was 40.16 and standard deviation was 2.65. According to the attitude scores farmers were classified into 3 categories. Highest proportion (74.52%) of the farmers had favorable attitude toward USG. The least (8.92) percent of farmers had less favorable attitude and 16.65 percent had highly favorable attitude towards USG.

## **Relationship between the selected characteristics and the adoption of USG**

### **Age and Adoption**

No significant relationship was found between the age of the farmers and the adoption of USG at 5% level of probability. The correlation coefficient shows a negative trend. That means age of the farmers had no influence on the adoption of USG.

### **Education and Adoption**

No significant relationship was found at 5% level of probability between the education of the farmers and the adoption of USG. That means education of the farmers had no influence on the adoption of USG. The 'r' value has depicted a positive trend.

### **Family Size and Adoption**

At 5% level of probability no significant relationship was found between the family size of the farmers and the adoption of USG also a negative trend has been found between two variables.

### **Farm Size and Adoption**

At 5% level of probability no significant relationship was found between the farm size of the farmers and the adoption of USG and the two variables have shown a negative trend.

### **Annual Income and Adoption**

There was a significant relationship between the annual income of the farmers had a positive and with their adoption of USG at 1% level of probability. That means annual income of the farmers had influence on the adoption of USG.



### **Extension Contact and Adoption**

No significant relationship was found between the extension contact of the farmers and the adoption of USG at 5% level of probability. That is, the extension contact of the farmers had no influence on the adoption of USG.

### **Cosmopolitanism and Adoption**

At 5% level of probability no significant relationship was found between the cosmopolitanism of the farmers and the adoption of USG.

### **Organizational Participation and Adoption**

There was a significant and a positive relationship between the organizational participation of the farmers and with their adoption of USG at 5% level of probability.

### **Agricultural Knowledge and Adoption**

There had a positive and significant relationship between agricultural knowledge and adoption of USG 1% level of probability. It was therefore suggested that the agricultural knowledge of the farmers had a positive and significant influence on their adoption of USG.

### **Attitude toward the USG and Adoption**

At 1% level of probability it was found that the Attitude of the farmers toward the use of USG had a positive and significant relationship with their adoption of USG.

## 5.2 Conclusion

Conclusions have been drawn on the basis of the findings of the study, the logical interpretation of their meanings and other relevant facts are presented below

- I. The majority percentage of the farmers (82.16%) had medium to high adoption of the USG and 17.83 percent farmers had low adoption. The application of the USG saved considerable amount of money and time of the Boro rice growers. In the study area USG has introduced only 8 years earlier. This finding led to conclusion that, with the passes of time the rate of adoption may be increased.
- II. The adopters of USG have been categorized as; Innovators 1.91%, Early Adopters 12.1%, Early Majority 34.39%, Late Majority 36.3% and Laggards 15.3%. This result is very close to the distribution of adopters made by Rogers. To sum up it can be said that, with the increase of time more farmers will adopt the innovation.
- III. Most of the respondents of this study (59.25%) had no education. Interestingly their level of education had no impact on the adoption of USG.
- IV. According to findings, the adoption of USG had significant and positive relation with the annual income of the farmers. So it may be concluded that those who had higher income were venturesome and dared to adopt new technologies.
- V. The Extension contact of the respondents was found an insignificant factor regarding the adoption of USG. Extension contact helped the farmers to be more experienced, modernized and became effective motivator for formation of favourable attitude toward the adoption of USG.
- VI. Cosmopolitaness of the farmers had no relationship with the adoption of USG. So it can be concluded that the cosmopolitaness is not an influential factor for adopting USG.

- VII. Organizational participation of the farmers of the study area played significant role in the adoption of USG. So it may be concluded that, if the farmers had more organizational participation then adoption would have been increased.
- VIII. Agricultural knowledge of the farmers was positively correlated with the adoption of USG and the majority of the farmers had medium to high knowledge. To conclude it may be said that if the level of agricultural knowledge of the farmers could be increased the adoption of USG could also increased.
- IX. It has been revealed that most of the farmers possessed favorable to highly favorable attitude toward the use of USG and the attitude toward the use of USG had a positive and significant relationship with the adoption. Such findings led to the conclusion that favorable attitude of the farmers toward an innovation is helpful to increase the adoption.

