

**SITUATION OF VEGETABLE CULTIVATION IN THE KHULNA REGION
OF BANGLADESH DUE TO SHRIMP FARMING**

A THESIS
BY

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ABSTRACT

The main purposes of the study were to determine the present situation of vegetable cultivation due to shrimp farming and climate change. Data were collected from randomly selected 120 vegetable growers of three selected Upazilla under Khulna district through personal interview method by using an interview schedule during October 2012 to July 2013. Data were collected on total cultivable land, land suitable for vegetable cultivation, land under vegetable cultivation, types of vegetable cultivated, use of fertilizers and manures, diseases and insect infestation, intercultural operations, experience in agriculture, experience in vegetable cultivation and knowledge in vegetable cultivation to determine the situation of vegetable cultivation. Besides, data were collected on eleven selected characteristics of the vegetable growers and the problems confronted by them. Most of respondents had medium to high experience in agriculture and vegetable cultivation and they belonged to medium knowledge category in cultivation of vegetable. Among the 19 confronted problems unavailability of good quality seed, salinity, diseases and insect infestation were some of the major problems. Among the 11 selected characteristics of the respondents only cosmopolitanism and knowledge of vegetable cultivation showed a negative significant relationship. Total cultivable land area is high in shrimp farming and the average amount of suitable land for vegetable cultivation and land under vegetable cultivation in non-prawn farming area is high. In case of non-shrimp farming area and shrimp farming area, diseases and insect infestation is higher than prawn farming area and non-prawn farming area. The average yields were higher in case of prawn farming area and non-prawn farming area than shrimp farming area and non-shrimp farming area. Among the selected 10 causes of changing of choosing vegetables, the most important was introduction of prawn culture for prawn farming area, increase of high demand of vegetables for non-prawn farming area, increase of salinity for shrimp farming area and non-shrimp farming area. There was a trend to increase in the total number of cropping patterns from 1980s to 2013 and showed a distinct figure of changing vegetables cropping patterns at different years. Among the selected 9 causes of changing vegetables cropping patterns, the most important was introduction of prawn farming for prawn farming area, increase of vegetables yield in a unit area for non-prawn farming area, increase of salinity for shrimp farming area and natural calamities for non-shrimp farming area.

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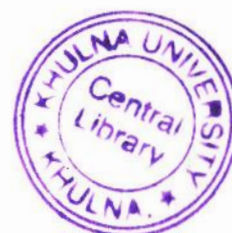


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CHAPTER I

INTRODUCON

General Background

Bangladesh is a thickly populated country. It has a population of about 150 million with 147,570 square kilometers area (BBS, 2011). About 80 percent of her total population live in the rural areas and 51.69 percent of the country's total labor force are engaged in agriculture (BBS, 2004). Agriculture is the most dominant sector of Bangladesh economy.

Vegetables sub-sector plays an important role for development of Bangladesh. Vegetables are herbaceous plant whose fruits, seeds, roots, tubers, leaves etc. are used as food. Nearly 100 different types of vegetables comprising both of local and foreign origins are grown in Bangladesh. Vegetable is important for nutrition, economy and food security. Vegetables can be identified as a significant one for the economy for its noteworthy contribution in raising the foreign exchange earnings and occupies an important position among the items exported from Bangladesh. Vegetables contribute 3.2% of the agricultural Gross Domestic Product (BBS, 2009). Bangladesh earned US \$ 41.11 million from export of agricultural products in 2003-2004, which contributed 0.54% to total export earnings (BER, 2008).

As a developing country, Bangladesh is adequately suffering from the problems of poverty, unemployment and malnutrition. Vegetable sub-sector can play important role to solve these problems in the shortest possible time. The importance of vegetable can be realized from two stand points such as, economic and nutritional point of view. It creates a great opportunity of employment for the large number of unemployed women of Bangladesh.

Vegetables compared to other food items provide low cost nutrition source. It can be produced even small amount of land and also in homestead area. It can be grown within a short time period and more than one crop can be grown within a crop season. There are a large number of vegetables having different varieties, which can be grown throughout the year. However, the largest numbers of vegetables are grown in the winter season. Vegetables are generally labor intensive crops and thus offer a considerable promise for generating increased rural employment opportunities.

Climate and soil of Bangladesh is very much suitable for growing vegetables round the year. Further, there is a tremendous pressure on cultivable land because of increasing population, land fragmentation and economic hardship. There is little or no scope for bringing any new land under cultivation. This huge population has a tremendous amount of nutrient requirement. Vegetables are important sources of nutrients.

To meet the existing demand of the population vegetables production per unit area must be increased. This is possible by converting single cropped area into double and triple cropped area by using improved technology in production of crops, fruits and vegetables.

In order to maximize output from a limited land it is essential to practice intensive cultivation of quick growing vegetable. It is often argued that high yielding vegetables if properly grown can give more than five times higher return than that of any cereals crops. It can be seen from Table 1.1 and Table 1.2 (Shown in Appendix I) that the total production of vegetables during the period from 2006-07 to 2010-11 per capita consumption of vegetable in Bangladesh is perhaps the lowest amongst the countries of South Asia and South-East Asia. Only 3 percent of total land covering 4, 29000 hectares belonged to vegetable cultivation.

It can be seen from Table 1.3 (Shown in Appendix II) that the daily per capita consumption of vegetables in this country is only 50 g against the required amount of 200 g. This gap causes malnutrition among the people of Bangladesh since almost vegetables are rich in vitamins and minerals.

In Bangladesh a good number of vegetables are grown throughout the year, in view of increase the income of population and nutritional considerations there is a great need for vegetable production. Farmers used to grow vegetables in and around the homestead area but now-a-days a large number of farmers grow vegetable on commercial scale because vegetable cultivation is more profitable than cereal crops.

Introduction of prawn farming opens a new dimension in case of vegetables production around the *gher* boundry. The *gher* farming technology was developed in the 1980s by farmers in Bagerhat district. Since then *gher* farming has spread rapidly to other districts: Khulna, Jessore, Gopalganj and Satkhira, and the number of *ghers* increases by approximately 10-20

percent every year (CARE Bangladesh 1996, 1998, 2000). *Gher* farming is now the primary livelihood strategy of more than 100,000 rural households in the south-west of Bangladesh. *Gher* farming has brought about dramatic changes in the society as well as to the institutions that govern the local and the regional economy. Shrimp farming also adversely affects agricultural production. Increasing the intensity of saline in soil is bad for vegetable cultivation.

Climate change is defined as any change in global temperatures and precipitation over a period of time due to natural variability or as a result of human activity. It is the mother of all environmental changes (Glantz and Qian, 2010).

Changes in the world's climate will bring major shifts in food production (Rosenzweig, *et al.*, 1993). In some places, temperatures will rise and rainfall will increase; in others, rainfall will decrease. In addition, coastal flooding will reduce the amount of land available for agriculture (Schneider, 1989).

In general, food crops are sensitive to climate change. Such change, which affects soil temperature and moisture levels, also determines the vitality of both beneficial organisms and pests. Due to the enormous uncertainties surrounding global climate change, estimates of cropland reductions vary widely from 10 to 50 percent (Stevens, 1989)

1.2 Statement of the Problem

Commercial cultivation of vegetables is very much important to fulfill nutritional requirement and to earn foreign currency. To achieve this goal commercial cultivation of vegetables should be cultivated in planned way. In fact in commercial cultivation of vegetables farmers face many problems. Especially salinity problem in the coastal region is a common affair. Shrimp farming and frequency of natural calamity like flood, drought, water logging, and inundation of saline water etc. is not suitable for vegetable cultivation. If problems of vegetables growers are ascertained and surmounted Bangladeshis economy has a chance to experience a radial future. From this point of view the researchers became very much interested to undertake a research program entitled "Situation of vegetable cultivation and change of cropping pattern due to climate change and shrimp farming." In cultivation of vegetable

farmers face many problems. Considering the nature of study the researcher sought information from the following research questions.

- What is the present situation of vegetable cultivation?
- What are the problems being faced by the farmers in cultivation of vegetables?
- What are the personal, social, economic and psychological characteristics of the vegetables growers?
- What is the past and present vegetable cropping pattern?
- What are the main causes of changing vegetable cropping pattern?

1.3 Justification of the Study

Prosperity of agriculture is generally measured by the level of production and the extent of probability. Bangladesh is endowed with a favorable climate and soil for the production of different crops year round. Although the agro-climatic situations of Bangladesh are suitable for the cultivation of a large variety of crops but about 80 percent of the gross cropped area are at present confined to the production of rice and wheat. Since the mid-sixties all the government programs have been aimed at achieving self-sufficiency in food grain production. This illusive chasing towards self-sufficiency in food grain production led to adverse effect on the hectareage and production of vegetable. As a result the people of Bangladesh are suffering from severe malnutrition.

The government of Bangladesh has given emphasis on year round vegetable production to meet the nutritional and caloric need for increasing employment opportunities and income of farmers.

To make cultivation of vegetables profitable it is necessary to involve farmers' in production, planning and ascertain problem with regard to vegetables production.

To identification of the present condition of malnutrition of the people, find out the way of increasing production of vegetables by identifying main problems of vegetables cultivation, if there exist any change of vegetable cropping pattern due to climate change and shrimp farming, farmer benefited or not from such kind of change etc. are the main justifications of the study.

Due to climate change, temperature of the world is increasing. As a result of global warming, sea level is rising as ice is melting continuously. Due to the rise in sea level, salinity of water is uprising. For anyhow, if this saline water enters into the crop field, it rapidly affects the crop production negatively. Because of natural calamity, sea water is going into the cultivated land through the channel of river. The frequency of natural calamity like flood, drought, water logging, and inundation of saline water are occurring due to climate change. It is causing the damage of sensitive embankments of rivers. Thus hampering of crop field and eventually the living places with a surge has become a common phenomenon in the coastal area.

1.4 Scope of the Study

The present study makes attempt to have an understanding of present situation of vegetable cultivation and problems faced by the farmers in cultivation of vegetables and explore its relationship with their selected characteristics.

The present study also makes attempt to have an identification of different cropping pattern and the causes of changing vegetable cropping pattern.

The findings of this study will be particularly applicable to the farmers or the respective study area. The findings may also have applicability to other areas of the country where the physical, socio-economic and cultural conditions are mostly similar with those of the study area. However, the findings of the study will be helpful for the specialist of different organizations and planners, policy makers and extension agents in removing constraints faced by the farmers in cultivation of vegetable.

The administrators, supervisors, field workers and others who are to work in the field of vegetable production may find this study informative. This study could be helpful for vegetable cultivation programme in one hand and motivate to cultivate more vegetables and earn more foreign exchange on the other.

1.5 Limitations of the study

Considering the time, money, labor and other necessary resources available to the researcher, the following limitations have been observed throughout the study:

1. The study was conducted only three selected Upazilla under Khulna district namely Dumuria, Paikgachha and Koyra.

Training: It indicates the exposure of training of respondents for the intensification of knowledge and skill in agriculture to perform their farm related activities more efficiently.

Experience in agriculture: It refers time period of involvement of respondent with agriculture.

Knowledge in vegetable cultivation: Literally, knowledge means knowing or what one knows about a subject, fact, person, etc. Knowledge on vegetable cultivation thus refers to farmers' understanding of different aspects of vegetable cultivation.

Organizational participation: It refers to the involvement of respondents in different local and social organization.

Extension media contact: The term "extension media contact" as used in this study, refers to ones becoming accessible to the influence of extension programme thorough different extension teaching methods or different extension change agents.

Cosmopolitaness: Cosmo politeness is the degree to which an individual's extent of orientation outside of his own social system.

1.7 Specific Objectives of the Study

The present study was undertaken at Dumuria, Paikgachha and KoyraUpazila of Khulna district, in view of the consideration of above stated research questions the following specific objectives have been formulated for giving proper direction to the study:

- To determine the present situation of vegetable cultivation.
- To identify vegetables cropping pattern and causes of changing vegetables cropping pattern.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review the past studies conducted by different researchers related to the present study. This study as already indicated, was undertaken to have an understanding about selected characteristics of the vegetable growers. As far as possible the researcher tried to review the available literature from different countries related to problem confrontation and other related matters. Unfortunately none of these studies directly relates to the present study.

Literature having relevance to the present study has been reviewed in three sections. In the First section, literature relating to problem faced by the farmers in different aspects has been presented. The second one is in connection with the relationship of selected characteristics of individuals with their faced problems and the rest one is vegetables cropping patterns and causes of changing cropping pattern.

2.1 Studies on Problems Confronted by Farmers in Different Aspects of agriculture

Islam and Bari (2008) conducted a study to find out present status of vegetable cultivation at Dumuria Upazila of Khulna, Bangladesh. They found that most of the respondents had small to moderate sized cultivable lands. Majority of the respondents had moderate to moderately large sized lands suitable for vegetable cultivation. Cauliflower, cabbage, potato, tomato, brinjal were more extensively cultivated. Most of the respondents use cow dung, urea, TSP and MoP in vegetable cultivation. Viral disease was the most occurring disease in vegetables cultivation. Leaf cutting caterpillar was most commonly occurring insect. Most of respondents had medium to high experience in agriculture and vegetable cultivation and they belonged to medium knowledge category in cultivation of vegetable. A number of eighteen problems were identified as confronted by the vegetable growers. Scarcity of quality fertilizer ranked the first position according to problem confrontation index while lack of quality irrigation water occupied the last position according to the same. Among the identified eighteen problems, the most common as well as highly severe problems were scarcity of quality fertilizer, diseases and insect infestation and low market price

in season. Majority of the respondents confronted medium problem as compared to about one third in the high category, only about one tenth of the respondents in low problem confrontation category. Among selected 9 characteristics of the respondents, farm size and extension media contact showed a negative significant relationship with their problem confrontation.

Rahaet *al.* (1986) identified some common problems of cotton cultivation as perceived by the farmers in Bangladesh. Those were lack of suitable land, lack of irrigation facility, shortage of labor, shortage of cash money, lack of technical knowledge, lower price of cotton and non-availability of seed, insecticides, and fertilizers.

Zinyama (1988) conducted relative observation to find out the farmers perceptions of the constraints against increased crop production in the subsistence communal farming sector of Zimbabwe. Five of the most frequently cited, constraints were: (i) lack of money with which to purchase seasonal agricultural inputs, particularly fertilizers, (ii) lack of basic farming implements, notably the ox-driven single furrow plough, (iii) lack of draught cattle (iv) inadequate arable land and (v) inadequate family labor or agricultural work.

Marothia (1983) conducted a study to find out the constraints in the adoption of paddy technologies in two villages in Block, Madhaya Pradesh, India. The findings reveal that the majority of farmers still adopt a partial package of recommendations, mainly due to high cost of input, financial limitations and risk of crop failure. Inadequate supportive input-facilities were found to be responsible for the slow adoption a paddy technology.

Kher and Halyal (1988) administrated a research work to identify the constraints in adoption of sugarcane production technology. The most important constraint identified regarding the adoption of improved sugarcane production technology were an irregular and insufficient electricity supply, small size of holding for green manuring, inconvenience of intercropping due to weeds, high cost of farm fuel, scare irrigation facilities, absence of location specific recommendations for earthing up, lack of drought resistant varieties and lack of technical knowledge about plant protection and chemical fertilizers.

Chanderet *al.* (1990) in their study identified constraints in potato cultivation. Main constraints were ignorance about improved cultivars and cultivation practices, ignorance about scientific method of sowing, lack of guidance of marketing potato; high cost of improved cultivars, high cost of fertilizers, pesticide and irrigation, lack of enough space for storing potatoes scientifically and so on.

Biswas (1992) in his study identified farmer's problems in cotton cultivation. Non availability of quality seed in time, unfavorable and high cost of fertilizer and insecticides, lack of operating capitals, not getting fair weight and reasonable price according to grade, affects of cattle in cotton field, lack of technical knowledge, lack of storage facility, stealing from field at maturity stage and late buying of raw cotton by Cotton Development Board were identified as major problems of cotton in Jessore district.

Rahman (1995) in his study, identified farmers faced problems in cotton cultivation which were non-availability of quality seed in time, unfavorable and high cost of fertilizer and insecticides, lack of operating capital, not getting fair weight and reasonable price according to grade, affects of cattle in cotton field, lack of technical knowledge, lack of storage facility, stealing from field at maturity stage and late buying of raw cotton by Cotton Development board in Mymensing district.

Faroque (1997) found that female rural youth in Bhaluka (Mymensingh) lacked cash for buying seeds, seedlings and deprived of necessary knowledge in improved vegetable cultivation. He further added that the majority of the female rural youth faced very high (54%) problems.

Alam *et al.* (2000) conducted a survey on jute crops in seven districts of Bangladesh to find Out the state of art in jute cultivation and found that scarcity of quality seeds, high labor wage and low market price of fiber were the major constraints of jute production.

Ismail (2001) conducted a study on problems faced by the farm youths of hoar area of Mohangonj Upazila. Study revealed six top problems in rank order were (i) no arrangement of loan for the farm youth for fishery cultivation, (ii) lack of government program in agriculture for the farm youth, (iii) absence of loan giving agencies for establishing farm in locality, (iv) general people face problem for fishery due to government leasing of Jalmohal, (v) lack of government programmes for establishing poultry farm, (vi) lack of agricultural loan for the

farm youth.

Pramanik (2001) made an extensive study on twenty-four problems of farm youth, at the villages relating to different problems in crop cultivation Mymensingh. Out of twenty-four problems the top four problems in rank order were: i) local NGO take high rate of interest against a loan, ii) lack of agricultural machinery and tools, iii) lack of cash and (iv) financial inability to arrange improved seeds, fertilizers and irrigation.

2.2 Studies on Relationship between Selected Characteristics of the Farmers and their problem Confrontation

2.2.1 Age and Problem Confrontation

Shahidullah (1987) in his study of production, consumption and marketing behavior of the poultry farmers found negative relationship between age of the farmers and production, consumption and marketing behavior.

Rahman (1995) conducted a study to identify the relationship between the personal characteristics and constraints facing in cotton cultivation of Muktagacha Thana under Mymensingh district. He found that there was no significant relationship between the age of the farmers and their faced constraints in cotton cultivation. Similar findings were obtained Ali (1999), Rashid (1999), Pramanik (2001), Ahmed (2002), Hossain (2002), Salam (2003) and Halim (2003)) in their respective studies.

Bhuiyan (2002) in his study found a positive and significant relationship between age of the farmers and their constraint in banana cultivation. Similar findings were obtained by Rahman (1996) in his respective study.

Rashid (2003) found that age of the rural youth had significant negative relationship with problem confrontation in selected agricultural production activities.

2.2.2 Education and Problem Confrontation.

Mansur (1989) found that education of the farmers had significant negative effect on their problem confrontation in feeds and feeding cattle. Similar findings were obtained by Rahman (1995); Haque (1995), Rahman (1996), Karim (1996), Faroque (1997), Parmanik (2001),

Ahmed (2002), Hossain (2002), Bhuiyan (2002) and Salam (2003) in their respective studies.

Hoque (2001) found a significant negative relationship between education and problem confrontation of the FFS farmers in practicing IPM.

The study of Ismail (2001) revealed that there was no significant relationship between education and problem confrontation of farm youth. Similar findings were obtained by Rashid (1975) Raha (1989) and Halim (2003) in their- respective studies. Thus it can be concluded that an overwhelming majority of the researcher found a negative relationship between these two variables.

2.2.3 Family Size and Problem Confrontation

Yasmin(1987) showed that family size of the poultry farmers had significant positive relationship with their constraints on poultry production.

Haque (1995) found that there was no significant relationship between family size and problem confrontation of the MohilaBittaheenSamabayaSamittee. Similar findings were obtained by Rashid (1999), Bhuiyan (2002), Hossain (2002), Ahmed (2002) and Halim(2003) in then respective studies.

Salam (2003) in his study found a positive significant relationship between family size and their constraint in adopting environment friendly farming practices.

2.2.4 Annual income and problem confrontation

Hossain (1985) in his study found a significant relationship between income and problem confrontation of the landless labourers.

Rahman (1995) conducted a study and found negative significant relationship with their problem confrontation in cotton cultivation.

Mansur (1989) found that the income of the farmers had no significant effect on their problem confrontation in feeds and feeding cattle. He also found a negative trend among therelationship.

Raha (1989) found that the income of the farmers had no significant relationship on their

irrigation problem confrontation, but relationship showed appositive tendency.

Rashid (1975) in his study found that there was no relationship between income of the farmers and their agricultural problem confrontation. Though the relationship was not significant, relevant data indicated a considerable negative trend between income of the farmers and their agricultural problem confrontation of the farmer.

2.2.6 Organizational Participation and Problem Confrontation

Mansur (1989) in his study indicated that Organizational participation of the farmers had a significant negative relationship with their problem confrontation.

Karim (1996) found that Organizational participation of the farmers had significant negative relationship with their problem confrontation.

Karim (1974) found a consistent negative trend between organizational participation of the union Assistant and their Problem confrontation, the relationship between two variables was not statistically significant.

2.2.7 Cosmopoliteness and Problem Confrontation

Rashid (1975) found that there was negative relationship between cosmopoliteness, farmers and their agricultural constraints faced.

Kashem (1977) found that there was a negative relationship between cosmopoliteness of the landless laborers and their constraints faced. There was, however, a negative trend between the two variables.

Hoque (1993) study revealed a storage positive relationship between cosmopoliteness of the cane growers and their constraint in sugarcane cultivation. Similar findings were obtained by Islam (1993), Khan (1993) and Parveen (1993) in their respectively studies.

Haque (1993) observed in his study a strong positive relationship between cosmopoliteness of the cane growers and their adoption of improved practiced in sugarcane cultivation.

Pramanik (2001) found that the cosmopoliteness of the farm youth had negative correlation with their crop cultivation, health and recreational problems.

Ali (1999) found that the cosmopolitaness of the rural youth had significant positive relationship with their anticipated problem confrontation in self employment by undertaking selected agricultural income generating activities.

2.2.8 Extension Media Contact and Problem Confrontation

Ali (1984) found that contact and non-contact farmers differed significantly in respect of their extension contact. He observed that extension contact the contacted non-contact farmers had significant contribution towards their agricultural knowledge.