### **5.3 Recommendations**

The adoption of innovation largely depends on its attributes and time. Not all individual of a social system adopt an innovation at a time. People take their time to assess the innovation and then they decide to adopt it. In Bangladesh the farmers adopt the agricultural technologies in a steady way and thus the rate of adoption is low. Hence, we need more extensive extension effort to transfer the technologies; subsequently the inventors have to be conscious about the usability of their invented innovation. However, based on the findings, the following recommendations were put forward.

- a) In view of the importance of the increase of the production of rice, the adoption of USG should be made more. Therefore, it may be recommended that the farmers should

be encouraged by the DAE, agricultural input dealers and other concerned organizations' personnel to form favorable attitude toward USG and to motivate them to use this urea.

b) The DAE and other agriculture related organization should take necessary steps to enhance their extension media contact with the farmers. So that the farmers will come to know about the new technologies frequently.

c) Based on the problems faced by the farmers while using USG in rice cultivation the experts should visit the farmers more frequently. So that they can provide advice and adequate information which will help the farmers to overcome their faced problems.

d) Adequate supply of USG should be ensured and the dealers are to be motivated to sell the USG.

e) Farmers having more agricultural knowledge were more likely to have more adoption. It is recommended that the farmers' agricultural knowledge should be increased.

### **5.3.1 Recommendations for Further Study**

1) In the present study Urea Super Granule is the only technology used to determine the adopter categories and to measure the adoption. Similar study may be replicated using other agricultural technology in order to generalize the findings of the study.

2) The present study has been conducted in a selected block of Manikgonj Sadra Thana. The findings of the study should be verified in the other part of the country.

3) In this study 10 characteristics were selected to explore the relationship. But there were a wide variation of the farmers' characteristics. So it may be recommended that further research can be done to explore the influence of such other characteristics of the farmers on the adoption of USG.

- 4) This study included only 232 respondents to determine the adopter categories, which was the 20 percent of the total number of the farmers of that block. To generalize the categories it may be recommend that further research can be done in the area including as many respondents as possible.
- 5) Adopter categories of the farmers may be determined by using other methods.
- 6) As the study on the adopter categories is a rare study in Bangladesh so more researches can be done on this aspect.

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## Department of Agricultural Extension & Information System

### Sher-e-Bangla Agricultural University (English version of the Interview Schedule)

Interview Schedule to collect data for the research on "Classification of Urea Super Granule Adopters of Mulzan Block of Manikgonj District in Boro Season"

**Name of the respondent:**

**Sl. No.**

**Village:**

**Upazila:**

**Date:**

Please answer the following question (put tick mark on the appropriate one and where applicable).

1. **How old are you?** ..... Years.

2. **Education:** Please mention your educational level

a) Cannot read and write

b) Only can sign

c) Read up to class .....

3. **Family Size:** Please mention how many members in your family (including yourself)?

.....

4. **Farm Size:** Please describe your land holdings according to nature of tenure.

| Sl No.         | Nature                              | Local unit | Hectare |
|----------------|-------------------------------------|------------|---------|
| A <sub>1</sub> | Own land under own cultivation      |            |         |
| A <sub>2</sub> | Own land given to others as 'Borga' |            |         |
| A <sub>3</sub> | Land taken from others as 'Borga'   |            |         |
| A <sub>4</sub> | Land taken from others on lease     |            |         |
| A <sub>5</sub> | Homestead                           |            |         |
| A <sub>6</sub> | Pond                                |            |         |
| A <sub>7</sub> | Others                              |            |         |
|                | Total                               |            |         |

**5. Annual Income:** Please mention your approximate annual family income from following sources:

| Source           |             | Amount (Taka) |
|------------------|-------------|---------------|
| Agriculture      | Aus rice    |               |
|                  | Aman rice   |               |
|                  | Boro rice   |               |
|                  | Jute        |               |
|                  | Maize       |               |
|                  | Pulse crops |               |
|                  | Vegetables  |               |
|                  | Fruits      |               |
|                  | Poultry     |               |
|                  | Livestock   |               |
|                  | Fish        |               |
|                  | Others      |               |
| Non Agricultural | Service     |               |
|                  | Business    |               |
| Others           |             |               |

**6. Extension Media Contact:** Please indicate the extent of your contact with the following media

**A. Personal Contact:**

| Name of the Personnel                | Extent of contact               |                     |                 |                |                |
|--------------------------------------|---------------------------------|---------------------|-----------------|----------------|----------------|
|                                      | Regularly                       | Often               | Occasionally    | Rarely         | Not at all     |
| Neighbors                            | 24-30<br>day/month              | 16-23<br>days/month | 8-15 days/month | 1-7 days/month | 0<br>day/month |
| Relatives                            | 4<br>Times/month                | 3<br>Times/month    | 2 Times/month   | 1 times/month  | 0 time         |
| Village leaders                      | 12 times<br>Or more<br>/year    | 8-11<br>times/year  | 4-7 times/year  | 1-3 times/year | 0 time/year    |
| Ideal Farmers                        | 12 times<br>Or more<br>/year    | 8-11<br>times/year  | 4-7 times/year  | 1-3 times/year | 0 time/year    |
| Agricultural<br>input dealers        | 10-12<br>times Or<br>more /year | 7-9<br>times/year   | 4-6 times/year  | 1-3 times/year | 0 time/year    |
| Block<br>Supervisor                  | 10-12<br>times Or<br>more /year | 7-9<br>times/year   | 4-6 times/year  | 1-3 times/year | 0 time/year    |
| NGO workers                          | 10-12<br>times Or<br>more /year | 7-9<br>times/year   | 4-6 times/year  | 1-3 times/year | 0 time/year    |
| Agricultural<br>Extension<br>officer | 7 times or<br>more /year        | 5-6<br>time/year    | 3-4 time/year   | 1-2 time/year  | 0 time/year    |
| Upazilla<br>Agricultural<br>officer  | 7 times or<br>more /year        | 5-6<br>time/year    | 3-4 time/year   | 1-2 time/year  | 0 time/year    |

**B. Group and Mass contact:** Please indicate the extent of your contact with the following media

| Nature of contact    | Extent of contact         |                   |                 |                |             |
|----------------------|---------------------------|-------------------|-----------------|----------------|-------------|
|                      | Regularly                 | Often             | Occasionally    | Rarely         | Not at all  |
| <b>Group Contact</b> |                           |                   |                 |                |             |
| Result Demonstration | 7 times or more /year     | 5-6 time/year     | 3-4 time/year   | 1-2 time/year  | 0 time/year |
| Method Demonstration | 7 times or more /year     | 5-6 time/year     | 3-4 time/year   | 1-2 time/year  | 0 time/year |
| Group Discussion     | 10-12 times or more /year | 7-9 times/year    | 4-6 times/year  | 1-3 times/year | 0 time/year |
| Field Day            | 7 times or more /year     | 5-6 time/year     | 3-4 time/year   | 1-2 time/year  | 0 time/year |
| <b>Mass Contact</b>  |                           |                   |                 |                |             |
| Daily Newspaper      | 24-30 days/month          | 15-23 days/month  | 8-14 days/month | 1-7 days/month | 0 day/month |
| Leaflet              | 5 or more In life         | 3-4 times in life | 2 times in life | 1 time in life | 0 in life   |
| Radio                | 24-30 days/month          | 15-23 days/month  | 8-14 days/month | 1-7 days/month | 0 day/month |
| Television           | 4/month                   | 3/month           | 2/ months       | 1/6 months     | 0/year      |

**7. Cosmopolitaness:** Please indicate the extent of visit of the following places

| Place to visit                                                 | Extent of visit       |                  |                 |                 |               |
|----------------------------------------------------------------|-----------------------|------------------|-----------------|-----------------|---------------|
|                                                                | Regularly             | Often            | Occasionally    | Rarely          | Not at all    |
| Visit to the house of friends/relatives outside of the village | 12 or more times/year | 9-11 times/year  | 5-8 times /year | 1-4 times/ year | 0 time/ year  |
| Visit to Manikgonj town                                        | 5 or more times/month | 3-4 times/ month | 2 times /month  | 1time/ month    | 0 time/ month |
| Visit to other upazilla                                        | 12 or more times/year | 9-11 times/year  | 5-8 times /year | 1-4 times/ year | 0 time/ year  |
| Visit to other district                                        | 12 or more times/year | 9-11 times/year  | 5-8 times /year | 1-4 times/ year | 0 time/ year  |
| Others (please specify)                                        |                       |                  |                 |                 |               |