Rahman (1995) in his study conducted that extension contact of the farmer significant negative relationship with their faced constraints in cotton cultivation. Similar findings were obtained by Rahman (1996), Faroque (1997), Pramanik (2001), Hossain (2002), Bhuyan (2002), Ahmed (2002), Salam (2003) and Halim (2003) in their respective studies.

The study of Ismail (2001) revealed that there was no significant relationship between farm youths' extension contact and their agricultural problem confrontation. Similar findings were obtained by Raha(1989) and Hoque (2001) in their respective studies.

Farouque (1997) study on female youth revealed that extension contact of female rural youth had a significant negative relationship with their problem confrontation in selected issues.

2.2.9 Training Experience and Problem Confrontation

Gharu (1989) reported in his study on Training Needs of Horticulture Inspector in Punjab state the previous in-service training exposure of the respondents was most significantly associated with their training needs in the selected area of Horticultural technology.

2.2.10 Area under Vegetable Cultivation and Problem Confrontation

Islam (1987) in his research studied the relationship between cattle strength of the farmers and their artificial insemination problem confrontation and found that cattle strength of the farmers had a significant negative relationship with their artificial insemination problem confrontation. Similarly, Ali and Anwar (1987) found that there was a negative relationship between cattle strength of the farmers and their cattle problem confrontation.

Rahman (1995) found a significant and negative relationship between area under cotton

cultivation of the farmers and their faced constraint.

Raha (1989) found that there was no significant relationship between the farm area under irrigation and their irrigation problem confrontation. On the other hand similar findings were obtained by Mansur (19120) and Bhuiyan (2002) in their respective studies.

Halim (2003) in his study conducted that the respondents' area under rice cultivation had a positive relationship with their constraints in adopting crop diversification.

2.2.11 Knowledge on Vegetable Cultivation and problem confrontation

Sarker (1983) showed that there was a negative significant relationship between education and poultry knowledge of the farmers and their poultry problem confrontation, while Islam(1987), in his study found that knowledge regarding utility of artificial insemination of the farmers is positively related to their artificial insemination problem confrontation.

Raha (1989) reported from his study that farmers' knowledge in irrigation of modernboro paddy had no significant relationship with their irrigation problem confrontation. Anwar (1994), Karim (1996), Rashid (1999), Ismail (2001), Salam (2003) and Rashid (2003) found similar in their respective studies.

Mansur (1989) found in his study that there was a substantial significant relationship between knowledge in feeds and feeding cattle of the farmers and their problem confrontation in feeds and feeding. Similar findings were obtained by Sarker (1983), Rahman (1995), Rahman (1996), Paramanik (2001), Haque (2001), Hossain (2002), Bhuiyan, (2002), Ahmed (2002) and Halim (2003) in their respective studies.

The study of Ali (1999) revealed that knowledge of the rural youth had significant positive relationship with their anticipated problem confrontation in self-employment by undertaking selected agricultural income generating activities.

Karim(1996) indicated in his study that agricultural knowledge of the kakrol growers had significant negative relationship with their problem confrontation Rahman (1990) also found similar findings in his study.

Saha(1983) studied on poultry problem confrontation and reported that the relationship

between poultry knowledge and poultry problem confrontation was negative.

2.2 Cropping patterns

Local T. aman paddy is the single major crop grown extensively in the Khulna region (Razia and Iqbal, 1988). The effect of salt water intrusion both through surface and ground water have long been recognized as a limiting factor to the sustainable development of agriculture in southern region of the country (Karim *et al.*, 1990). Nuruzzaman (1990) showed in his study that shrimp cultivation has reduced both percentage of land under paddy cultivation and yield of paddy per unit area where soil salinity has been increased.

In the absence of any other significant natural resources, the economy of Bangladesh has essentially evolved as agriculture oriented over country and agriculture in turn is critically on land and water both of which are scarce at one time or other. Every cultivable inch of land is under cultivation and no new land is available to produce more food for an increasing population. On the contrary, the available arable land is shrinking every day for new settlements and physical infrastructure (Ahmed and Samsuddula, 2000). Farming everywhere followed similar cropping schedules, corresponding to the seasons noted above if not impeded by environmental problems. Land was raised and lowered over time to deal with local flood regimes and was prepared largely with "traditional" tillage technologies. Rice cultivation involved considerable field preparation, including leveling and bunding. Local and high-yielding varieties (HYV) of rice were used, as were fertilizers and pesticides (Asaduzzaman, 1979). In the northwestern and winter seasons, HYV rice required irrigation water supplied through special projects or by way of low-lift pumps. Rice yields were low by global and Asian standards, created by poor access to and inefficient use of inputs, the impacts of flooding on them, and inadequate irrigation (Khan, 1972). Jute was the next most important crop to rice, grown totally for an international market.

Drawf wheat increased among farmers in the mid-1980s as did mustard, rape, pulses, and sundry vegetables. Market gardening and off-farm activities were increasing in peri-urban locales (Ali, 1980). The sheer marginality of most farm households, however, required that they produce the majority of their own food, which was only sold under conditions of normal surplus (rare) or duress (e.g., debt).

2.3 Changes of cropping pattern

Recently a growing number of farmers have placed more emphasis on dike crops and fish, and decreased the focus on the prawn component. This change has been partly the result of external factors that have strongly affected prawn production in 1997-98 and which increased the vulnerability of 'gher' operator. In 1997, a threatened import ban on prawns from Bangladesh led to lower selling prices for producers. In 1998, the cost of post-larvae was four times that of 1997 due to a poor wild-catch of post-larvae. Prawn farming mainly takes place in the district of Sathkhira, Khulna, Bagerhat in the Southwestern region of Bangladesh (Ahmed and Samsuddula, 2000). During the past three decades the agriculture sector of Kerala has undergone wide-ranging changes in terms of ownership of land, cropping pattern, cultivation practices, productivity, and intensity of cultivation. Unlike the other regions in India, the farm front of Kerala is characterised by extreme diversity in its bio-physical resource base and agro climatic endowments providing multiple opportunities for raising a variety of crops. In earlier periods, the choice of cropping pattern was guided by agronomic considerations and consumption needs of farmers; but it seems that mainly market forces determine the emerging trend. Official figures show that agricultural income in Kerala which showed a steady growth up to the mid-seventies began to decline thereafter and showed vacillating trend in the eighties. This change is mainly attributed to the shift in area from seasonal/annual crops to high-value-yielding perennial cash crops having a long gestation period. By the end of the eighties, cash crops started generating higher income to the farm sector. Therefore, during the past five years agricultural income has started rising. However, the questions whether this performance is sustainable and the emerging cropping pattern is in the best interest of the State, require serious consideration (Mahesh, 1999).

Manavalan *et al.* (1995) detected change in cropping patterns in two successive campaigns by developing an image differencing algorithm involving the near infrared and red bands (IRS-LISS 2 data).

Analysis of changes in the cropping pattern in Himachal Pradesh revealed that during the period 1970-90 the area under fruit crops registered an increase of 6% per annum, followed by wheat (1.5%), vegetables (1.31%), maize (1.19%) and spices (1.07%). On the other hand, the area under non-green revolution crops—pulses, barley, paddy and oilseed—decreased at the annual rates of 3.90, 1.47, 0.57 and 0.12%, respectively (Dahiya *et al.*, 1991).

In this phase, field trials with cropping patterns, new crop varieties, and agronomic techniques continued. It was noted that farmers (especially small-scale farmers) had made major changes in their crop production methods. Results showed that yields could be increased by 30% and income by 50% from the main rice crop. As well, new cropping patterns were developed and adopted by farmers on research sites (Projects in Bangladesh: <http://www.idre.ca/en>).

2.4 Causes of changing cropping pattern

Maresh (1999) found out some promising causes of changing cropping patterns which were i) Demand for land for non-agricultural purposes, ii) State-intervention, iii) technological changes, iv) Increase in pressure on land and v) Neighborhood aspects.

The major cropping pattern in Bangladesh agriculture mostly consist of rice based cereal crops (Haque, 1998). More than 60% of the total cropped area covered by Boro-Taman rice cropping pattern in Bangladesh (FRG, 1997). This is the dominant cropping pattern in medium high land area of Khulna region under high Ganges River floodplain (AEZ 13). The area and production of HYV Boro rice in Khulna region was 111134 ha and 342470 tones; meanwhile HYV Taman rice was 184673 ha and 465840 tones, respectively (BBS, 2004). Soil fertility and productivity changes over time and this change is towards negative direction because of intensive cropping with modern varieties, improper and imbalance use of fertilizer and manure (BARC, 2005). Again crops grown in different cropping patterns and environment responded differently to fertilizer nutrients. Mineral fertilizer inputs are the crucial factors to the overall nutrient balance in intensive cropping systems (Islam and Haque, 1998).

Mallick (2008) reported that a range of climate change consequences such as extreme weather, ecosystem changes, cropping pattern changes, inundation, migration, disease, food and livelihood security.

Changes in the thermal climate due to inter-annual climatic variability can potentially modify existing cropping pattern by forcing farmers to rearrange transplanting and harvesting dates. The study finds that under abnormally cool conditions transplanting dates will be pushed well into February to avoid plant injury and harvesting dates will be moved into the monsoon. The growing seasons will be longer under cooler than normal thermal conditions. Under abnormally warm conditions harvesting dates will be established well into March and will cause reduction of yield due to a shorter growing season. These conditions will also cause

spatial shift in crop potential and changes in the cropping pattern. Due to longer boro rice growing season farmers will lose a significant amount of cropping land which is usually used for low and deep water rice cultivation.

New crops will need to be introduced during the beginning of a year to overcome the loss of production under abnormally cool conditions. Wheat and potato can be good options for the farmers for such conditions. New aus rice variety needs to be introduced after the boro harvesting under warmer than the normal conditions to overcome the loss of yield due to a shorter growing season (Mahmood, 1998).

Turner and Ali (1996) reported changes in agricultural intensity and, by implication, changes in the technology and management of cultivation. It employs an understanding of small-holder farming behavior in which variations exist in the production goals and rules of manipulating labor and capital toward those goals. This variation follows from the proportion of cultivation for subsistence and market and draws on behavior detailed in two ideal models.

Environmental constraints on agricultural change were profound, increasing the six village explained variance for cropping frequency to 68% (2A) of which 51% followed from the constraint index alone and for land productivity to 73% (2B). The low performing villages, which were highly constrained by flooding and inadequate water, accounted for most of this outcome. Virtually no improvement in the explained variance in intensity was found for the high-performing villages by considering environmental variables (Turner and Ali, 1996).

Agricultural production critically depends on suitable climate and soil conditions, as well as direct human management. Although technology - including irrigation and fertilizer use - has extended the boundaries of cultivation, many large regions of the world are still unsuitable for crops. Using land use datasets and ecological modeling tools, we examine the links between land use practices, agricultural production, and the underlying patterns of climate and soil quality. Some of our initial results indicate a disturbing trend: the regions of the world with the least suitable agricultural lands are likely to be the ones hit hardest by increasing population and possible changes in climate (Agricultural System: <http://www.sage.wisc.edu/pages/agriculture.html>)

CHAPTER III

METHODOLOGY

In any scientific research methodology plays an important role. Research methodology is a systematic way to solve a research problem. It may be understood a sign of studying how research is done (Kothari, 2004). A researcher needs careful consideration before conducting a study. Methodology would enable the researcher to collect valid information and to analyze properly to arrive at correct decisions. The researcher has great responsibility to clearly describe as to what sort of research design, method and procedure he would follow in collecting valid and reliable data and to analyze and interpret those to arrive at correct conclusion. The methods and procedures followed in conducting this study have discussed in this chapter.

3.1 Locale of the study

This study was a survey based research. The study was confined to three upazilas (Dumuria, Paikgachha and Koyra) of Khulna district. Khulna, the south-western divisional city in Bangladesh, is situated between 21.38' and 23.1' north latitude and 88.58' east longitude and is 12 ft above mean sea level (<http://www.khulnacity.org/>).

This study was conducted into 4 types of areas such as prawn farming area, non-prawn farming area (non-saline zone) and shrimp farming area and non- shrimp farming area (saline zone).

Distribution of study area

District	Upazila	Types of Area	Union
Khulna	Dumuria	PFA	Dhamalia Rudaghara Ragunathpur
		NPFA	Kharnia Atlia Shobna
	Paikgachha	SFA	Gadaripur Raruli Chandkhali
	Koyra	NSFA	Uttar Bedkashi Moharajpur Bagali

PFA = prawn farming area, NPFA = non-prawn farming area,

SFA = shrimp farming area, NSFA = non-shrimp farming area

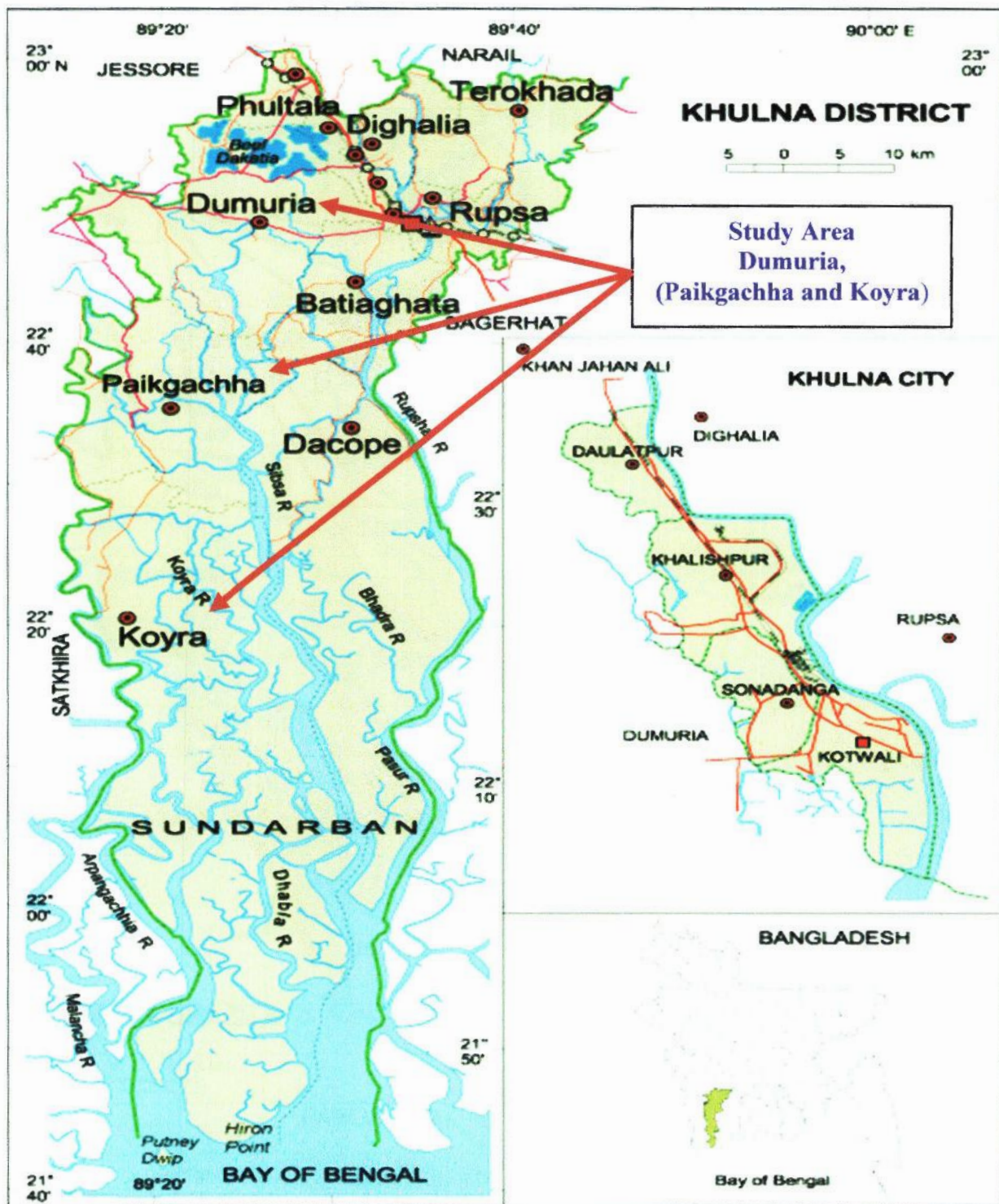


Figure 3.1 Map of Khulna District



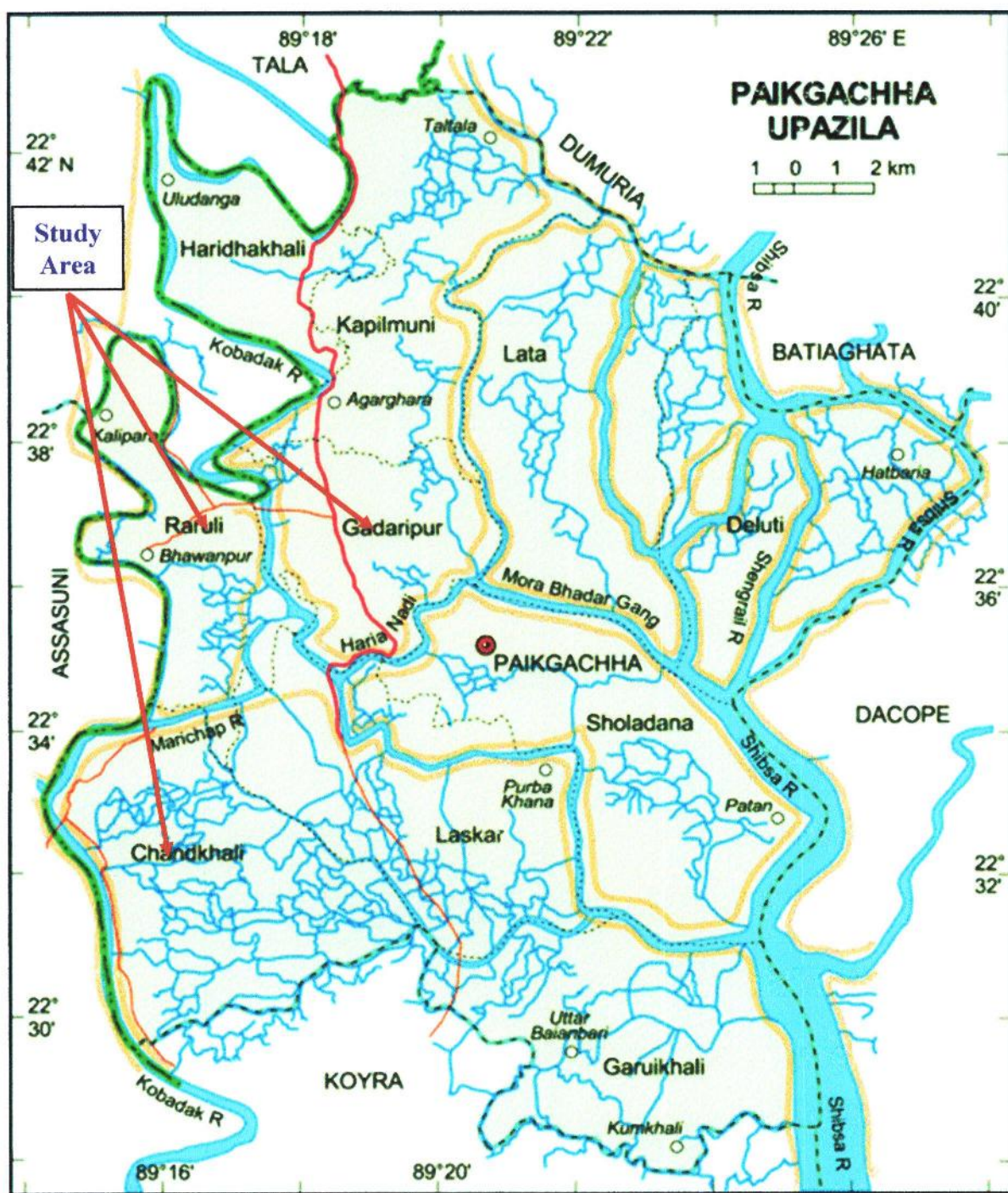


Figure 3.3 Map of Paikgachha Upazila (Study Area)

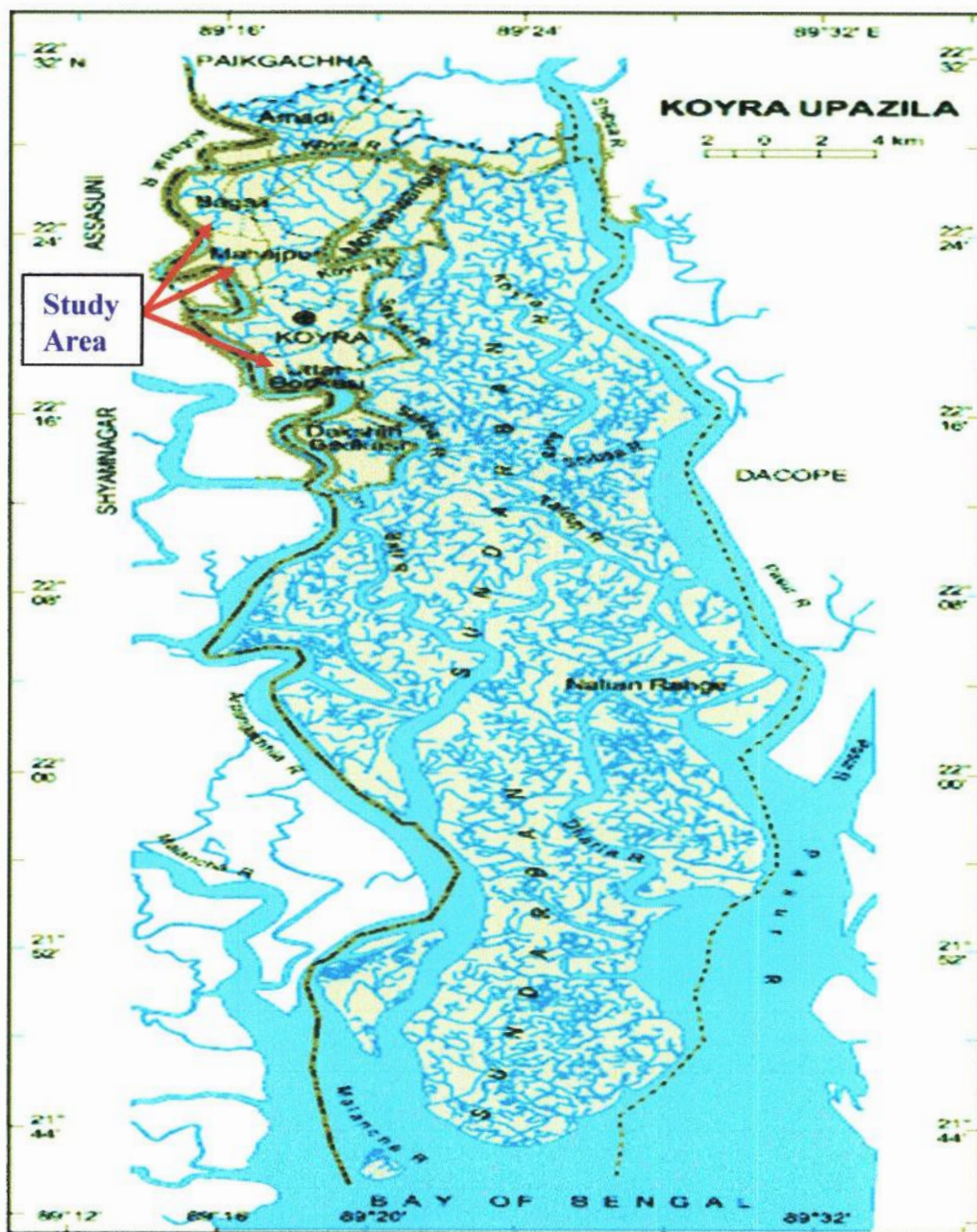


Figure 3.4: Map of Koyra Upazila (Study Area)

3.2 Unit of Analysis

The unit of analysis of the study was the farm households of four selected different areas. The major criteria considered for selection of farm households from the study area were:

- The farmers of these farm households were cultivators of vegetables
- They were cultivating vegetables to fulfill their own demand and their economic development
- The farmers of the selected study area particularly who were about 40 years old and involved in Prawn/shrimp farming in case of prawn farming area and shrimp farming area.

3.3 Population and sampling

The vegetables cultivators of the selected areas were treated as population of the study. Following the random sampling method, irrespective of population size 10 vegetables growers were selected from each of the mentioned union. Thus the final sample size stood 120.

3.5.1 Sampling Design

Study area			Number of sampled farmers	Total sampled farmers
Khulna District				
Upazila		Union		
Dumuria	Prawn farming area	Dhamalia	10	30
		Rudaghara	10	
		Ragunathpur	10	
	Non-prawn farming area	Kharnia	10	30
		Atlia	10	
		Shobna	10	

Paikgachha	Shrimp farming area	Gadaripur	10	30
		Raruli	10	
		Chandkhali	10	
Koyra	Non-shrimp farming area	Uttar Bedkashi	10	30
		Moharajpur	10	
		Bagali	10	
Total				120

3.6 Instrument for data collection

An interview schedule was used as the research instrument in order to collect relevant information from the respondents. The interview schedule was carefully designed keeping the objectives of the study in mind. The interview schedule was prepared for data collection in Bangla keeping the objectives of the study in view. The interview schedule contained both open and close ended, simple and direct form of questions to collect data on the selected variables. After preparation of interview schedule it was pre-tested with 10 farmers of Rudaghara union. After pre-test, necessary correction, addition, alternation and rearrangement were made before it was run for final data collection. The interview schedule was then multiplied in its final form for collection of data. English version of the same interview schedule may be seen at Appendix 1.

3.7 Data Collection

Data for this study were collected by the researcher himself through face to face interview by using interview schedule during October 2012 to July 2013. Before going to make an interview, appointments with the interviewees were made in advance with the help of the concerned Sub Assistant Agriculture Officer (SAAO). All possible efforts were made to explain the purpose of the study to the respondents in order to get valid and pertinent information from them. The farmers of the selected areas helped investigator greatly in collecting information. The researcher also obtained cooperation from the members of the union parished of the respective villages, local leaders and school teachers during collection of data.

3.8 Specification and Measurement of the Variables

A variable is any characteristic, which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). A well-organized piece of research usually contains at least two important elements, viz. an independent variable and a dependent variable. An independent variable is that variable which is manipulated by the researcher in his attempt to ascertain its relationships to an observed phenomenon. A dependent variable is that variable which appears, disappears or varies as the researcher introduces, removes or varies the independent variables (Townsend, 1953). In this connection, the researcher reviewed literature to widen his understanding about the nature and scope of the variables relevant to this piece of research.

3.8.1 Specification and Measurement of Independent Variables

Based on the practical knowledge, side by side an extensive review of literature and discussions with relevant experts and academicians, the researcher selected 10 characteristics of the respondents. The characteristics of respondents which were treated as independent variables for the study are age, education, family size, experience in agriculture, experience in vegetable cultivation, annual income, organizational participation, cosmopolitaness, extension media contact, training exposure and knowledge in vegetable cultivation. On the basis of definition of the terms presented in earlier sections, operationalization of the variables was done which are presented below.

3.8.1.1 Age

The age of the farmers was measured in terms of actual years from his birth to the time of interview on the basis of his statement. A score of one (1) was assigned for each year of his age. It appears at item no. 3 (Appendix 1) in interview schedule. Based on age, the farmers were classified into three categories as shown Table 3.1
Table 3.1: Categories of the farmers according to age

Categories	Score(years)
Young aged	<40
Middle aged	40-55
Old aged	>55

3.8.1.2 Education

The level of education of farmers was measured by the year of schooling. If a farmer did not know how to read and write, his education score was taken as zero (0). A score of one was given to those farmers who could sign his name only. Besides, the farmers got actual score for his every of schooling, i.e. 1 for class one and two for class 2 and so on. Thus the score of education of a farmer was determined from response to item no 5 in the interview schedule (Appendix I). Based on education, the farmers were classified into different categories as shown in Table 3.2.

Table 3.2 Categories of farmers according to their level of education

Categories	Score
Illiterate	0
Primary	1-5
Secondary	6-10
Higher secondary	11-12
Higher education	>12

3.8.1.3 Family Size

Family size of farmers was measured in terms of number of family who lives under same roof and share same kitchen. The farmers were given score 1 for each member of his family. The question to measure the family size of the farmers has been presented in item no 6 in interview schedule (Appendix I). The farmers were classified into different categories based on family size shown in Table 3.3.

Table 3.3 Categories of farmers according to their family size

Categories	Score
Small sized family	1-4
Medium sized family	5-6
Large sized family	>6

3.8.1.4 Experience in Agriculture

The farming experience of farmers was measured by the length covered by from his starting years in farming to the time of interview on the basis of his statement. A score of one (1) was assigned for each year of his experience. It appears on item no. 7(a) in the interview schedule (Appendix I).

Table 3.4 Categories of farmers based on their experience in agriculture

Categories	Score
Low experience	<10
Medium experience	10-20
High experience	>20

3.8.1.5 Experience in vegetables Cultivation

The experience on vegetables cultivation of a farmer was measured in terms of actual years he engaged in vegetables cultivation by asking him directly. The length was measured by length covered from his starting year to the time of cultivation. A score of one (1) was assigned for each year of his experience. It appears in item no. 7(b) in the interview schedule (Appendix I).

Table 3.5 Categories of farmers based on their experience in vegetables cultivation.

Categories	Score
Low experience	<10
Medium experience	10-20
High experience	>20

3.8.1.6 Annual Income

Annual income of a farmer was measured in taka on the basis of his total yearly earning from agriculture and non-agriculture sources including earning of members of farmers family. The yield of all crops in the preceding was noted. Then all the yields were converted into cash income according to the preventing market price. The price of other enterprise (i.e. cows, goats, poultry, fishes etc.) was also added to the price. Earning of the each farmer themselves and members of the family from different

sources (like service, business, and labor) were also included in calculating the income. Yearly income of all family members from farming and non-agriculture sources were added together to obtain total family income. Data obtain in response to item no. 8 in the interview schedule were used to determine the income of the farmers. The farmers were classified into different categories based on their annual income is shown in Table 3.6.

Table 3.6 Categories of farmers according to their annual income

Categories	Score
Low income	<100000
Medium income	100000-120000
High income	>120000

3.8.1.7 Extension Media Contact

Extension media contact is defined as a person communication with different sources of information available in and out of his social system. Beside this, their level of communication were also spread to the combined discussion, participation of result demonstration, field day with other farmers and listening radio and TV program about agriculture, printing leaflet, bulletin, paper, watching poster, advertisement etc. In this study, the extension contact score was computed for each farmer on the basis of the extent of his contact with selected media as ascertained from his responses to question no.9 in interview schedule (Appendix I). A number of 13 sources were included in the interview.

The frequency of contact was classified into 4 categories such as frequently, occasionally, rarely, not at all and a weight of 3, 2, 1 and 0 was assigned to these categories respectively. The categorization procedure of the farmers based on extension media contact is presented in Table 3.7

Table 3.7 Categories of farmers according to extension media contact

Category	Score
Low contact	<16
Medium contact	17-20
High contact	>20

3.8.1.8 Organizational Participation

Organizational participation of farmers was a measured on the basis of the nature of his involvement in different organizations found operating in the study area. The

researcher identified different organization in the study area such as Agricultural Co-operative society, NGO Society, School Committee, Madrasa Committee, Mosque/Temples Committee, Bazar Committee & Sports cultural shown in the item no 10 in the interview schedule (Appendix I). Organizational participation scores were assigned in following manner for activities of individual farmer in each group of organization:

Nature of participation	Score assigned
Not participated	0
Ordinary Member	1
Executive member	2
Executive officer	3

A respondent could be attached to a number of such organizations, and thus his score was determined by adding up the weighted scores for his participation in all the organizations. Based on organizational participation score, the farmers were classified into different categories as presented in Table 3.8

Table 3.8 Categories of farmers according to their score of organizational participation

Categories	Score
No participation	0
Low participation	1
High participation	>1



3.8.1.9 Cosmopoliteness

Cosmopoliteness of farmers was measured in terms of his nature of visits to the ten different places external to his own social system. Following four point rating scales were used to compute the cosmopolitans score as presented below:

Nature of visit	Score
Not even once a month (Not at all)	0
1-2 times a month (Rarely)	1
3-4 times a month (Occasionally)	2
5-9 times a month (Frequently)	3

The Cosmopolitaness score of a farmer was calculated by adding together the scores obtained for his visits to each of the eleven types of places as mentioned above. The scores of farmers could range from 0-33. Cosmopolitaness was represented in the item no. 11 (Appendix 1). Categories of farmers based on their cosmopolitaness were done as shown in Table 3.9

Table 3.9 Categories of farmers according to their score of Cosmopolitaness

Categories	Scores
No cosmopolitaness	<10
Low cosmopolitaness	10-19
High cosmopolitaness	>19

3.8.1.10 Training Exposure

Training score of the respondents was measured depending on the number of training he had received. For computing training score (1) was given for receiving one training only. Respondents, who had received one or two or three training, were assigned a score of 1, 2 and 3 respectively. The added score was noted. The score zero (0) was assigned if one did not have any training. It is shown in the item number 13 in the interview schedule (Appendix 1). Based on training, the respondents were classified into different categories as shown in Table 3.10.

Table 3.10 Categories of respondents according to training exposure

Categories	Score
No training	0
Low training	1
High training	> 1

3.8.1.11 Knowledge in vegetables cultivation

To measure the knowledge of respondents on vegetables cultivation 15 items scale was included in interview schedule. Each farmer was asked to answer the 15 questions. Each of the questions was assigned two score of one irrespective of their hardness or difficulties to answer by the respondents. Thus the whole questions comprised of 30 marks. Each farmer was given a particular number depending on the percentage of appropriateness of answer to the question. The total score obtained by a respondent was

calculated by summing up the scores against each of the 15 questions. It was included under item no. 19 of interview schedule (Appendix I).

Table 3.11 Categories of farmers according to their score of knowledge on vegetables cultivation.

Categories	Score
Low knowledge	<17
Medium knowledge	17-23
High knowledge	>23

3.9 Specification and Measurement of Dependent Variable

The problem confrontation was treated as dependent variable for this study.

3.9.1 Problem Confrontation

In this study, problem confrontation score was computed for each respondent as ascertained from his responses to question no. 21 in the interview schedule (Appendix I). Each respondent was asked to indicate his problem against selected 19 issues (Table 3.12).

Table 3.12 Problem confronted by respondents

Sl no	Problems	Extent of severity of problems			
		Very severe	Moderately severe	Negligible	Not at all
1	Traditional land cultivation				
2	Unavailability of good quality seed				
3	Poor germination+				
4	Poor productivity				
5	Scarcity of quality fertilizer				
6	Diseases and insect infestation				
7	Lack of good quality irrigation water				
8	Salinity				
9	Lack of loan facilities				
10	High production cost				
11	Transportation				
12	Lack of preservation/ storage facilities				
13	Lack of knowledge on processing				
14	Low market price in season				

15	Interference of middlemen in the marketing system				
16	Lack of extension program				
17	Food habit				
18	Natural calamities				
19	Lack of protection				

A 4 point type scale such as very severe , moderately severe, negligible and not at all were employed against each of the problems to determine the extent/ severity of a problem. A score 3, 2, 1 and 0 were assigned against each of the scale respectively.

To ascertain the problem confrontation score, all the senses obtained by a respondent against the selected 19 issues were added. Based on problem confrontation sense, the respondents were classified into three categories as shown in Table 3.13

Table 3.13 Categories of respondents according to their score of problem confrontation

Categories	Score
Low problem confrontation	< 20
Medium problem confrontation	20-30
High problem confrontation	>30

3.9.2 Severity of Problem

The severity of the problem was determined based on problem confrontation index (PCI). The PCI was determined by using the following formula,

$$PCI = N_1X3 + N_2X2 + N_3X1 + N_4X0 \text{ (The Formula is adopted from, Ahmed, M.B. 2006)}$$

Where,

N_1 =Number of respondents confronted the problem with high severity

N_2 = Number of respondents confronted the problem with medium severity

N_3 = Number of respondents confronted the problem negligible

N_4 = Number of respondents confronted the problem not at all.

For example, among 120 respondents, 8, 32, 36 and 44 respondents indicated the extent

of problems no. 1 as highly severe, severe, less severe and not at all respectively. Thus the PCI for problem no. 1 is

$$PCI = 8 \times 3 + 32 \times 2 + 36 \times 1 + 44 \times 0$$

$$= 24 + 64 + 36 + 0$$

$$= 124$$

The PCI for each problem could range from 0 to 360. Where 0, 1- 120, 121-240, above 240 indicate not at all, less severe, severe and highly severe problem respectively. Based on PCI percentage the problems were classified into different categories as shown in Table 3.14

Table 3.14 Severity of problem based on PCI percentage

Categories	Score (%)
Less severe	< 20
Severe	20-40
Highly severe	>40

3.10 Present situation of vegetable cultivation

Present situation of vegetable cultivation was determined based on some parameters. The parameters were:

3.10.1 Total usable land for vegetables cultivation

a) Total cultivable land

b) Suitable land for vegetable cultivation

c) Land under vegetable cultivation

3.10.2 Use of fertilizers and manures

3.10.3 Intercultural operations

3.10.4 Disease infestation

3.10.5 Insect infestation

3.10.6 Types of vegetables cultivated in the respondent's farms

3.10.7 Varieties of vegetables cultivated in the respondent's farms

3.10.1 Total Usable Land for Vegetable Cultivation

The researchers recorded information about respondent's farm where he cultivates vegetables in his field. The question to measure a) Total cultivable land, b) Suitable land for vegetable c) Land under vegetable cultivation has been shown in the item number 12 in interview schedule (Appendix 1).

Table 3.15 Categories of respondents according to total cultivable land

Categories	Score (ha)
Small	<0.40
Moderate	0.40-0.8
Moderately large	0.81-1.2
Large	> 1.2

Table 3.16 Categories of respondents according to suitable land for vegetable cultivation

Categories	Score (ha)
Small	<0.10
Moderate	0.10-0.20
Moderately large	0.21-0.40
Large	>0.40

Table 3.17 Categories of respondents according to land under vegetable cultivation

Categories	Score (ha)
Small	<0.10
Moderate	0.10-0.20
Moderately large	0.21-0.40
Large	>0.40

3.10.2 Use of Fertilizer and Manures

The name of different manures and fertilizers were included in interview schedule. The fertilizers and manures were urea, TSP, MoP, cow dung/compost, gypsum, zinc sulphate and other fertilizer. It was included under item no. 14 of interview schedule (Appendix I).

3.10.3 Intercultural Operations

The researcher categorized the intercultural operations into weeding, irrigation, mulching, earthing up, thinning, staking, and slacking. On the other hand how many times and when it was done in a year and by what means it was done was also included as shown in item no. 15 (Appendix I).

3.10.4 Diseases infestation

To know the situation about disease infestation information were collected by asking question about the symptoms and their control measures they adopted. An item was prepared in the interview schedule at item no 16 (Appendix 1) in this purpose. Here the name of the diseases with their symptoms and control measure were asked.

3.10.5 Insect infestation

The researcher collected information about insect infestation of vegetables cultivation. Researchers were collected insect name, their symptoms and control measure from respondents. It appears in item no 17 (Appendix I) in interview schedule.

3.10.6 Types of Vegetable Cultivated in the Respondents Farm

The researcher categorized the vegetables into their name, citation number and was presented with figure.

3.10.7 Causes of change in choosing vegetables for cultivation

Statement with 10 items was used to determine respondent's tendency regarding selection of vegetables cultivation (24 no. item in Appendix I). They were

- 1 = Increase of salinity
- 2 = Introduction of prawn farming
- 3 = Excess rainfall
- 4 = Drought
- 5 = Lack of essential irrigation water
- 6 = Natural calamities
- 7 = Change of food habit
- 8 = Availability of new variety
- 9 = high demand of vegetables
- 10 = Good market price



The respondent responded freely and the total number of respondents in each item determined the causes of change in choosing vegetables for cultivation.

3.11 Vegetables cropping pattern

This section was measured by following the 4 types of different selected study area such as prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area.

3.11.1 Vegetable cropping pattern in different years

Cropping pattern is the yearly sequence and spatial arrangement of crops or crops and fallow on a given area of land. The vegetable cropping patterns that are being practiced by the respondents for different years were recorded. Item number 25, 26, 27 and 28 in the interview schedule (Appendix I) represent the vegetable cropping patterns.

3.11.2 The causes of changing vegetable cropping patterns

A statement with 9-item was used to determine the respondent's perception regarding the causes of changing vegetable cropping patterns. (Appendix I; item 29) A 4 point liker type scale such as very severe, severe, negligible and not at all were employed to determine the perception of the respondent regarding the causes of changing vegetable cropping patterns. A score of 3, 2, 1 and 0 were assigned against the scales very severe, severe, negligible and not at all, respectively.

9-item statements used to determine the respondents' perception regarding the causes of changing vegetable cropping patterns are as follows.

- 1 = Increase the demand of vegetable production
- 2 = Increase of vegetables yield in a unit area
- 3 = Increase of high yielding variety of vegetables
- 4 = Land leased out for shrimp farming
- 5 = Establishment of orchard
- 6 = Increase of salinity
- 7 = Demand of land for non-agricultural process
- 8 = Introduction of prawn/shrimp farming and
- 9 = Natural calamities

The perception score regarding the causes of changing vegetable cropping patterns were determined by summing up all the scores obtained against each of the 9-statements.

3.12 Data Processing and Analysis

Collected data were compiled, coded, tabulated for processing and analysis in accordance with the objectives of the study. For arriving at a meaningful conclusion, tabular presentation of data was intensively used. The SPSS IBM-20 computer package program was used to analyze the data. Descriptive statistics like number, percentage, range, mean and standard deviation were used in describing selected independent variables of the study.

CHAPTER IV

RESULTS AND DISCUSSION

The findings of the study and interpretation of results has been presented in this chapter. These are conveniently presented according to the objectives of the study. This chapter is divided into 3 sections. The first section deals with the overall conception about selected characteristics of the respondents, the identification of the problems faced by the vegetables grower and relationship between the selected characteristics of the respondents and their problem confrontation. The second section deals with the present situation of vegetable cultivation. The third section deals with the identification of vegetables cropping pattern and the causes of changing vegetables cropping pattern.

4.1. Facts on the Selected Characteristics of the Respondents

4.1.1 Age

The age of the respondents ranged from 30-78 with a mean and standard deviation of 48.18 years and 46.00, respectively. Based on age, the respondents have been classified into three categories as shown in Table 4.1.1.

Table 4.1.1 Distribution of respondents according to their age

Categories	Score (years)	Farmers (N=120)		Mean (years)	Standard deviation
		No. of farmers	Percentage (%)		
Young aged	<40	18	15.0	48.18	46.00
Middle aged	40-55	75	62.5		
Old aged	>55	27	22.5		
Total		120	100	Min. 30	Max. 78

Data presented in Table 4.1.1 indicate that majority (62.5%) of the respondents belonged to middle age category as compared to old (22.5%) and young (15%).

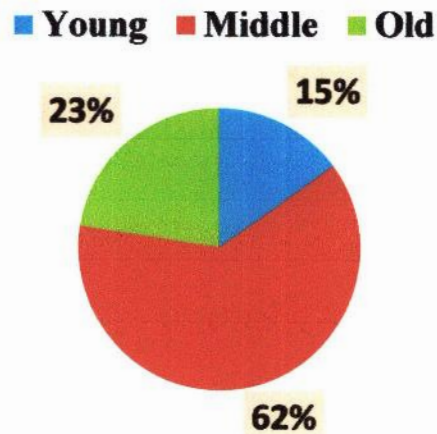


Figure 4.1 Distribution of respondents according to their age

It was trying to find out the respondents who have belonged to about 40 years old. This was because to fulfill the objectives of the research.