**8. Organizational Participation:** Please mention your extent of organizational participation

| Sl. No | Name of the organization               | Nature of participation |                            |                             |                                 |
|--------|----------------------------------------|-------------------------|----------------------------|-----------------------------|---------------------------------|
|        |                                        | No participation        | Ordinary Member (Year) 1X1 | Executive Member (Year) 1X2 | President/ Secretary (Year) 1X3 |
| 1.     | Union Parishad                         |                         |                            |                             |                                 |
| 2.     | Gram Sarkar                            |                         |                            |                             |                                 |
| 3.     | Mosque/ Mandir committee               |                         |                            |                             |                                 |
| 4.     | NGOs' Society                          |                         |                            |                             |                                 |
| 5.     | Local farmers' cooperative association |                         |                            |                             |                                 |
| 6.     | School committee                       |                         |                            |                             |                                 |
| 7.     | Madrasa committee                      |                         |                            |                             |                                 |
| 8.     | Village defense committee              |                         |                            |                             |                                 |
| 9.     | Others (If any)                        |                         |                            |                             |                                 |

**9. Agricultural Knowledge:** Please answer the following questions

| Question                                                          | Full Marks | Marks obtained |
|-------------------------------------------------------------------|------------|----------------|
| Mention the name of 5 Boro Rice variety                           | 5          |                |
| Mention the name of two chemical fertilizer                       | 5          |                |
| Name two harmful pests of Boro rice                               | 5          |                |
| Mention two name of disease that cause severe damage to Boro rice | 5          |                |
| Mention the name of five weeds related to Boro rice               | 5          |                |
| Mention two green manure crop                                     | 5          |                |
| How many steps of IPM do you follow                               | 5          |                |
| Mention the name of five organic manure                           | 5          |                |
| Mention the name of five farm machineries                         | 5          |                |
| Mention the name of five pesticides                               | 5          |                |
| Total                                                             | 50         |                |

**10. Attitude of farmers towards the use of Gutee Urea:**

Please indicate your agreement of the following statements

| Sl. No. | Statements                                                                                                                                              | Extent of agreement |       |            |          |                   |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|------------|----------|-------------------|
|         |                                                                                                                                                         | Strongly agree      | Agree | No opinion | Disagree | Strongly disagree |
| 1       | Application of urea super granule increases the yield regarding the application of usual urea, for this reason I am interested to apply this fertilizer |                     |       |            |          |                   |
| 2       | I think its unnecessary to place in a certain depth of soil                                                                                             |                     |       |            |          |                   |
| 3       | Application of this fertilizer increases the availability of nitrogen so that each plant can uptake it                                                  |                     |       |            |          |                   |
| 4       | I am not interested in using this fertilizer as it is complex to apply                                                                                  |                     |       |            |          |                   |
| 5       | I intend to use this fertilizer as it requires less number of labourer                                                                                  |                     |       |            |          |                   |
| 6       | Farmers don't show interest because they do not know the appropriate technique of application                                                           |                     |       |            |          |                   |
| 7       | A huge amount of urea can be saved by using Gutee urea                                                                                                  |                     |       |            |          |                   |
| 8       | I think this fertilizer is not available in the market                                                                                                  |                     |       |            |          |                   |
| 9       | It only suitable for those crops which need relatively more irrigation                                                                                  |                     |       |            |          |                   |
| 10      | I think publicity has not enough been done to make this fertilizer popular                                                                              |                     |       |            |          |                   |
| 11      | I think exposure to the air this urea is relatively more stable than the usual urea                                                                     |                     |       |            |          |                   |
| 12      | It can create damage to the plant if it comes to contact                                                                                                |                     |       |            |          |                   |

**11. Adoption of Gutee Urea:** Please answer the following questions

A. Do you use Urea Super Granule in Boro rice cultivation?

Yes

No

If yes then please mention the first year when you have used Urea Super Granule?

B. Are you still continuing the use of Urea Super Granule?

Yes

No

C. Please mention the area where you have applied urea super granule last year.

Thank you for your cordial cooperation

Signature of the Data Collector

Date



## Appendix B

### Correlation Matrix

|          |                     | AGE    | EDU    | FAMILYSI | FARMSIZE | INCOME | EXTCONT | COSMOPOL | ORGPART | KNOWLEDG | ATTITUDE | ADOPTION |
|----------|---------------------|--------|--------|----------|----------|--------|---------|----------|---------|----------|----------|----------|
| AGE      | Pearson Correlation |        |        |          |          |        |         |          |         |          |          |          |
|          | Sig. (2-tailed)     |        |        |          |          |        |         |          |         |          |          |          |
|          | N                   |        |        |          |          |        |         |          |         |          |          |          |
| EDU      | Pearson Correlation | .013   |        |          |          |        |         |          |         |          |          |          |
|          | Sig. (2-tailed)     | .867   |        |          |          |        |         |          |         |          |          |          |
|          | N                   | 157    |        |          |          |        |         |          |         |          |          |          |
| FAMILYSI | Pearson Correlation | .250** | -.097  |          |          |        |         |          |         |          |          |          |
|          | Sig. (2-tailed)     | .002   | .226   |          |          |        |         |          |         |          |          |          |
|          | N                   | 157    | 157    |          |          |        |         |          |         |          |          |          |
| FARMSIZE | Pearson Correlation | -.069  | .148   | -.063    |          |        |         |          |         |          |          |          |
|          | Sig. (2-tailed)     | .388   | .064   | .430     |          |        |         |          |         |          |          |          |
|          | N                   | 157    | 157    | 157      |          |        |         |          |         |          |          |          |
| INCOME   | Pearson Correlation | .151   | .304** | .105     | -.011    |        |         |          |         |          |          |          |
|          | Sig. (2-tailed)     | .059   | .000   | .191     | .888     |        |         |          |         |          |          |          |
|          | N                   | 157    | 157    | 157      | 157      |        |         |          |         |          |          |          |
| EXTCONT  | Pearson Correlation | .253** | .365** | .110     | .050     | .313** |         |          |         |          |          |          |
|          | Sig. (2-tailed)     | .001   | .000   | .169     | .535     | .000   |         |          |         |          |          |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    |         |          |         |          |          |          |
| COSMOPOL | Pearson Correlation | .150   | .248** | .017     | -.175*   | .432** | .405**  |          |         |          |          |          |
|          | Sig. (2-tailed)     | .061   | .002   | .834     | .028     | .000   | .000    |          |         |          |          |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    | 157     |          |         |          |          |          |
| ORGPART  | Pearson Correlation | .038   | .338** | .047     | -.018    | .266** | .420**  | .234**   |         |          |          |          |
|          | Sig. (2-tailed)     | .636   | .000   | .561     | .826     | .001   | .000    | .003     |         |          |          |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    | 157     | 157      |         |          |          |          |
| KNOWLEDG | Pearson Correlation | .054   | .401** | -.031    | .088     | .407** | .418**  | .331**   | .310**  |          |          |          |
|          | Sig. (2-tailed)     | .499   | .000   | .701     | .275     | .000   | .000    | .000     | .000    |          |          |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    | 157     | 157      | 157     |          |          |          |
| ATTITUDE | Pearson Correlation | -.188* | .198*  | -.022    | .012     | .255** | -.010   | -.038    | .032    | .276**   |          |          |
|          | Sig. (2-tailed)     | .018   | .013   | .780     | .880     | .001   | .901    | .639     | .588    | .000     |          |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    | 157     | 157      | 157     | 157      |          |          |
| ADOPTION | Pearson Correlation | -.006  | .097   | -.014    | -.071    | .245** | .084    | .102     | .119*   | .231**   | .435**   |          |
|          | Sig. (2-tailed)     | .941   | .225   | .866     | .380     | .002   | .295    | .202     | .143    | .004     | .000     |          |
|          | N                   | 157    | 157    | 157      | 157      | 157    | 157     | 157      | 157     | 157      | 157      |          |

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).