4.1.2 Education

The education scores of the respondents ranged from 0-17 with a mean and standard deviation of 7.53 years and 4.60, respectively. Based on education, the respondents have been classified into five categories as shown in Table 4.1.2.

Table 4.1.2 Distribution of respondents according to level of education

Categories	Score	Farmers (N=120)		Mean	Standard deviation
		No. of farmers	Percentage		
Illiterate	0	6	5.0	7.53	4.60
Primary	1-5	42	35.0		
Secondary	6-10	45	37.5		
Higher secondary	11-12	13	10.8		
Higher education	>12	14	11.7		
Total		120	100	Min. 0	Max. 17

Data presented in Table 4.1.2 show that the highest proportion (37.5%) of the respondents possessed secondary level of education followed by primary education (35%), higher education (11.7%) and higher secondary education (10.8%). Only 5% that means a very few of the respondent farmers were illiterate.

4.1.3 Family Size

The family size of the respondents ranged from 2-10 with a mean and standard deviation of 4.22 and 1.02, respectively. Based on experience in family size, the respondents have been classified into three categories as shown in Table 4.1.3.

Table 4.1.3 Distribution of respondents according to their score of family size

Categories	Score	Farmers (N=120)		Mean	Standard deviation
		No. of farmers	Percentage (%)		
Small sized family	1-4	74	62.0	4.22	1.02
Medium sized family	5-6	42	35.0		
Large sized family	>6	4	3.0		
Total		120	100	Min 2	Max 10

Data presented in Table 4.1.3 reveal that about majority (65.0%) of the farmers had small sized family as compared to medium (34.2%) and large (0.8%) sized family.

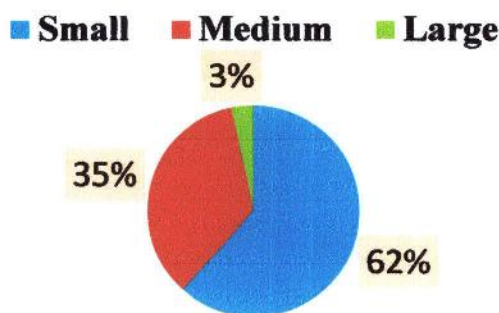


Figure 4.2 Distribution of respondents according to their score of family size

4.1.4 Experiences in Agriculture

To measure the experience, the duration of involvement of the farmers in agriculture was considered. The scores on experience in agriculture of the farmers ranged from 10-66 years with mean of 29.72 years and standard deviation of 10.39. Based on the experience in agriculture, the farmers were grouped into different categories as shown in the Table 4.1.4.

Table 4.1.4 Distribution of respondents according to their experience in agriculture

Categories	Score	Farmers (N=120)		Mean (years)	Standard deviation
		No. of farmers	Percentage (%)		
Low experience	<10	5	4.2	29.72	10.39
Medium experience	10-20	27	22.5		
High experience	>20	88	73.3		
Total		120	100	Min 10	Max 66

It was found that the most (73.3%) of the respondents had high experienced and a very few (4.2%) respondents was low experienced. And the rest (22.5%) of the respondents was medium experienced.

4.1.5 Experience in vegetable Cultivation

To measure the experience, the duration of the farmers' involvement in vegetable cultivation was considered. The scores on experience in vegetable cultivation of the farmers ranged from 2- 66 years with mean and standard deviation of 26.08 years and 10.50, respectively. Based on the experience in vegetable cultivation the farmers were grouped into different categories as shown in the Table 4.1.5.

Table 4.1.5 Distribution of respondents according to their experience in vegetable cultivation

Categories	Score	Farmers (N=120)		Mean (years)	Standard deviation
		No. of farmers	Percentage (%)		
Low experience	<10	11	9.2	26.08	10.50
Medium experience	10-20	36	30		
High experience	>20	73	60.8		
Total		120	100	Min 2	Max 66

It was found that the majority of the farmers (60%) had high experienced, followed by medium (30%) and low (9.24%) experience. These findings have harmony with the findings regarding experience in agriculture.

4.1.6 Annual Income

The annual income (from non-agricultural + agricultural sources) of the farmers ranged from 70 thousand taka to 1150 thousand taka with the mean and standard deviation of 207941.7 taka and 147344.35, respectively. On the basis of their annual income, the farmers were classified into three categories as shown in Table 4.1.6.

Table 4.1.6 Distribution of respondents according to their annual income

Categories	Score	Farmers (N=120)		Mean (Taka)	Standards deviation
		No. of farmers	Percentage %		
Low income	<100000	18	15.0	207941.7	147344.35
Medium income	100000-120000	61	50.8		
High income	>120000	41	34.2		
Total		120	100	Min 70000	Max 1150000

Data presented in Table 4.1.6 indicate that slightly more than half (50.08%) of the respondents belonged to medium income group followed by (34.2%) high income and 15% of respondents was low income categories.

4.1.7 Extension Media Contact

Respondents use various information sources and media to a different extent in order to receive agricultural information. Extension media contact scores of the respondents ranged from 2 - 26, with an average of 9.75 and standard deviation of 3.54. Based on the computed extension media contact score, the respondents were classified into three categories as shown in Table 4.1.7.

Data presented in Table 4.1.8 reveal that low participation was observed for majority (45.8 %) of the respondents and about one-fifth (21.7%) of the farmers had high medium participation in different organization while 32.5% of the respondents had no organizational participation.

4.1.9 Cosmopoliteness

The cosmopoliteness scores of the respondents ranged from 6-23 with a mean and standard deviation of 10.42 and 3.05, respectively. Based on cosmopoliteness scores, the respondents have been classified into three categories as shown in Table 4.1.9.

Table 4.1.9 Distribution of respondents according to their score of cosmopoliteness

Categories	Score	Farmers (N=120)		Mean	Standard deviation
		No. of farmers	Percentage (%)		
No cosmopoliteness	<10	55	45.8	10.42	3.05
Low cosmopoliteness	10-19	63	52.5		
High cosmopoliteness	>19	2	1.7		
Total		120	100	Min 6	Max 23

Data presented in Table 4.1.9 reveal that about majority (52.5%) of the respondents had low cosmopoliteness. Only 1.7% of the respondents are highly cosmopolite while 45.8% of the respondents had no cosmopoliteness.

4.1.10 Training Exposure

The scores of training exposure of the respondents ranged from 0 - 2 with an average of 0.16 and standard deviation of 0.48. Depending on the individual training exposure scores, the respondents were grouped into the following categories as shown in Table 4.1.10.

Table 4.1.10 Distribution of respondents according to their exposure to training

Categories	Score	Respondents (N=120)		Mean	Standard deviation
		Number	Percentage (%)		
No training	0	105	87.50	0.16	0.48
Low training	1	11	9.17		
High training	>1	4	3.33		
Total		120	100	Min 0	Max 2

Data presented in Table 4.1.10 indicate that most of the respondents (87.50%) had no training followed by low training (9.17%) and 3.33% respondents had high training. It is revealed from the result that most of the respondents were less interested to take training. This might be probably due to lack of proper training facilities in village level and items selected for farmers training by DAE (Department of Agricultural Extension) were not consistent of the respondent's concern.

4.1.11 Knowledge in vegetable Cultivation

The knowledge in vegetable cultivation scores of the respondents ranged from 10- 30 with a mean and standard deviation of 18.59 and 3.35, respectively. On the basis of their knowledge in vegetable cultivation score, the respondents were classified into three categories as shown in Table 4.1.11.

Table 4.1.11 Distribution of respondents according to their score of knowledge in vegetable cultivation

Categories	Score	Farmers (N=120)		Mean	Standard deviation
		No. of farmers	Percentage (%)		
Low knowledge	<17	36	30.0	18.59	3.35
Medium	17-23	77	64.2		
High knowledge	>23	7	5.8		
Total		120	100	Min 10	Max 30

Majority (64.2%) of the respondents belonged to medium knowledge group, while about 30% of respondents had low knowledge and 5.8% had high knowledge in vegetable cultivation. Since, most of the respondents had medium to high knowledge, it is logical to assume that they had high experience for identification of problem in vegetable cultivation.

4.2 Problem Confrontation of Vegetable cultivation

4.2.1 Identification of problems confronted by the respondent farmers

There are so many problems in vegetables cultivation. The farmers of the study area confronted a number of 19 problems with different extent related to vegetables cultivation.

4.2.2 Severity of problem

The severity of the problems was determined based on PCI (Problem Confrontation Index).

The findings of the study have the harmony with this argument to some extent. Among the confronted problems unavailability of good quality seed, salinity, diseases and insect infestation were some of the major problem. On the other hand, lack of protection, lack of loan facilities, high production cost, scarcity of quality fertilizer were some of the less severe problems (Table 4.2.1 and Table 4.2.2).

Table 4.2.1 Problem Confrontation Index (PCI)

Sl. No.	Name of the problems	PCI	Percentage	Rank
1	Traditional land cultivation	126	35.00	11 th
2	Unavailability of good quality seed	230	63.89	1 st
3	Poor germination	140	38.89	8 th
4	Poor productivity	153	42.50	5 th
5	Scarcity of quality fertilizer	56	15.56	15 th
6	Diseases and insect infestation	211	58.61	3 rd
7	Lack of good quality irrigation water	168	46.67	4 th
8	Salinity	224	62.22	2 nd
9	Lack of loan facilities	47	13.06	18 th
10	High production cost	50	13.89	17 th
11	Transportation	53	14.72	16 th
12	Lack of preservation/ storage facilities	86	23.89	12 th
13	Lack of knowledge on processing	137	38.06	9 th
14	Low market price in season	135	37.50	10 th

15	Interference of middlemen in the marketing system	60	16.67	14 th
16	Lack of extension program	145	40.28	6 th
17	Food habit	74	20.56	13 th
18	Natural calamities	142	39.45	7 th
19	Lack of protection	36	10.00	19 th

Table 4.2.2 Severity of problem based on PCI percentage

Categories	Distribution of problems	
	Individual problem number (Serial)	Percent
Less severe (<20%)	6 (15,5,11,10,9,19)	31.60
Severe (20%-40%)	7 (17,18,3,13,14,1,12)	36.80
Highly severe (>40%)	6 (2,8,6,7,4,16)	31.60
Total	19	100

4.2.3 Extent of Problem Confrontation

The score of problem confrontation ranged from 3-40 with a mean of 19.23 and having standard deviation of 6.86. Considering the mean and standard deviation, the farmers were categorized into low, medium and high problem confrontation categories

Table 4.2.3 Distribution of respondents according to their score of problem confrontation

Categories	Score	Farmers (N=120)		Mean	Standard deviation
		No. of farmers	Percentage (%)		
Low problem confrontation	<20	72	60.0	19.23	6.86
Medium problem confrontation	20-30	38	31.7		
High problem confrontation	>30	10	8.3		
Total		120	100	Min 3	Max 40

Data presented in Table 4.2.3 reveal that majority (60%) of the respondents confronted low problem. Only 8.3% of the respondents confronted high problem while 31.7% of the respondents confronted medium problem.

Relationship between the selected characteristics of the respondents with their problem confrontation in vegetable cultivation

This section deals with the relationship between 11 selected characteristics of the farmers and their problem confrontation in vegetable cultivation. To explore the relationships between the selected characteristics of the respondents and their problem confrontation, Pearson's Product Moment co-efficient of correlation (r) was used. The relationships of the selected characteristics of the respondents with their problem confrontation appear in Table 4.2.4.

Table 4.2.4 Computed coefficient of correlation (r) between farmers' selected characteristics and their problem confrontation.

Sl. No.	Independent variable (selected characteristics)	Dependent variable	Observed "r" values (Pearson Correlation)
1	Age	Problem confrontation	-0.071
2	Education		-0.178
3	Family size		0.045
4	Experience in agriculture		-0.147
5	Experience in vegetable cultivation		-0.159
6	Annual income		-0.136
7	Organizational participation		0.271**
8	Cosmopoliteness		-0.211*
9	Extension media contact		-0.101
10	Training Exposure		0.026
11	Knowledge in vegetable cultivation		-0.298**

* = Significant at 0.05 level

** = Significant at 0.01 level

Among the 11 selected characteristics of the respondents, only two characteristics such as, cosmopoliteness and knowledge in vegetable cultivation showed a negative but significant relationship. The negative trend of relationships implies that the lower

is the cosmopoliteness and knowledge in vegetable cultivation of the respondents, the higher is the problem confrontation in vegetable cultivation.

4.3 Present situation of vegetable cultivation

4.3.1 Total usable land for vegetable cultivation

In order to identify the land used under vegetable cultivation, firstly, total cultivable and land suitable for vegetable cultivation, which were under the procession of a respondent were studied.

4.3.1. a Total cultivable land

The total cultivable land in shrimp farming area ranged from 0.06 -4.10 ha with mean and standard deviation of 1.03 ha and 0.94, respectively while it was 0.04-2.27, 0.53 ha and 0.47 for the same in case of non-shrimp farming area. The data also indicate that the average amount of land in shrimp farming area was higher than that of non-shrimp farming area, prawn farming area and non-prawn farming area (Table 4.3.1)

Table 4.3.1 Distribution of respondents according to their total cultivable land

PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Categories	Score (ha)	Respondents							
		PFA		NPFA		SFA		NSFA	
		No.	%	No.	%	No.	%	No.	%
Small	<0.40	5	16.7	7	23.3	7	23.3	8	26.7
Moderate	0.40-0.80	18	60.0	5	16.7	5	16.7	19	63.3
Moderately large	0.81-1.2	4	13.3	9	30.0	9	30.0	1	3.3
Large	>1.2	3	10.0	9	30.0	9	30.0	2	6.7
Total		30	100	30	100	30	100	30	100
Range (ha)		0.13 – 2.94		0.13 – 4.05		0.06 – 4.01		0.04 – 2.27	
Mean (ha)		0.63		0.59		1.03		0.53	
Standard deviation		0.52		0.69		0.94		0.47	

Data presented in Table 4.3.1 indicate that majority (60%) of the respondents in shrimp farming area had moderately large to large amount of cultivable land while more than three-fourths of the respondents (76.6%) in non-shrimp farming area had small to moderate amount of cultivable land. But most of the respondents of prawn farming area (76.7%) and non-prawn farming area (90%) possessed small to moderate amount of cultivable land.

4.3.1. b Land suitable for vegetable cultivation

The total suitable land for vegetable cultivation in non-prawn farming area ranged from 0.04 -0.81ha with mean and standard deviation of 0.24 ha and 0.19, respectively while it was 0.02-1.54, 0.22 ha and 0.37 for the same in case of shrimp farming area.

The data also indicate that the average amount of suitable land for vegetable cultivation in non-prawn farming area was higher than that of shrimp farming area, non-shrimp farming area and prawn farming (Table 4.3.2)

Table 4.3.2 Distribution of respondents according to their suitable land for vegetable cultivation

PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA =

Categories	Score (ha)	Respondents							
		PFA		NPFA		SFA		NSFA	
		No.	%	No.	%	No.	%	No.	%
Small	<0.10	12	40.0	7	23.33	8	26.7	10	33.3
Moderate	0.10-0.20	10	33.3	9	30.00	6	20.0	8	26.7
Moderately large	0.21-0.40	7	23.3	8	26.67	9	30.0	9	30.0
Large	>0.40	1	3.33	6	20.00	7	23.3	3	10.0
Total		30	100	30	100	30	100	30	100
Range (ha)		0.04 – 0.40		0.04 – 0.81		0.02-1.54		0.02-0.53	
Mean (ha)		0.14		0.24		0.22		0.18	
Standard deviation		0.09		0.19		0.37		0.14	

non-shrimp farming area

Data presented in table 4.3.2 indicate that about three-fourths of the respondents (73.3%) in prawn farming area had small to moderate amount of suitable land while

in case of non-shrimp farming area that was 60%. But more than fifty percent of the respondents of non-prawn farming area (56.67%) possessed moderate to moderately large and shrimp farming area (53.3%) possessed moderately large to large amount of suitable land for vegetable cultivation.

4.3.1. c. Land under vegetable cultivation

The land under vegetable cultivation in non-prawn farming area ranged from 0.04 - 0.40 ha with mean and standard deviation of 0.18 ha and 0.11, respectively while it was 0.02-0.86, 0.16 ha and 0.15 for the same in case of shrimp farming area. The data also indicate that the average amount of land under vegetable cultivation in non-prawn farming area was higher than that of shrimp farming area, non-shrimp farming area and prawn farming (Table 4.3.3)

Table 4.3.3 Distribution of respondents according to their land under vegetable cultivation

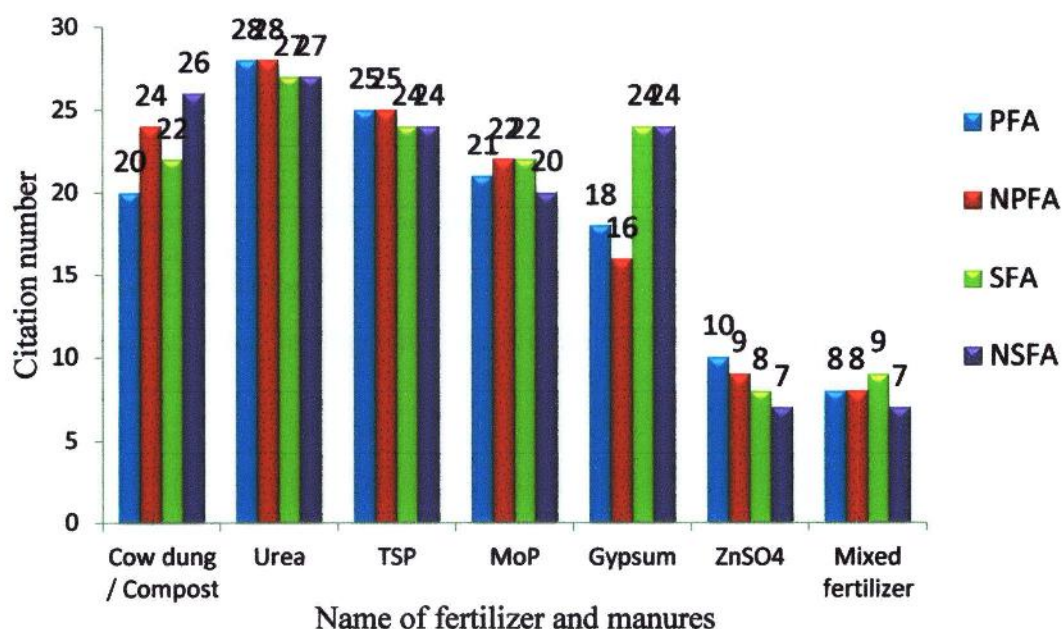
PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Categories	Score (ha)	Respondents							
		PFA		NPFA		SFA		NSFA	
		No.	%	No.	%	No.	%	No.	%
Small	<0.10	16	53.3	9	30.0	10	33.3	18	60.0
Moderate	0.10-0.20	10	33.3	10	33.3	9	30.0	6	20.0
Moderately large	0.21-0.40	4	13.3	8	26.7	6	20.0	6	20.0
Large	>0.40	0	0.0	3	10.0	5	16.7	0	0
Total		30	100	30	100	30	100	30	100
Range (ha)		0.02 – 0.27		0.04 – 0.40		0.02 – 0.86		0.02 – 0.27	
Mean (ha)		0.11		0.18		0.16		0.11	
Standard deviation		0.06		0.11		0.15		0.08	

Data presented in table 4.3.3 indicate that most of the respondents of prawn farming area (86.6%), non-shrimp farming area (80.0%), shrimp farming area (63.3%) and non-prawn farming area (66.3%) possessed small to moderate amount of land under vegetable cultivate.

4.3.2 Use of Fertilizers and Manures

It was revealed that 28 respondents (93.33%) used urea in both prawn farming area and non-prawn farming area while 27 respondents (90%) used urea in both shrimp farming area and non- shrimp farming area (Figure 4.3)



PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Figure 4.3 Use of fertilizers and manures by respondents in their farm

It was also revealed that among the 30 respondents, 20 (66.67%)-26 (86.67%) respondents used cow dung, TSP and MoP in the all types of study area. Data presented in Figure 4.6 that indicated 24(80%) respondents used gypsum in both shrimp farming area and non-shrimp farming area while that was only 18 respondents in prawn farming area and 16 respondents in non-prawn farming area.

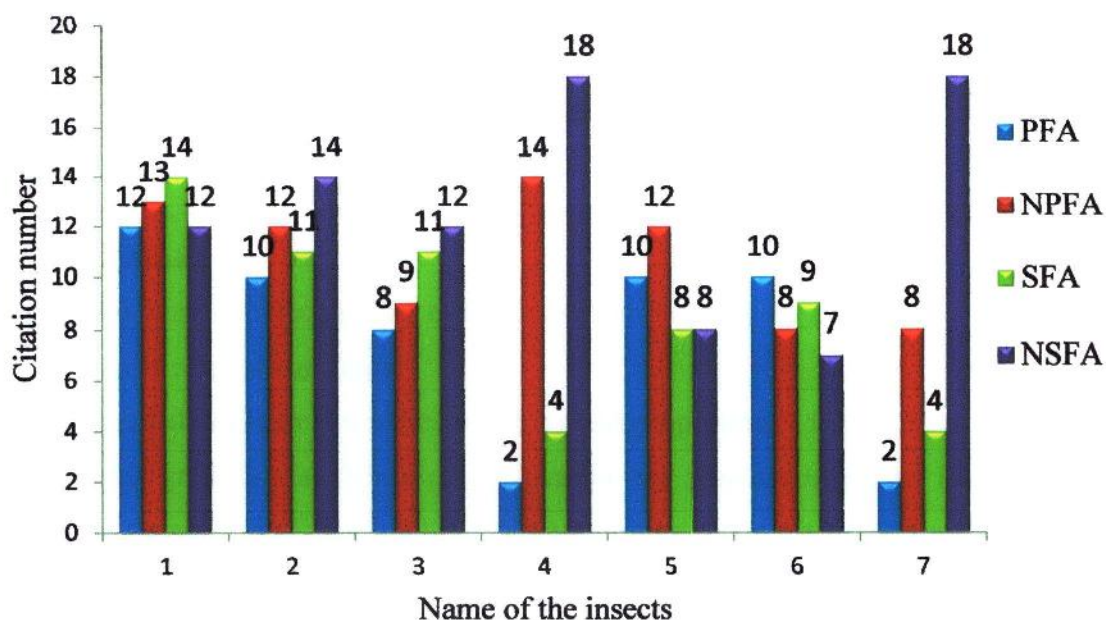
4.3.3 Intercultural Operation

Data presented in Table 4.3.4 that indicate most of the respondents (86.67%-93.33%) were practiced weeding and irrigation in all types of study area. A good percentage of respondents (40.00%-73.3300%) followed earthing up, thinning and staking in their field (Table 4.3.4). Slacking and mulching were also followed by some of the respondents in their field.

Data presented in Figure 4.4 indicate that highest proportion (23, 20, 11, 10 and 6) of the respondents cited that their plants were affected by viral diseases, leaf spot of cabbage & cauliflower, powdery mildew of cucurbits, early blight of potato & tomato and little leaf of brinjal, respectively in non-shrimp area while (15, 12, 11, 10 and 7) respondents cited that their plants were affected by mosaic of okra & tomato, late blight of potato & tomato, anthracnose of bean & cucurbits, early blight of potato & tomato and wilt of potato & tomato, respectively in the shrimp farming area.

4.2.5 Insect Infestation

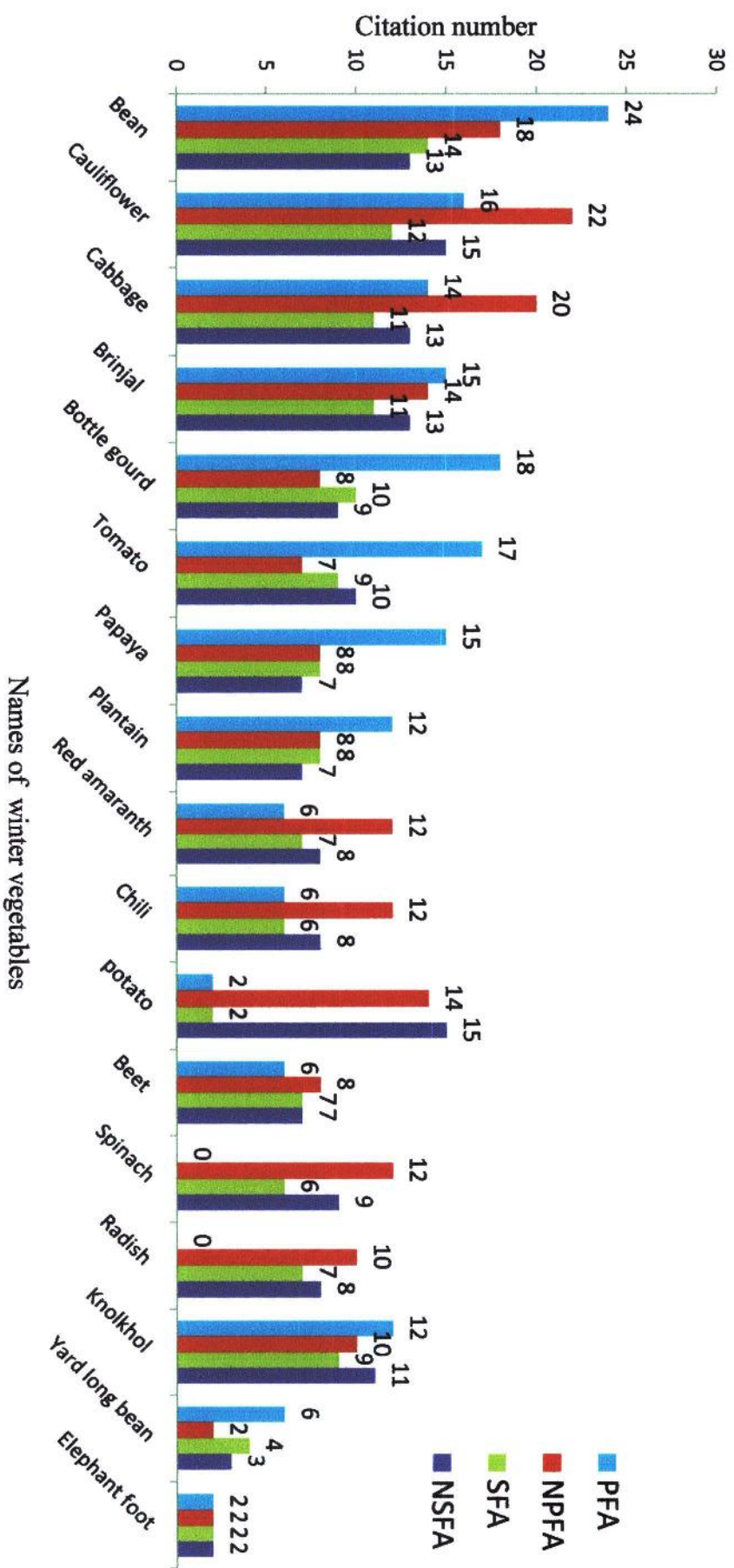
Data presented in Figure 4.5 indicate that highest proportion (18, 18, and 14) of the respondents cited that their plants were infested by potato tuber moth, cutworm of potato fruits and shoot borer of brinjal and okra in non-shrimp farming area while (14, 11 and 11) of the respondents cited that their plants were infested by leaf cutting caterpillar, fruit and shoot borer of brinjal and okra and red mite in non-shrimp farming area.



PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

1= Leaf cutting caterpillar, 2= Fruit & shoot borer of brinjal & okra, 3= Red mite, 4= Cutworm of potato, 5= Pumpkin beetle, 6= Aphid of bean & tomato, 7= Potato tuber moth

Figure 4.5 Status of insect infestation in different vegetables cultivation

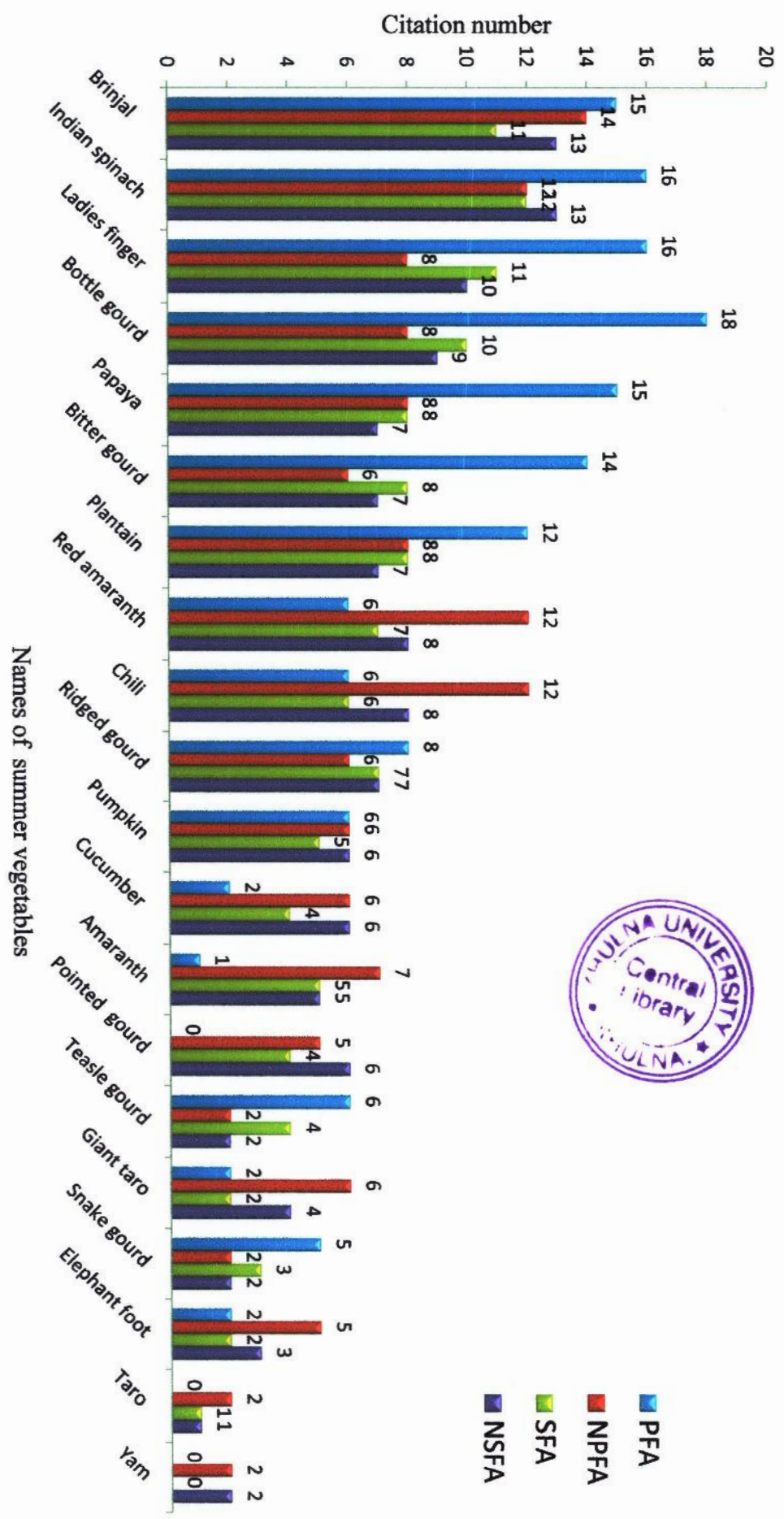


PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Figure 4.7 Status of recognized winter vegetables based on their cultivation in respondents' farm

A number of 17 vegetables were grown in winter to a different extent by the respondents of the prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area. Data presented in Figure 4.7 indicate that bean was cultivated by highest proportion (24 out of 30) respondents in the prawn farming area while cauliflower (22 out of 30), bean (14 out of 30), cauliflower (15) and potato (15) were cultivated by the highest proportion of the respondents in non-prawn farming area, shrimp farming area and non-shrimp farming area, respectively.

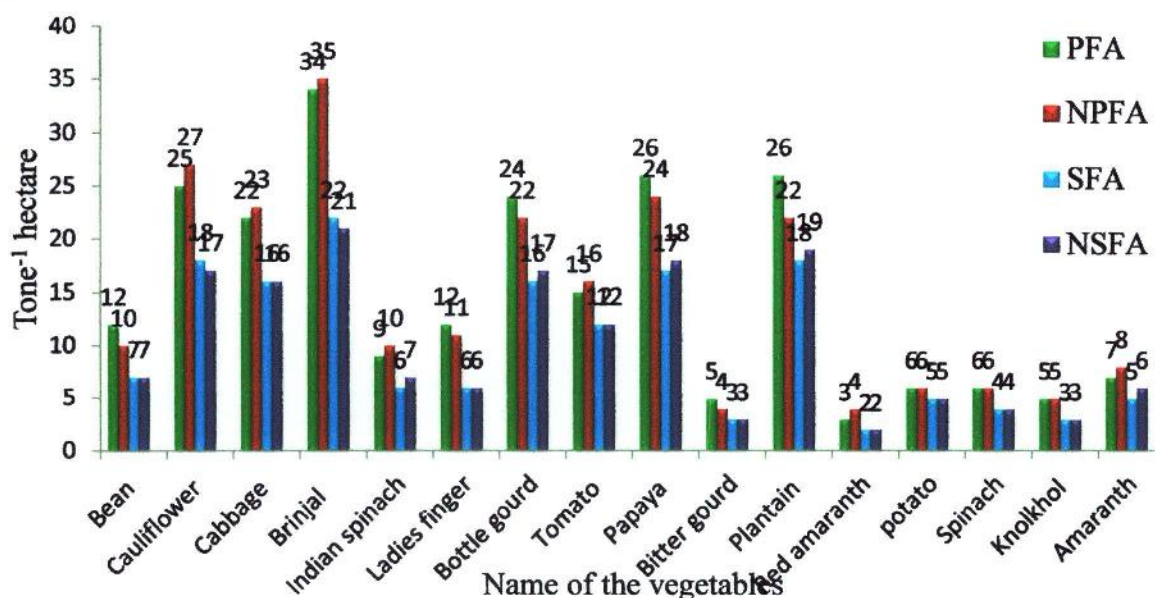
A number of 20 vegetables were grown in summer to a different extent by the respondents of the prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area. Data presented in Figure 4.8 indicate that highest proportion (15, 16, 16, 18, 15, 14 and 12) of the respondents grew brinjal, indian spinach, ladies finger, bottle gourd, papaya, bitter gourd and plantain, respectively in prawn farming area while red amaranth (12) and chilli (12) were cultivated by the highest proportion of the respondents in non-prawn farming area. In case of shrimp farming area Indian spinach (12), brinjal (11) and bottle gourd (10) were cultivated by the highest proportion of the respondents while both brinjal and Indian spinach (13) red amaranth (8) and chilli (8) were cultivated by the highest proportion of the respondents in the non-shrimp farming area.



PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area
 Figure 4.8 Status of recognized summer vegetables based on their cultivation in respondents' farm

4.3.7 Average yield of some top most cultivated vegetables in the study area

Yield depends on climate, soil, environment, variety etc. The observation of the respondent farmers also varied in the study area about the present yield of vegetables. The average yield of some top most cultivated vegetables in the study area are presented in Figure 4.9.



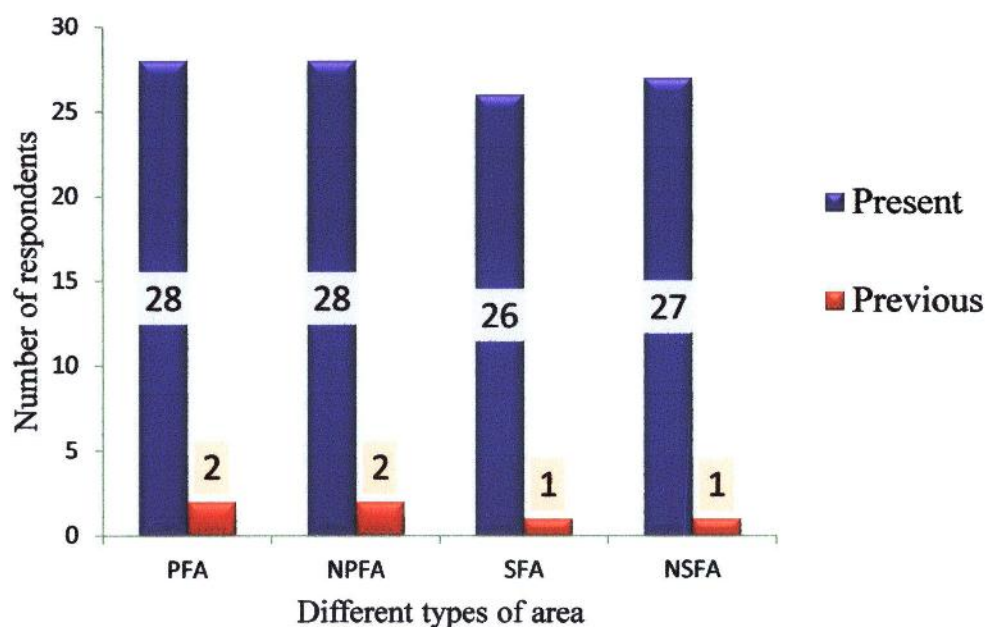
PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Figure 4.9 Average yields of some top most cultivated vegetables

Data presented in Figure 4.9 indicate that the average yields were higher in case of prawn farming area and non- prawn farming area than shrimp farming area and non-shrimp farming area. Frequent natural calamities and salinity affect the vegetables production was the observation of the interviewer.

4.3.8 Situation of vegetables varieties used in the respondents' farm

Most of the respondent farmers use various kinds of HYV / Hybrid varieties presently as vegetable cultivation in all types of the study area while most of them used local variety about 30 years ago.



PFA = prawn farming area, NPFA = non-prawn farming area, SFA = shrimp farming area, NSFA = non-shrimp farming area

Figure 4.10 Situation of HYV/ Hybrid varieties used in the respondents' farm

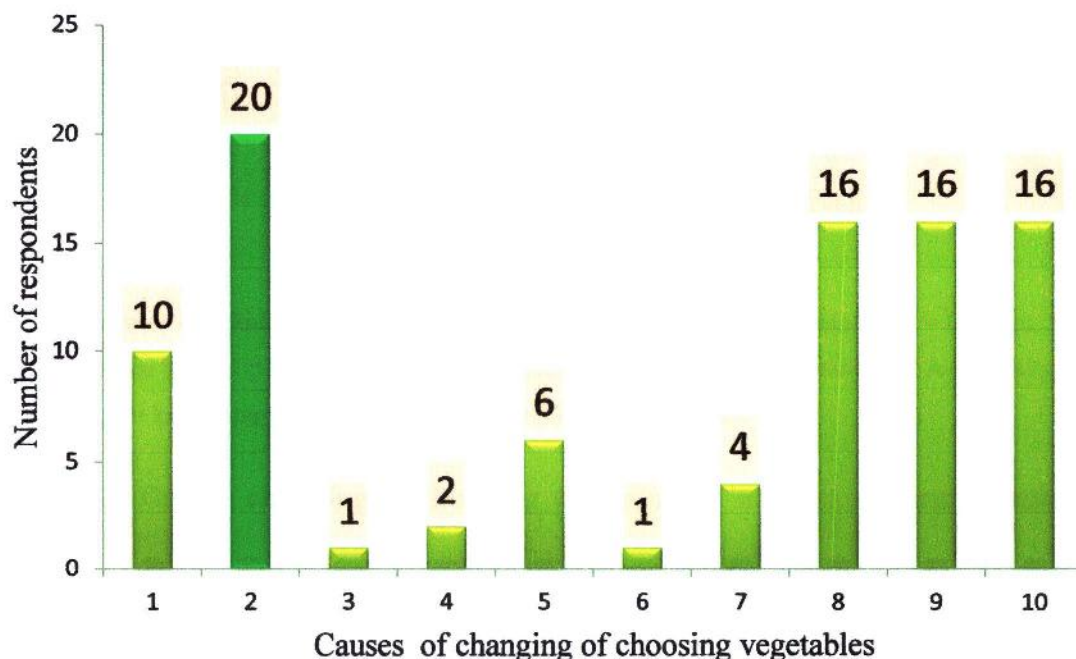
Data presented in Figure 4.10 indicate that the cultivation of hybrid /HYV vegetables increased overtime in all types of areas.

4.3.10 Causes of change in choosing vegetables for cultivation

This study was conducted into 4 types of areas such as prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area so that about a typical figure of vegetables cultivation might be presented. In the total study area, most of the farmers use local variety of vegetables.

In the study area of prawn farming among the 30 respondents, 8 respondents didn't cultivate vegetable before prawn farming. Prawn farming opens a new dimension in case of vegetables production even in low land i.e. *gher's* ail. It is quite impossible to imagine cultivation of vegetables before prawn farming in the bill dakatia, bill shingha, bill modhugram, bill boruna etc. when these entire bills remained under water up to 1990s. Besides this, availability of new varieties, high demand of vegetables and good market price plays an important role in case of choosing vegetables cultivation in prawn farming area.

In case of choosing vegetables 20 respondents out of 30 were agreed with the statement of introduction of prawn farming, 16 respondents were agreed with the 3 statements, availability of new varieties, high demand of vegetables and good market price, 10 respondents were agreed with the statement of the increase of salinity. 6, 4, 2, 1 and 1 respondent were agreed with the statements of lack of essential irrigation water, change of food habit, drought, natural calamities and excess rainfalls, respectively (Figure 4.11).

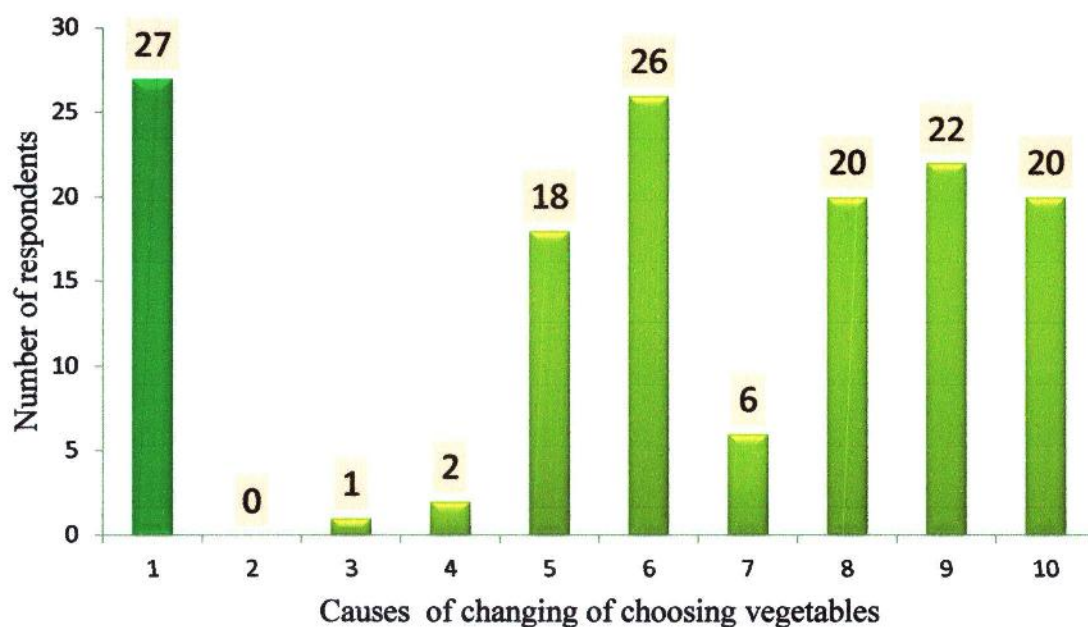


Note: 1 = Increase of salinity, 2 = Introduction of prawn farming, 3 = Excess rainfall, 4 = Drought, 5 = Lack of essential irrigation water, 6 = Natural calamities, 7 = Change of food habit, 8 = Availability of new variety, 9 = high demand of vegetables and 10 = Good market price

Figure 4.11 Causes of changing of choosing vegetables at prawn farming area

In the study area of non-prawn farming most of the farmers cultivate vegetable on the basis of commercial purpose since many years mainly in high land and some of medium high land. In this study area the soil is fertile and suitable for vegetable cultivation. Besides this, availability of new varieties, high demand of vegetables and good market price plays an important role in case of choosing vegetables cultivation in non- prawn farming area.

calamities.



Note: 1 = Increase of salinity, 2 = Introduction of shrimp farming, 3 = Excess rainfall, 4 = Drought, 5 = Lack of essential irrigation water, 6 = Natural calamities, 7 = Change of food habit, 8 = Availability of new variety, 9 = high demand of vegetables and 10 = Good market price

Figure 4.14 Causes of changing of choosing vegetables at non-shrimp farming area

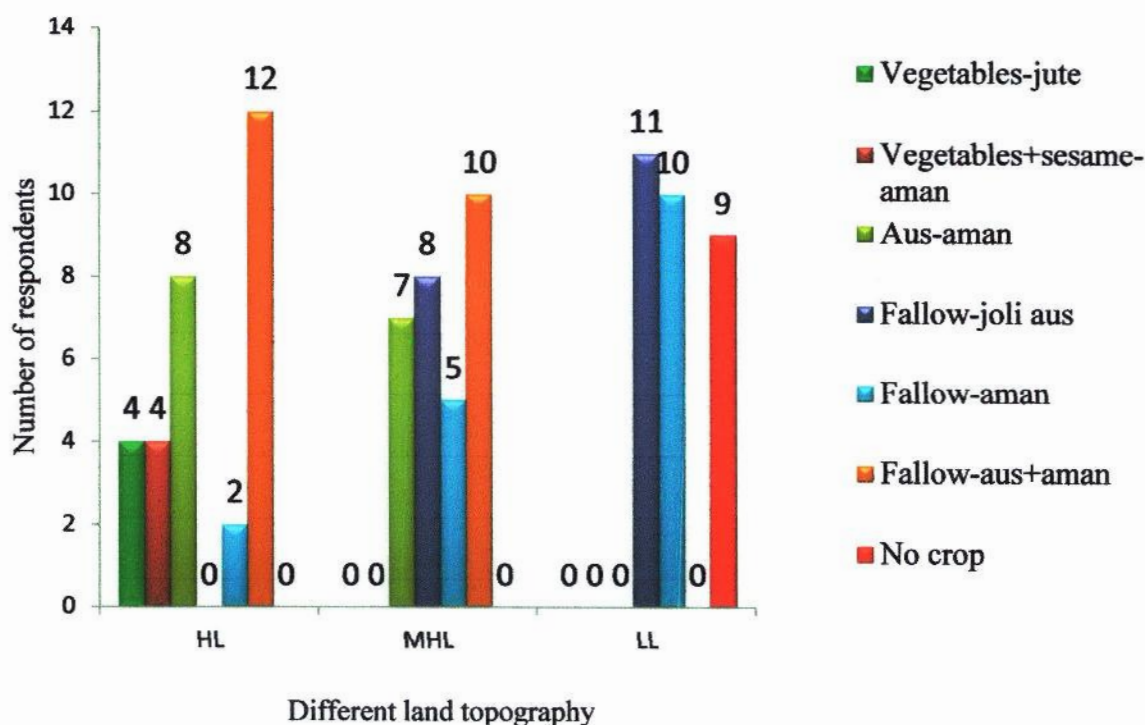
High demand of vegetables was cited by 22 respondents as the causes of selecting vegetables. Good market price and availability of new varieties were cited by 20 respondents as the causes of selecting vegetables. 18 respondents were agreed with the statement of lack of essential irrigation water. 6 respondents were agreed with the statement of change of food habit (Figure 4.14).

4.4 Vegetables cropping pattern

4.4.1 Identification of vegetables cropping pattern in different years

In the study area of prawn farming in 1980 a total of 6 cropping patterns (Figure 4.15) were practiced. At that time, it was found that single cropped cropping pattern (fallow-aman) was practised in all type of land topography but another single cropped cropping pattern (fallow-joli aus) was practised by the majority of the respondents in medium high land and low land but it was not practised in high land. Besides these, vegetable cropping pattern (vegetables-jute) and (vegetables+sesame-aman) were found to be practised in high land. A large portion of respondents mentioned that no crop was grown in low land. It was due to inundation of this type of land.

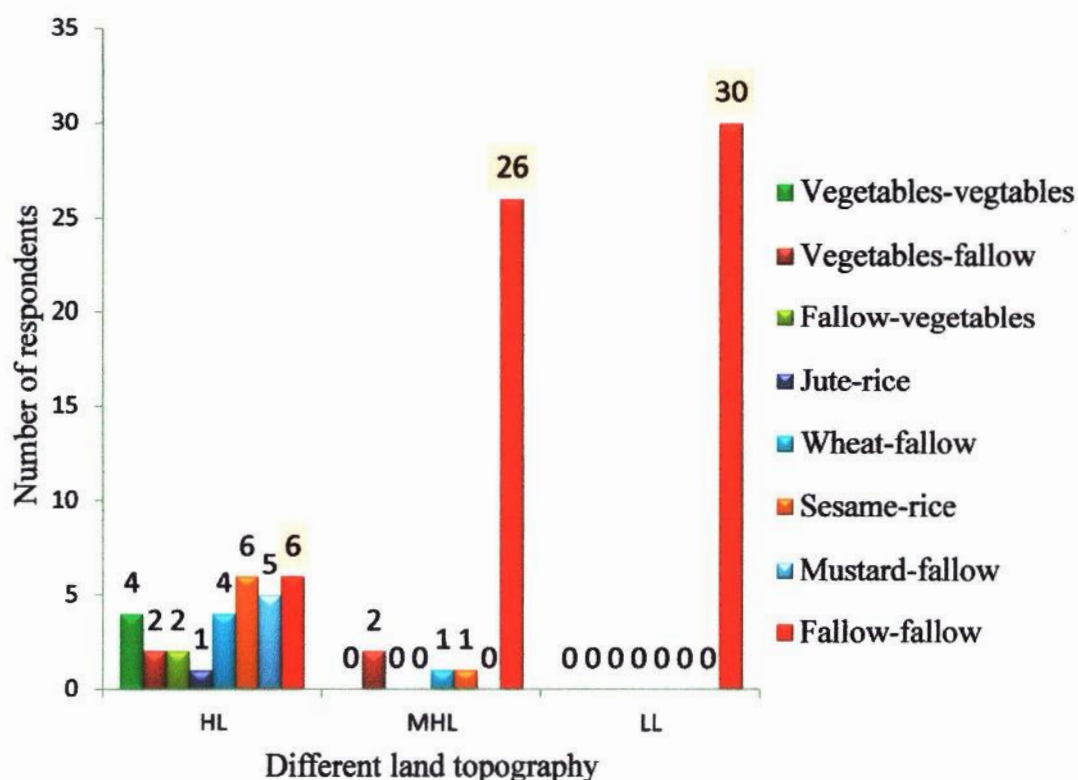
At that time, among all the respondents (30), fallow-aman was noticed to be practised by 12 respondents in high land and 10 respondents in medium high land. Fallow-joli aus was noticed by 10 respondents in low land and 8 respondents in medium high land. Fallow-aman was cited by 10, 5 and 2 respondents in low land, medium high land and high land, respectively. Aus-aman was noticed to be practiced by 8 respondents in high land and 7 respondents in medium high land. Vegetables-jute and vegetables+sesame-aman was practiced by 4 respondents both in high land and 9 respondents followed no cropping pattern in low land i.e. did not cultivate crops. (Figure 4.15)



HL = High land, MHL = Medium high land, LL = Low land

Figure 4.15 Vegetables cropping pattern of prawn farming area in 1980

In 1990s, most of the prawn farming of the study area remained under water around the year and then a dramatically decrease the changing cropping pattern as observe from the study area. As a result only a total of 6 cropping pattern were practised in 1990s. At that time, 30 respondents in low land, 26 respondents in medium high land and 6 respondents in high land were not practiced any crops due to submergence. Vegetables- vegetables was practised by 5 respondents in high land. On the other hand, vegetables- fallow was practised by 4 respondents both in high land and medium high land. Sesame- rice cropping pattern was practiced by 6 respondents in high land and 1 respondent in medium high land. Wheat-fallow was noticed by 4 respondents in high land and 1 respondent in medium high land (Figure 4.16)

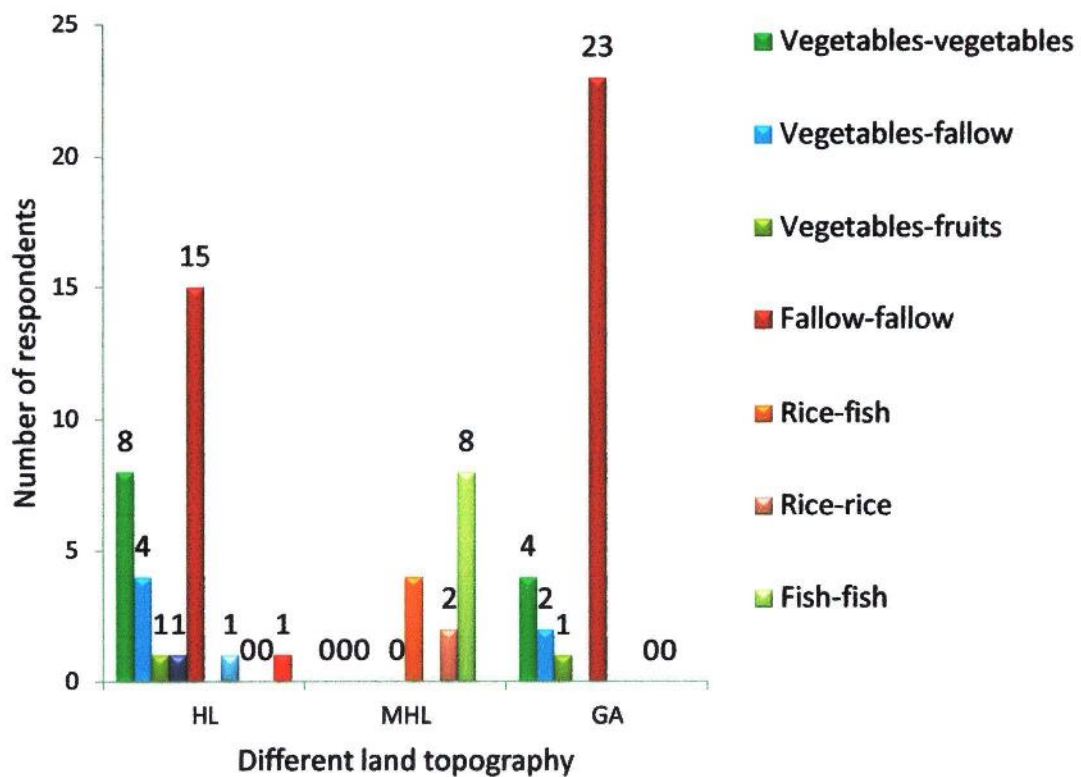


HL = High land, MHL = Medium high land, LL = Low land

Figure 4.16 Vegetables cropping pattern of prawn farming area in 1990

About 20 years ago prawn farming was started in most of the study area and after that time a dramatically increase the change in cropping pattern as mention by the respondents in the study area. After stating prawn farming a total of 14 cropping pattern (figure 4.17) were practiced. Among the 30 respondents in this study area, 8 respondents were not practiced the vegetables cultivation before prawn farming. Prawn farming creates an opportunity to cultivate vegetables production even in low land. Most of the farmers were practising to cultivate vegetables in the *gher's ail* besides fish along with rice.

Vegetables-vegetables cropping pattern was noticed by 18 respondents in *gher's ail* and 9 respondents in high land. Rice-fish pattern was followed by 22 respondents in medium high land. Vegetables- fallow pattern was practiced by 5 respondents in high land and 2 respondents in *gher's ail*. Vegetables-fruits pattern was practiced by 2 respondents both in high land and *gher's ail*. Fruits-fruits was notised by 6 respondents in high land. Fallow – fish was noticed by 4 respondents in medium high



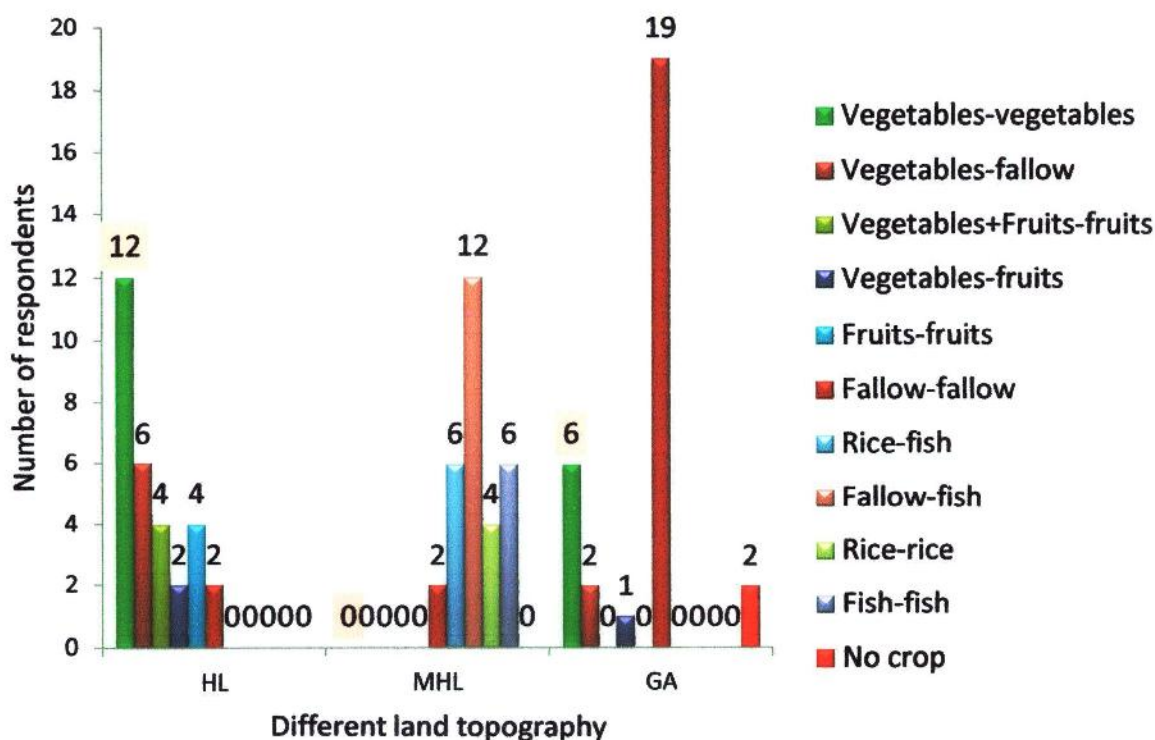
HL = High land, MHL = Medium high land, GA = Gher's ail

Figure 4.22 Vegetables cropping pattern of shrimp farming area in 2000

In the study area shrimp farming during the study period a total of 10 cropping pattern was found. Vegetables cultivation was mostly done in high land especially in homestead area where the intensity of salinity is low. This study area was a quite saline zone. In low land crop cultivation is totally absent. Maximum respondents practiced shrimp farming. Very few respondents practiced vegetables cultivation in their *gher's ail* those situated in medium high land.

In that time, vegetables-vegetables was practiced by 12 respondents in high land and 6 respondents in *gher's ail*. Vegetables-fallow was practiced by 6 respondents in high land and 2 respondents in *gher's ail*. Vegetables+fruits-fruits was followed by 4 respondents in high land. Vegetables-fruits was

practiced by 2 respondents in high land and 1 respondent in *gher's ail*. Fruits-fruits was followed by 4 respondents in high land. Fallow-fish was practiced by 12 respondents in medium high land. Rice-fish was practiced by 6 respondents in medium high land. Rice-rice was practiced by 4 respondents in medium high land. Fish-fish was practiced by 6 respondents in medium high land. Fallow-fallow was noticed to be practiced by 21 respondents in *gher's ail* and 2 respondents in medium high land and high land (Figure: 4.23).



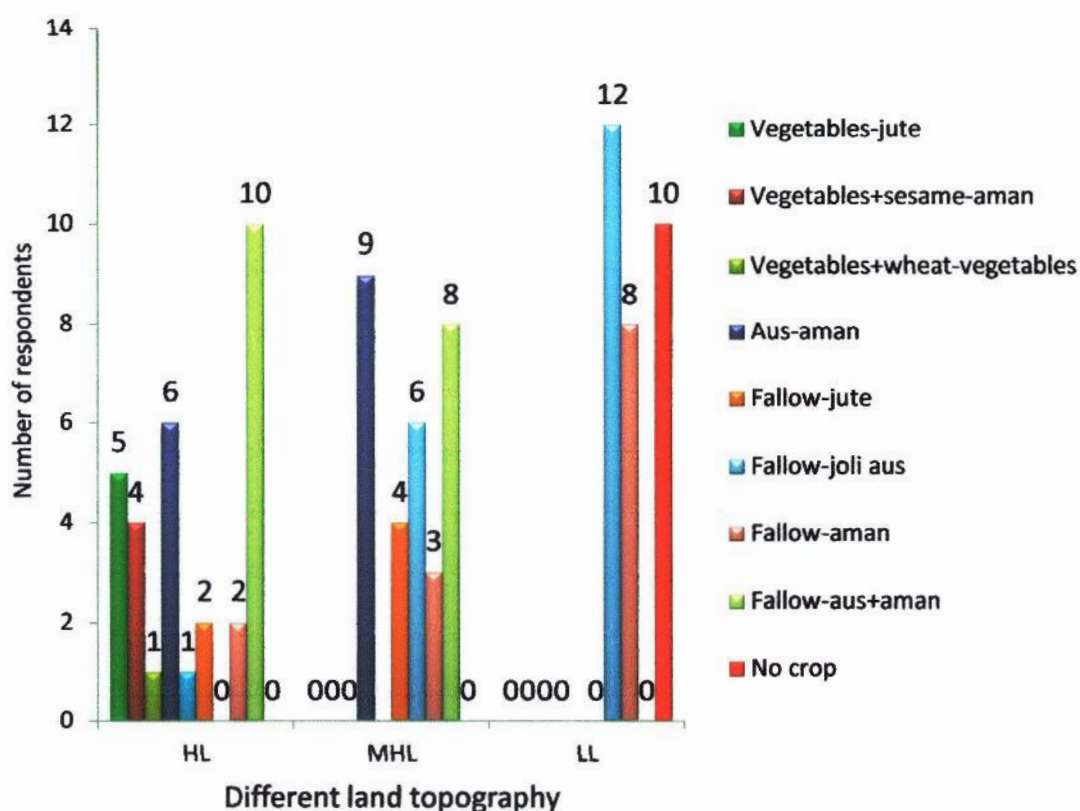
HL = High land, MHL = Medium high land, GA = Gher's ail

Figure 4.23 Present vegetables cropping pattern of shrimp farming area

In the study area of non-shrimp farming in 1980 a total of 8 cropping patterns (Figure 4.24) were practiced. At that time, it was found that single cropped cropping pattern fallow-aman was practised in all type of land topography but another single cropped cropping pattern fallow- joli aus was practised by the majority of the respondents in medium high land and low land but it was not practised in high land. Besides these, vegetable cropping pattern vegetables-jute and vegetables+sesame-aman were found

to be practised in high land. A large portion of respondents mentioned that no crop was grown in low land. It was due to water logging condition.

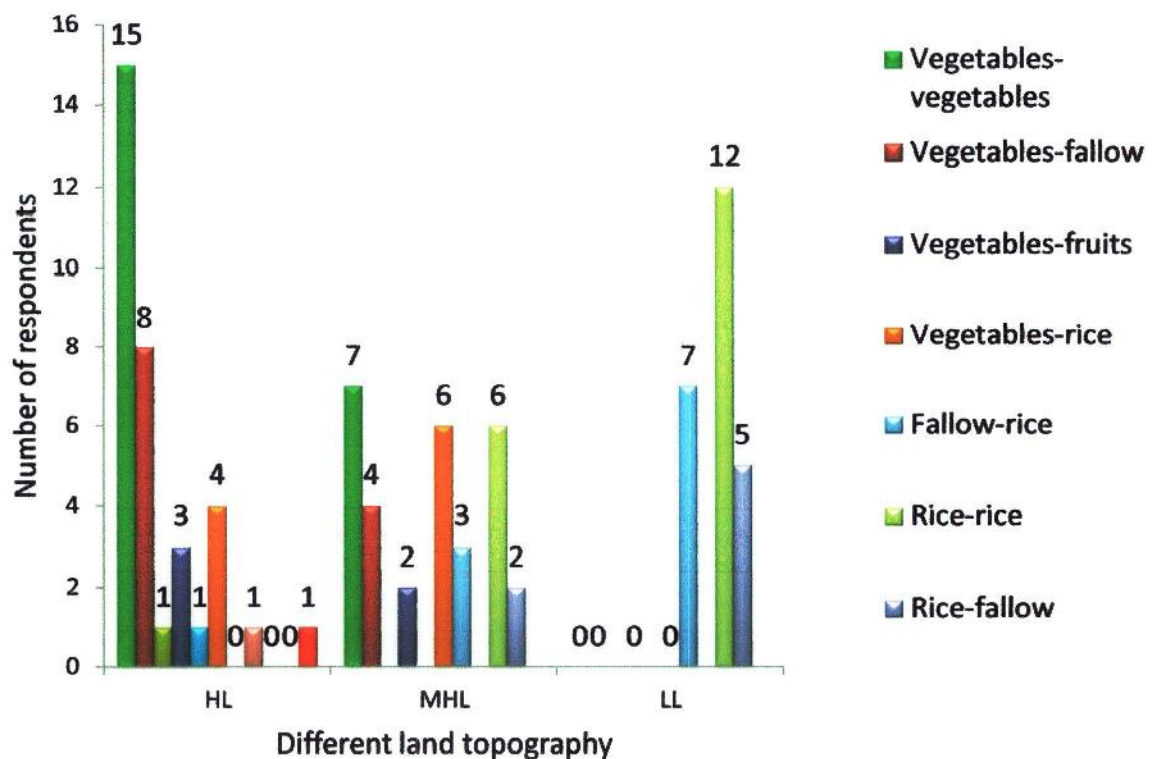
In that time, among all the respondents, fallow-*aus+aman* was noticed to be practised by 10 respondents in high land and 8 respondents in medium high land out of 30 respondents. Fallow-*joli aus* was noticed by 12 respondents in low land and 6 respondents in medium high land. Fallow-*aman* was cited by 8 respondents in low land, 3 respondents in medium high land and 2 respondents in high land. *Aus-aman* was noticed to be practiced by 6 respondent in high land and 9 respondent in medium high land. Vegetables- *jute* was practiced by 5 respondents in high land. Vegetables+*sesame-aman* was practiced by 4 respondents in high land. Fallow-*jute* was practiced by 4 respondents in medium high land and 2 respondents in high land. 10 respondents followed no cropping pattern in low land i.e. did not cultivate crops (Figure 4.24).



HL = High land, MHL = Medium high land, LL = Low land

Figure 4.24 Vegetables cropping pattern of non-shrimp farming area at 1980

In the study area of non-shrimp farming in 2000s, vegetables–vegetables cropping pattern was noticed by 15 respondents in high land and 7 respondents in medium high land. Vegetables-fallow was practiced by 8 respondents in high land and 4 respondents in medium high land. Vegetables-fruits was noticed by 3 respondents in high land and 2 respondent in medium high land. Vegetables–rice pattern was practiced by 4 respondents in medium high land and 6 respondents in high land. Fallow–rice was practiced by 3 respondents in medium high land and 8 respondents in low land. Rice-rice cropping pattern was noticed to be 15 respondents in low land and 6 respondents in medium high land. Rice-fallow cropping pattern was followed by 2 respondents in medium high land and 7 respondents in low land (Figure 4.25).

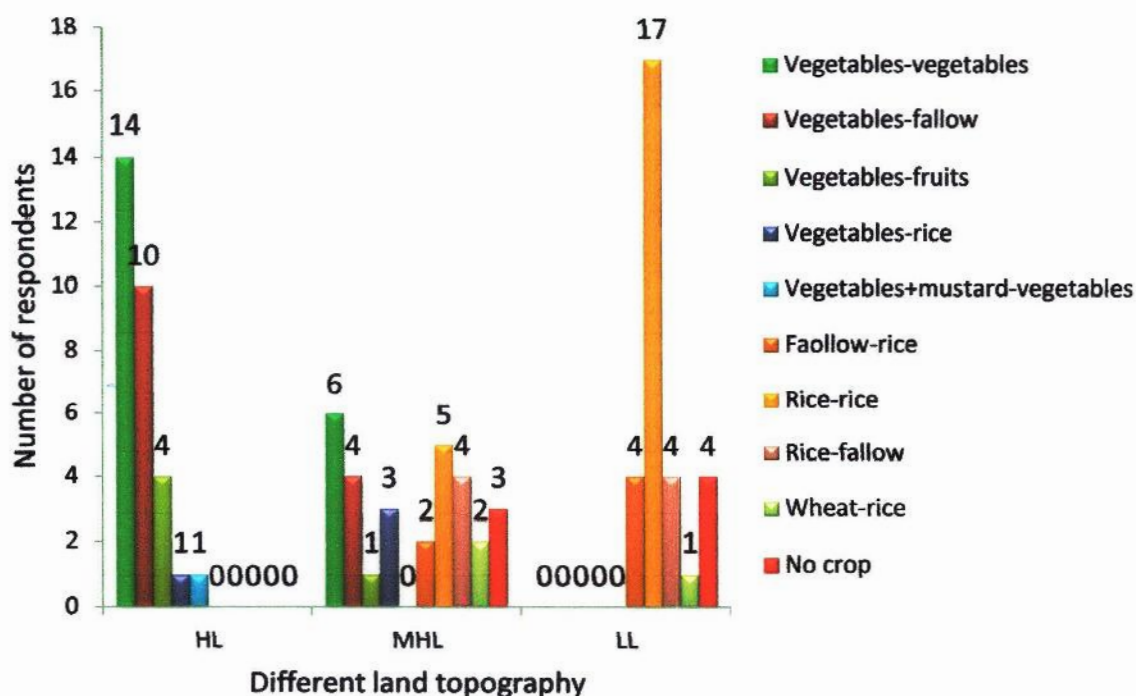


HL = High land, MHL = Medium high land, LL = Low land

Figure 4.25 Vegetables cropping pattern of non-shrimp farming area in 2000

In the study area of non-shrimp farming, during the study period vegetables–vegetables cropping pattern was noticed by 14 respondents in high land and 6 respondents in medium high land. Vegetables-fallow was practiced by 10 respondents

in high land and 4 respondents in medium high land. Vegetables-fruits was noticed by 4 respondents in high land and 1 respondent in medium high land. Vegetables-rice pattern was practiced by 3 respondents in medium high land and 1 respondent in high land. Fallow-rice was practiced by 2 respondents in medium high land and 4 respondents in low land. Rice-rice cropping pattern was noticed to be 17 respondents in low land and 5 respondents in medium high land. 4 respondents was followed rice-fallow cropping pattern both in medium high land and low land. Wheat-rice was practiced by 2 respondents in medium high land and 1 respondent in low land. 4 respondents in low land and 3 respondents in medium high land followed no cropping pattern i.e. did not cultivate crops (Figure 4.26).



HL = High land, MHL = Medium high land, LL = Low land

Figure 4.26 Present vegetables cropping pattern of non-shrimp farming area

The results as described above clearly indicate that there was a great change but gradual in cropping patterns. From 50 years ago it was found in the study area as well as in the whole Bangladesh (Haque, 1998) that most of the cropping pattern was consisted of price based cereal crop. Gradual change in

dominance in the cropping pattern took places from 50 years ago when the most dominant pattern was fallow-aman as well as fallow- aus+aman in high land and medium high land, in 30 years ago the most dominant pattern was aman in all types of land and fallow- joli aus in all types except high land.

4.4.2 Causes of changing vegetables cropping pattern

In the study area, it was clearly found that there is a great variation in cropping patterns as described above. As there were variations in cropping patterns there prevail some causes of changing these cropping patterns. The changes were related mainly to environmental factors and man-made factors. The perceptions of the respondents as observed about these causes have been described below.

The respondents' perceptions were tested on the basis of analysis of selected 9 causes, which are detailed out in the methodology chapter. In this session the respondents' perception are analyzed for interpretation and understanding chronologically. Firstly, the distribution of the respondents was done based on different study area against each of the 9 statements.

It is very difficult to determine the perception of an individual regarding anything because perception varies from individual to individual. Same thing could be perceived differently/different ways by different individual. However, the respondents were asked to express their perception by indicating agreement against each of the selected 9 statement related to the causes of changing cropping patterns and based on the opinions.

Increase of demand of vegetable production

We know Bangladesh is an over populated country. So food shortages and malnutrition have become general problems in the country. Vegetables are considered as an indispensable part of our daily diet, yet it contributes a very little portion of our total food intake because of short supply and health unawareness. The problem of existing acute malnutrition and food shortages might be overcome by producing more vegetables to a significant extent which will ultimately lead to build a healthy nation.

Increase of vegetables yield per unit area

Due to introduction of prawn farming, an opportunity had been created to cultivate vegetables into a fraction of unit area. Most of the respondents were agreed with this phenomenon and they encouraged of cultivating vegetables more. As a result, the cropping pattern has been changed.

Availability of high yielding variety of vegetables

Advance technology has improved various kinds of high yielding varieties as well as resistant varieties. Due to introduction of such high yielding and resistant varieties, the cropping pattern has been changed significantly.

Land leased out for shrimp cultivation

Many of the farmers leased out their lands to others for shrimp/prawn cultivation for riskless return from the land. Lands are leased out extensively in the area where *gher* farming is practiced. As a result, the leased owner practice only shrimp/prawn for high return rather followed other cropping patterns.

Establishment of orchard

For fulfillment of the domestic demand and market demand due to higher price a lot of agricultural land has been converted into orchard. Fruit trees are also planted on the bank of *gher*. This phenomenon prompted in changing cropping patterns in the study areas.

Increase of salinity

Due to inundation of the sea water the salinity level of soil increases as well as the cropping pattern has been changed. Cropping has also been changed due to introduction of salinity resistant varieties.

Demand of land for non-agricultural process

The activities in commerce, industry, transport have risen with increase in population and changes in the socio-economic conditions of the people these increase has led to raise in demand of land for construction of residential houses, shops, establishments of roads etc (Mahesh, 1999). Since almost the entire available land in the study area was already under some economic uses. The land required for non-agricultural activities have to be taken from cultivable areas.

Introduction of prawn/shrimp farming

One of the most important factors found to change vegetable cropping pattern was introduction of prawn /shrimp farming as a high return enterprise in the study area as well as in the whole southwestern region of Bangladesh. Marine and freshwater shrimp and prawn farming is an age-old practice in many countries of Asia. Though Bangladesh discovered this as an economic activity during early 70's, even a decade ago, higher earnings than the principal crops (e.g. rice, jute and wheat), shrimp ponds were instructed in the coastal belt of greater Khulna region. History of shrimp cultivation is very old in the coastal areas of Bangladesh. Farmers used to cultivate

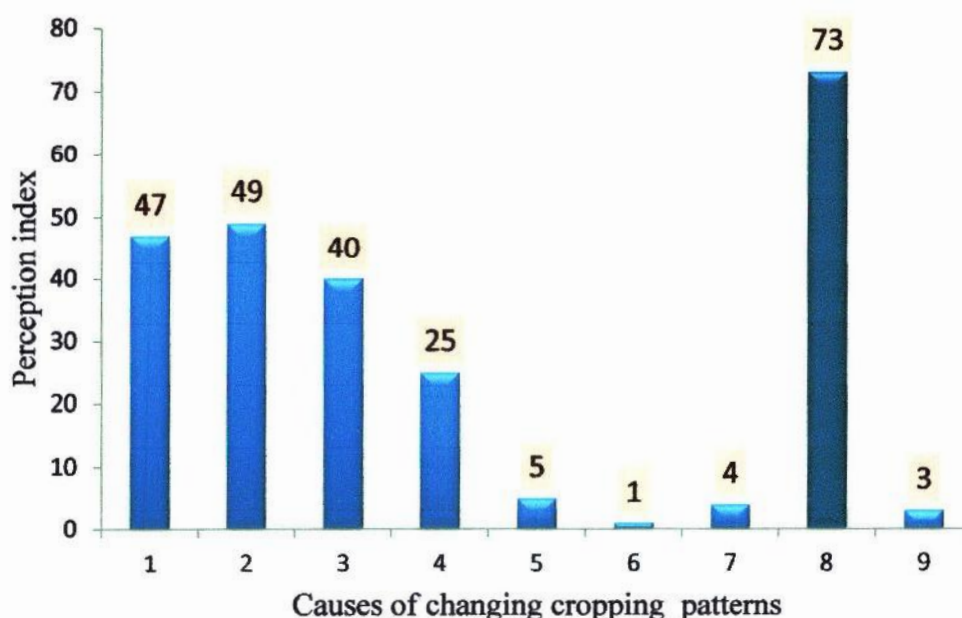
shrimp in small scale for a long time especially in Khulna region. With the rise in international demand and high price, brackish water shrimp in the Coastal areas has become popular. Currently, brackish water shrimp is not practiced only in Khulna region in the southwest but also in the Cox's Bazar area (Nuruzzaman, 1993).

Natural calamities

Some natural calamities such as frequent cyclones viz. '*sidar*', '*aila*' in the study area of non-shrimp farming in 2009 damaged the current cropping pattern. The frequency of natural calamity like flood, drought, water logging, and inundation of saline water are occurring due to climate change. It is causing the damage of sensitive embankments of rivers. Thus hampering of crop field and eventually the living places with a surge has become a common phenomenon in the coastal area.

Perception index

Perception index (PI) of all causes of positive changing vegetable cropping pattern was calculated where it was highest in case of introduction of prawn farming (PI 73) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of prawn farming was introduction of prawn farming. On the other hand, increase of the demand of vegetable production, increase of vegetables yield in a unit area and availability of high yielding variety of vegetables were the moderate cause of changing vegetable cropping pattern and establishment of orchard, increase of salinity, demand of land for non-agricultural process and natural calamities were the less cause of negative changing of vegetable cropping pattern (Figure 4.27)



Note: 1 = Increase the demand of vegetable production, 2 = Increase of vegetables yield per unit area, 3 = Availability of high yielding variety of vegetables, 4 = Land leased out for shrimp cultivation, 5 = Establishment of orchard, 6 = Increase of salinity, 7 = Demand of land for non agricultural process, 8 = Introduction of prawn/shrimp farming and 9 = Natural calamities

Figure 4.27 Perception index of causes of changing vegetables cropping patterns at prawn farming area

Perception index (PI) of all causes of changing vegetable cropping pattern was calculated where it was increased due to demand of vegetable production (PI 36), increase of vegetables yield per unit area (PI 40) and availability of high yielding variety of vegetables (PI 34) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of non- prawn farming was increase of the demand of vegetable production, increase of vegetables yield per unit area and availability of high yielding variety of vegetables. On the other hand, introduction of prawn farming, establishment of orchard, increase of salinity, demand of land for non-agricultural process and natural calamities were the less cause of changing vegetable cropping pattern in the study area of non-prawn farming (Figure 4.28).

lack of protection, lack of loan facilities, high production cost, scarcity of quality fertilizer were some of the less severe problems. The score of problem confrontation ranged from 3-40 with a mean of 19.23 and having standard deviation of 6.86. Majority (60%) of the respondents confronted low problem. Only 8.3% of the respondents confronted high problem while 31.7% of the respondents confronted medium problem.

Among the 11 selected characteristics of the respondents, only two characteristics such as, cosmopolitaness and knowledge of vegetable cultivation showed a negative but significant relationship. The negative trend of relationships implies that the lower is the cosmopolitaness and knowledge of vegetable cultivation of the respondents the higher is the problem confrontation in vegetable cultivation.

Present situation of vegetable cultivation

The total cultivable land in shrimp farming area ranged from 0.06 -4.10 ha with mean and standard deviation of 1.03 ha and 0.94, respectively while it was 0.04-2.27, 0.53 ha and 0.47 for the same in case of non-shrimp farming area. Majority (60%) of the respondents in shrimp farming area had moderately large to large amount of cultivable land while more than three-fourths of the respondents (76.6%) in non-shrimp farming area had small to moderate amount of cultivable land. But most of the respondents of prawn farming area (76.7%) and non-prawn farming area (90%) possessed small to moderate amount of cultivable land. The total suitable land for vegetable cultivation in non-prawn farming area ranged from 0.04 -0.81 ha with mean and standard deviation of 0.24 ha and 0.19, respectively while it was 0.02-1.54, 0.22 ha and 0.37 for the same in case of shrimp farming area. About three-fourths of the respondents (73.3%) in prawn farming area had small to moderate amount of suitable land while in case of non-shrimp farming area that was 60%. But more than fifty percent of the respondents of non-prawn farming area (56.67%) possessed moderate to moderately large and shrimp farming area (53.3%) possessed moderately large to large amount of suitable land for vegetable cultivation. The land under vegetable cultivation in non-prawn farming area ranged from 0.04 -0.40 ha with mean and standard deviation of 0.18 ha and 0.11, respectively while it was 0.02-0.86, 0.16 ha and 0.15 for the same in case of shrimp farming area. Most of the respondents of prawn farming area (86.6%), non-shrimp farming area (80.0%), shrimp farming area

(63.3%) and non-prawn farming area (66.3%) possessed small to moderate amount of land under vegetable cultivate.

It was revealed that 93.33% respondents used urea in both prawn farming area and non-prawn farming area while 90% respondents used urea in both shrimp farming area and non-shrimp farming area. 80% respondents used gypsum in both shrimp farming area and non-shrimp farming area while that was only 60% respondents in prawn farming area and 53.33% respondents in non-prawn farming area. It was revealed that most of the respondents (86.67%-93.33%) were practiced weeding and irrigation in all types of study area. A good percentage of respondents (40.00%-73.33%) followed earthing up, thinning and staking in their field. Among the 30 respondents, highest proportion (23, 20, 11, 10 and 6) of the respondents cited that their plants were affected by viral diseases, leaf spot of cabbage & cauliflower, powdery mildew of cucurbits, early blight of potato & tomato and little leaf of brinjal, respectively in non-shrimp area while (15, 12, 11, 10 and 7) respondents cited that their plants were affected by mosaic of okra & tomato, late blight of potato & tomato, anthracnose of bean & cucurbits, early blight of potato & tomato and wilt of potato & tomato, respectively in the shrimp farming area. Among the 30 respondents, highest proportion (18, 18, and 14) of the respondents cited that their plants were infested by potato tuber moth, cutworm of potato fruits and shoot borer of brinjal and okra in non-shrimp farming area while (14, 11 and 11) of the respondents cited that their plants were infested by leaf cutting caterpillar, fruit and shoot borer of brinjal and okra and red mite in non-shrimp farming area.

Highest proportion (15, 18, 15 and 12) of the respondents grew brinjal, bottle gourd, papaya and plantain in prawn farming area while red amaranth (12) and chili (12) were cultivated by the highest proportion of the respondents in non-prawn farming area. In case of shrimp farming area both bottle gourd (10), papaya (8) and plantain (8) were cultivated by the highest proportion of the respondents while brinjal (13), red amaranth (8) and chili (8) were cultivated by the highest proportion of the respondents in the non-shrimp farming area. A number of 17 vegetables were grown in winter to a different extent by the respondents of the prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area. Bean was cultivated by highest proportion (24 out of 30) respondents in the prawn farming area while cauliflower (22 out of 30), bean (14 out of 30), cauliflower (15) and potato (15) were

cultivated by the highest proportion of the respondents in non-prawn farming area, shrimp farming area and non-shrimp farming area, respectively. A number of 20 vegetables were grown in summer to a different extent by the respondents of the prawn farming area, non-prawn farming area, shrimp farming area and non-shrimp farming area. The highest proportion (15, 16, 16, 18, 15, 14 and 12) of the respondents grew brinjal, Indian spinach, ladies finger, bottle gourd, papaya, bitter gourd and plantain, respectively in prawn farming area while red amaranth (12) and chilli (12) were cultivated by the highest proportion of the respondents in non-prawn farming area. In case of shrimp farming area Indian spinach (12), brinjal (11) and bottle gourd (10) were cultivated by the highest proportion of the respondents while both brinjal and Indian spinach (13) red amaranth (8) and chilli (8) were cultivated by the highest proportion of the respondents in the non-shrimp farming area.

The average yields were higher in case of prawn farming area and non-prawn farming area than shrimp farming area and non-shrimp farming area. Most of the respondent farmers use various kinds of HYV / Hybrid varieties presently as vegetable cultivation in all types of the study area while most of them used local variety about 30 years ago.

Causes of change in choosing vegetables for cultivation

In the study area of prawn farming among the 30 respondents, 8 respondents didn't cultivate vegetable before prawn farming. In this area, in case of choosing vegetables 20 respondents out of 30 were agreed with the statement of introduction of prawn farming, 16 respondents were agreed with the 3 statements, availability of new varieties, high demand of vegetables and good market price.

In the study area of non-prawn farming most of the farmers cultivate vegetable on the basis of commercial purpose since many years mainly in high land and some of medium high land. In case of choosing vegetables 28 respondents out of 30 were agreed with the statement of high demand of vegetables, 27 respondents out of 30 were agreed with the statement of good market price, 26 respondents out of 30 were agreed with the statement of availability of new varieties. 16 respondents were agreed with the statement of the change of food habit

In the study area of shrimp farming, salinity problem plays a negative role in case of vegetable production. Most of the farmer cultivates vegetable in high land and some in *gher'sail*, whereas salinity level is very low. In case of choosing vegetables 25 respondents out of 30 were agreed with the statement of increase of salinity. In case of choosing vegetables 28 respondents out of 30 were agreed with the statement of high demand of vegetables, 27 respondents out of 30 were agreed with the statement of good market price, 26 respondents out of 30 were agreed with the statement of availability of new varieties.

In this study area of non-shrimp, mostly vegetable production was done in high land and some in medium high land. In case of choosing vegetables 27 respondents out of 30 were agreed with the statement of increase of salinity, 26 respondents out of 30 were agreed with the statement of natural calamities. High demand of vegetables was cited by 22 respondents as the causes of selected vegetables. Good market price and availability of new varieties were cited by 20 respondents as the causes of selected vegetables. 18 respondents were agreed with the statement of lack of essential irrigation water.

Identification of vegetables cropping pattern in different years

In the study area of prawn farming in 1980 a total of 6 cropping patterns were practiced. At that time, it was found that single cropped cropping pattern (fallow-aman) was practised in all type of land topography. At that time, among all the respondents (30), fallow-aus+aman was noticed to practised by 12 respondents in high land and 10 respondents in medium high land. Fallow-joliauswas noticed by 10 respondents in low land and 8 respondents in medium high land. Fallow-aman was cited by 10, 5 and 2 respondents in low land, medium high land and high land, respectively. In 1990s, most of the prawn farming of the study area remained under water around the year and then a dramatically decrease the changing cropping pattern as observed from the study area. As a result only a total of 6 cropping pattern were practised in 1990s. At that time, 30 respondents in low land, 26 respondents in medium high land and 6 respondents in high land were not practiced any crops due to submergence.

About 20 years ago prawn farming was started in most of the study area and after that time a dramatic increase in the change in cropping pattern as mentioned by the respondents in the study area. After starting prawn farming a total of 14 cropping patterns were practiced. Among the 30 respondents in this study area, 8 respondents were not practicing vegetable cultivation before prawn farming. Vegetables-vegetables cropping pattern was noticed by 18 respondents in *gher's ail* and 9 respondents in high land. Rice-fish pattern was followed by 22 respondents in medium high land. In the study area of non-prawn farming at 1980 a total of 6 cropping patterns were practiced. At that time, among all the respondents (30), fallow-joliaus was practiced by 14 respondents in low land and 8 respondents in medium high. Fallow-aus+aman was noticed to be practiced by 10 respondents in high land and 8 respondents in medium high land. Fallow-aman was noticed by 10 and 7 respondents in low land and medium high land. In 2000s, in the study area of non-prawn farming, vegetables-vegetables was practiced by 12 respondents in high land and 6 respondents in medium in high. Vegetables-fallow was noticed to be practiced by 8 respondents in high land and 4 respondents in medium high land. Rice-rice was practiced by 14 respondents in low land and 5 respondents in medium high land.

In the study area of non-prawn farming had a great significant role of vegetable cultivation and production. At present, vegetables-vegetables cropping pattern was practiced by 16 respondents in high land 8 respondents in medium high land. Vegetables-fallow was noticed to be practiced by 8 respondents in high land and 5 respondents in medium high land. Rice-rice was practiced by 8 respondents in low land and 5 respondents in medium high land. In the study area of shrimp farming in 1980 a total of 9 cropping patterns were practiced. At that time, among all the respondents, fallow-aus+aman was noticed to be practiced by 12 respondents in high land and 10 respondents in medium high land. Fallow-joliaus was noticed to be practiced by 8 respondents in low land and 10 respondents in medium high land out of 30 respondents. Fallow-aman was cited by 10 respondents in low land and 5 respondents in medium high land. In the study area of shrimp farming in 2000s, vegetables-vegetables cropping pattern was practiced by 8 respondents in high land and 4 respondents in *gher's ail*. Vegetables-fallow was practiced by 4 respondents in high land and 2 respondents in *gher's ail*. Vegetables-fruits was practiced by 1 respondent. Fallow-fish was practiced by 16 respondents in medium high land. Fish-

fish was practiced by 8 respondents in medium high land. Fallow-fallow was noticed to be 23 respondents in *gher's ail* and 15 respondents in high land. In the study area shrimp farming during the study period a total of 10 cropping pattern was found. At that time, vegetables-vegetables was practiced by 12 respondents in high land and 6 respondents in *gher's ail*. Vegetables-fallow was practiced 6 respondents in high land and 2 respondents in *gher's ail*. Vegetables+fruits-fruits was followed by 4 respondents in high land. Fish-fish was practiced by 6 respondents in medium high land. Fallow-fallow was noticed to be 21 respondents in *gher's ail* and 2 respondents in medium high land and high land

In the study area of non-shrimp farming in 1980 a total of 8 cropping patterns were practiced. At that time, among all the respondents, fallow-aus+aman was noticed to be practised by 10 respondents in high land and 8 respondents in medium high land out of 30 respondents. Fallow-joliaus was noticed by 12 respondents in low land and 6 respondents in medium high land. Fallow-aman was cited by 8 respondents in low land, 3 respondents in medium high land and 2 respondents in high land. In the study area of non-shrimp farming in 2000s, vegetables-vegetables cropping pattern was noticed by 15 respondents in high land and 7 respondents in medium high land. Vegetables-fallow was practiced by 8 respondents in high land and 4 respondents in medium high land. Vegetables-fruits was noticed by 3 respondents in high land and 2 respondent in medium high land. Vegetables-rice pattern was practiced by 4 respondents in medium high land and 6 respondents in high land. Rice-rice cropping pattern was noticed to be 15 respondents in low land and 6 respondents in medium high land. Rice-fallow cropping pattern was followed by 2 respondents in medium high land and 7 respondents in low land. In the study area of non-shrimp farming, during the study period (vegetables-vegetables) cropping pattern was noticed by 14 respondents in high land and 6 respondents in medium high land. Vegetables-fallow was practiced by 10 respondents in high land and 4 respondents in medium high land. Vegetables-fruits was noticed by 4 respondents in high land and 1 respondent in medium high land. Rice-rice cropping pattern was noticed to be 17 respondents in low land and 5 respondents in medium high land.

Causes of changing vegetables cropping pattern

In the study area prawn farming, perception index (PI) of all causes of changing vegetable cropping pattern was calculated where it was highest in case of introduction of prawn farming (PI 73) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of prawn farming was introduction of prawn farming. On the other hand, increase of the demand of vegetable production, increase of vegetables yield in a unit area and increase of high yielding variety of vegetables were the moderate cause of changing vegetable cropping pattern and establishment of orchard, increase of salinity, demand of land for non-agricultural process and natural calamities were the less cause of changing vegetable cropping pattern. Perception index (PI) of all causes of changing vegetable cropping pattern was calculated where it was increase of the demand of vegetable production (PI 36), increase of vegetables yield in a unit area (PI 40) and increase of high yielding variety of vegetables (PI 34) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of non- prawn farming was increase of the demand of vegetable production, increase of vegetables yield in a unit area and increase of high yielding variety of vegetables. Perception index (PI) of all causes of changing vegetable cropping pattern was calculated where it was highest in case of increase of salinity (PI 60) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of shrimp farming was increase of salinity. On the other hand, increase of the demand of vegetable production, increase of vegetables yield in a unit area and increase of high yielding variety of vegetables were the moderate cause of changing vegetable cropping pattern. Perception index (PI) of all causes of changing vegetable cropping pattern was calculated where it was highest in case of natural calamities (PI 70) i.e. the respondents perceived as the main cause of changing vegetable cropping pattern in the study area of non-shrimp farming was natural calamities. On the other hand, increase of salinity, increase of the demand of vegetable production, increase of vegetables yield in a unit area and increase of high yielding variety of vegetables were the moderate cause of changing vegetable cropping pattern

Conclusion

Based on result and its logical interpretation the following conclusion may be drawn:

Data were collected from 120 respondents, randomly selected from 4 types of areas. Majority of the respondents were middle aged had secondary level of educational qualification, small sized family, high experience in agriculture, high experience in vegetable cultivation, medium annual income, low organizational participation, low cosmopolitaness, low extension media contact, moderate total cultivable land, small suitable land for vegetable cultivation, small land under vegetable cultivation, no training, and medium knowledge.

A number of problems were identified in vegetable cultivation faced by the farmers in the study area. Among the 19 confronted problems unavailability of good quality seed, salinity, diseases and insect infestation were some of the major problems. Result indicates that majority of the respondents (60%) fell in low problem confrontation category.

Among the 11 selected characteristics of the respondents only cosmopolitaness and knowledge of vegetable cultivation showed a negative significant relationship.

In case of shrimp farming area, total cultivable land area is higher than non-shrimp farming area, prawn farming and non-prawn farming but the average amount of suitable land for vegetable cultivation and land under vegetable cultivation in non-prawn farming area is higher than that of shrimp farming area, non-shrimp farming area and prawn farming area.

In case of non-shrimp farming area and shrimp farming area, diseases and insect infestation is higher than prawn farming area and non-prawn farming area.

The average yields were higher in case of prawn farming area and non-prawn farming area than shrimp farming area and non-shrimp farming area.

Among the selected 10 causes of changing of choosing vegetables, the most important cause was introduction of prawn farming for prawn farming area, increase of high demand of vegetables for non-prawn farming area, increase of salinity for shrimp farming area and non-shrimp farming area.

There was a trend to increase in the total number of cropping patterns from 1980s to present and showed a distinct figure of changing vegetables cropping patterns at different years.

Among the selected 9 causes of changing vegetables cropping patterns, the most important was introduction of prawn farming for prawn farming area, increase of vegetables yield in a unit area for non-prawn farming area, increase of salinity for shrimp farming area and natural calamities for non-shrimp farming area.

Recommendations

Recommendations based on the results and conclusion of the study has been presented below in two subsequent sections.

Recommendation for policy implication

An overwhelming majority of the farmers were found facing problem in vegetable cultivation. In this case both the DAE and Non-Governmental Organizations should take proper plan and programme to overcome the problems.

Findings the study indicate that the farmers faced highest constraints in unavailability of good quality seed. Lack of good quality seed hampered production of vegetable. The availability of good quality seed could be increased by adequate supply of good quality seed by agricultural agencies in vegetable growing areas.

Salinity was the most important constraints to the vegetable growers. For the remedy of this problem the supply of saline resistant variety should be increased. To increase vegetable production in such area various kinds of experiment and research should be increased by Government and NGOs.

Farmers faced problems in disease and insect infestation. Insect and disease causes massive damage of vegetable production. The availability of sprayers could be increased by arranging credit to farmers to purchase sprayers more over NGOs and DAE should provide training on IPM.

Farmers faced serious problem in extension work. The DAE and other non-government organizations should strengthen their extension service to the farmers to overcome their problems.

Establishment of storage and food processing industries at the vegetable growing area during peak period is of utmost necessity. Government should encourage private entrepreneurs in this direction.

Lack of training in vegetable cultivation was also a problem for vegetable growers for solving this problem DAE or Non-Government agencies should provide training for vegetable grower.

Natural calamities were an important problem for vegetable cultivation. Authority could solve partially this problem by giving early forecast.

Recommendation for further study

The present study can't provides all information for proper understanding of the farmer's problems in vegetables cultivation. Hence the following suggestions might helpful for further research.

In compare with wideness of study area, the respondent number was low. So by increasing huge respondent numbersimilar study may be undertaken.

The present study was conducted in three selective Upazila of Khulna district. Similar attempts may be undertaken in other parts of the country to document the vegetable cultivation and to investigate their cultivation and relevant aspects in the light of agricultural production. Findings of this study need verification by similar research in other parts of the country.

In addition to the constraints in vegetable cultivation, the farmers also face other constraints such as social, economic, housing, sanitation, health, nutrition and domestic etc. All these constraints affect the performance of the farmers. There is requirement for undertaking research on the various problems faced by the farmers which affect their performance.

Physiological, soil and environmental researches should be conducted to study the causes of changing of vegetables cropping pattern.

CHAPTER VI

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APPENDIX-I
AGROTECHNOLOGY DISCIPLINE
KHULNA UNIVERSITY
KHULNA-9208, BANGLADESH

INTERVIEW SCHEDULE

**SITUATION OF VEGETABLE CULTIVATION IN THE KHULNA REGION OF
BANGLADESH DUE TO CLIMATE CHANGE AND SHRIMP FARMING**

Farmer Id:

Please provide information regarding the following aspects

1. Name of the farmer :

Father's Name :

2. Address : Village : PostOffice :

Union : Upazilla :

District :

3. Age : Years

4. Profession :

5. Educational Qualification :

Please mention your educational qualification

(a) Can't read and write.

(b) Can sign name only

(c) Class passed.

6. Family size (number):

Please mention your family member

Sl. No.	Name of the family member	Age	Relation	Educational qualification

7. Experience in farming.

a) Involved in Agriculture years.

b) Involved in vegetables Cultivation years.

8. Annual income.

Please state your annual income according to following structure.

SL. No.	Source of income	Corresponding value (Taka)
1.	Agriculture (Fieldcrops, Vegetables, Fruit, Spices, etc.)	
2.	Domestic animal	
3.	Foreign currency	
4.	Fish	
5.	Business	
6.	Others	
	Total	

9. Extension media contact:

Please indicate the extent your contact with the following extension media

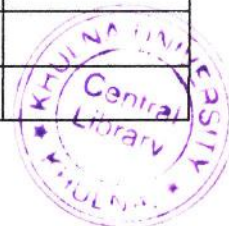
SL. No.	Extension media / programme name	Contact measure			
		Frequently	Occasionally	Rarely	Not at all
1.	Agricultural Extension Officer				
2.	Fisheries Officer				
3.	Other extension Officer				
4.	Sub assistant agricultural Officer				
5.	NGO worker				
6.	Business man (fertilizer)				
7.	Group discussion				
8.	Participation in Result Demonstration				
9.	Field day				
10.	Listening radio programme on agriculture				

11.	Watching TV programme on agriculture				
12.	Printed materials bulletin, leaflets, newspaper etc.				
13.	Poster, advertisement on agriculture in newspaper.				

10. Organization Participation.

Please indicate your nature of participation in different organizations.

Sl. No.	Name of the organization	Not related at all	Nature of the participation		
			General member	Executive member	President/ secretary
1	Agricultural Co-operative society				
2	NGO Society				
3	School Committee				
4	Madrasha Committee				
5	Mosque/Temples Committee				
6	Bazar Committee				
7	Sports cultural				



11. Cosmopolitaness.

State the frequency of your own visit outside of your own locality.

Sl. No.	Place of visit	Extent of visit			
		Frequently	occasionally	Rarely	Not at all
1	Friends and relatives house				
2	Other village				
3	Own union				
4	Other union				
5	Own UpazilaSadar				

6	Other upazilasadar				
7	Own District sadar				
8	Other District Sadar				
9	CapitalCity				
10	Out of country				

12. (a) Your total cultivable land hectare

(b) Landsuitable for vegetablescultivable hectare.

(c) Land undervegetablescultivation hectare.

13. Training exposure

Have you got any training on vegetables cultivation? "Yes" or "No". If your answer is "Yes", please give the following information

SL. No	Title of training	Duration (days)	Year	Venue of training	Training institute
1					
2					
3					

14. Fertilizer application

Give information about fertilizer application onvegetables

SL. No	Name of the fertilizer	Yes	No	Kg or g Per decimal	Time of application
1	Cow dung/FYM/Compost				
2	Urea				
3	TSP				
4	MoP				
5	Zypsum				
6	ZnSo ₄				
7	Other				

15. Intercultural operation

Please provide information on intercultural operation done in vegetablesfield

SL. No	Name of Operation	How many times	When	Applying time
1	Weeding			
2	Irrigation			
3	Earthing up			
4	Thinning			
5	Mulching			
6	Staking			
7	Staging			
8	Other			

16.Disease infestation

What kinds of diseases attackedin your vegetablesfield?

SL. No	Name of the disease	Symptom	Control measures		
			When	By what means	Dose per decimal

17. Insect infestation

What kinds of insect attacked on your vegetable?

SL. No	Name of the insect	Symptoms	Control measures taken		
			When	By what means	Dose per decimal

18. Applying insecticides

SL. No	Name of the insecticide	Control measures			
		When	Dose	Interval	Application of Insecticides before harvesting (days)

19. Knowledge on vegetables cultivation

Please answer the following question

Sl. No.	Questions	Total marks	Obtained marks
1	Mention name of two vegetables which grow quickly and less expensive	2	
2	Mention two HYV of brinjal	2	
3	Mention two year round vegetables?	2	
4	Which are more profitable? Cereals or vegetables?	2	
5	Mention two varieties of cauliflower.	2	
6	Mention two harmful insects of brinjal.	2	
7	How many days before harvesting pesticide should not be applied	2	
8	What is the lag period of vegetable cultivation?	2	
9	What is the main cause of low production of vegetables?	2	
10	What are the favorable conditions for insect attack in vegetables?	2	
11	What conditions are favorable for disease attack?	2	
12	What is IPM?	2	
13	Cite two problems of vegetables at storage condition?	2	
14	Indicate the marketing problems?	2	
15	Mention daily requirement of vegetables?	2	
	Total	30	

20. Give the name of different vegetables under cultivation at present.

SL. No	Name of the vegetables	Varieties of vegetables	Used land (Decimal)	Production (kg/decimal)	Yield (t/d)	Having at home(kg)	Sale (kg)	Market Rate (Taka)	Total Income/Decimal (Taka)

21. Problem Confrontation in vegetable cultivation

Please indicate the extent of problem you confronted in vegetable cultivation

SL. No	Problems	Extent of severity of problems			
		Very severe 3	Severe 2	Negligible 1	Not at all 0
1	Traditional land cultivation				
2	Unavailability of good quality seed				
3	Poor germination				
4	Poor productivity				
5	Scarcity of quality fertilizer				
6	Diseases and insect infestation				
7	Lack of good quality irrigation water				
8	Salinity				
9	Lack of loan facilities				
10	High production cost				
11	Transportation				
12	Lack of preservation/ storage facilities				
13	Lack of knowledge on processing				
14	Low market price in season				
15	Interference of middlemen in the marketing system				
16	Lack of extension program				
17	Food habit				
18	Natural calamities				
19	Lack of protection				

22. When have you been start Prawn/shrimp farming?

23. What vegetables did you cultivate before Prawn/shrimp farming?

SL. No.	Name of the vegetables	Varieties of vegetables	Used land (Decimal)	Production (kg/decimal)

24. Causes changing of choosing vegetables in case of vegetable cultivation

- ☐ Increase of salinity ☐ Introduction of prawn /shrimp farming ☐ Less rainfall
☐ Drought ☐ Lack of essential irrigation water ☐ Natural calamities
☐ Change of food habit ☐ Availability of new variety ☐ High demand of vegetables
☐ Good market price ☐ Others

25. Vegetables cropping pattern in 1980

Land topography	Cropping pattern in different seasons					
	Winter			Summer		
	PA	SA	NPA/NSA	PA	SA	NPA/NSA
High land						
Medium High land						
Low land						

26. Vegetables cropping pattern in 1990

Land topography	Cropping pattern in different seasons					
	Winter			Summer		
	PA	SA	NPA/NSA	PA	SA	NPA/NSA
High land						
Medium High land						
Low land						

27. Vegetables cropping pattern in 2000

Land topography	Cropping pattern in different seasons					
	Winter			Summer		
	PA	SA	NPA/NSA	PA	SA	NPA/NSA
High land						
Medium High land						
Low land/ <i>Gher's ail</i>						

28. Vegetables cropping pattern in 2013

Land topography	Cropping pattern in different seasons					
	Winter			Summer		
	PA	SA	NPA/NSA	PA	SA	NPA/NSA
High land						
Medium High land						
Low land/ <i>Gher's ail</i>						

29. Do you think there is change in vegetables cropping patterns in different time?

Yes ☐

No ☐

30. If yes, the causes of changing cropping patterns that you think are

SL. No	Causes	Extent of severity of problems			
		Very severe 3	Severe 2	Negligible 1	Not at all 0
1	Increase the demand of vegetable production				
2	Increase of vegetables yield in a unit area				
3	Increase of high yielding variety of vegetables				
4	Land leased out for shrimp cultivation				
5	For starting orchard				
6	Increase of salinity				
7	Demand of land for non agricultural process				
8	Introduction of prawn/shrimp farming				
9	Natural calamities				

31. Are you benefited due to change of cropping patterns?

Yes ☐

No ☐

(Thank you for your kind cooperation)

Date & Signature of the Enumerator

APPENDIX-II

Table 1.1 Area And Production Of Winter Vegetable By Crops, 2006-07 to 2010-2011.

(Area in acres and production in metric tons)

Name of Crops	2006-07		2007-08		2008-09		2009-2010		2010-2011	
	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
Rabi Brinjal	71205	222110	72514	215282	70376	213789	71047	216182	70750	215490
Cauli flower	38805	145208	39137	158483	39933	153228	41211	160040	40901	168238
Cabbage	37760	182685	40094	211097	40791	205627	41182	219958	39015	206851
Water gourd	31810	117120	33021	125949	34176	131716	34446	134359	35278	137301
Rabi Pumpkin	30715	103840	32259	107214	32833	116014	34908	124534	33847	122747
Tomato	47960	136835	48538	143058	50470	150720	58854	190213	61213	232459
Radish	62565	235815	68058	267048	65480	257371	66954	259743	65384	256711
Beans	38175	82980	38519	82872	40213	88385	40992	88581	42760	94756
Palong Sak	18375	38205	19258	44030	19809	42898	20215	45251	19959	43193
Lalsak	22760	37415	24733	41189	24350	41583	24877	44329	25118	42810
Carrot	2745	9855	2850	10430	3109	11380	3496	14075	3423	15021
Laushak	13660	20445	13954	22403	13715	22549	13959	22816	13830	23026
Other winter vegetables	19395	33095	18823	33806	18892	33159	19310	35190	18936	35078
Total :	433790	1363706	451758	1460961	454047	1468418	471451	1555271	470414	1583581

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Table 1.2 Area and Production of Kharif (Summer) Vegetables, 2006-07 to 2010-2011.

(Area in acres and production in metric tons)

Name of Crops	2006-07		2007-08		2008-09		2009-2010		2010-2011	
	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
Pumpkin	23670	77595	26081	82520	27505	92519	27424	92900	27602	95420
Brinjal	44015	110910	45417	122739	44737	123778	44377	125080	44268	124384
Patat	23510	58415	24048	70367	24558	72473	24749	78084	24655	83246
Lady's finger	23180	38715	24171	38508	24969	40452	25204	42366	25570	43212
Jhinga	20985	36595	22340	40995	22780	41610	23039	44084	23583	45942
Karola	19835	34445	21240	39648	21688	40127	22143	41419	22793	45097
Atum	48840	156725	52566	179866	56539	209048	58736	224546	59402	238545
Chakumra	16240	44380	19355	52660	21077	57308	22527	62673	23418	64898
Cucumber	16750	32480	17830	36740	17881	43902	18935	55152	19030	48448
Barbell	13820	18580	14139	19844	14468	21348	1488	21178	15347	22259
Pulsak	19105	52195	21276	55339	21937	63001	22604	66705	23255	66994
Chichinga	13475	24430	14485	216834	15193	28211	15741	30339	16245	31426
Danta	22450	58715	24833	75115	25100	65177	25463	65887	25845	67358
Over Kharif Veges	-	-	17755	39040	18551	34777	17766	32142	20997	37327
Kakrol	9140	17415	10600	22121	10820	22892	11215	24564	11202	14141
Dundal	8375	15430	8361	14807	8124	14842	8318	15250	8389	15290
Kachuraji	15980	35870	16528	36004	16610	36890	17008	38502	16750	38461
Salta	149	18250	112	17389	98	19014	19014	23025	18014	23025
Katcha Papaya	425	153284	1599	168928	4952	192948	192949	204221	192949	204221
Green Banana	32590	321585	33917	301065	30319	218840	27818	156965	25258	158365
Total	372334	1314824	4178248	1639885	427716	1448068	428917	1445182	445552	1468158

BBS, 2011. Statistical Yearbook of Bangladesh