

## CHAPTER – I

### INTRODUCTION

#### 1.1 Background of the Study

Nepal is a land locked mountainous country, which is situated between two big countries India and China. Its shape is rectangular bordered by China in the North and India in the East, West and South with open boarder and its total geographical area is 1, 47,181 square kilometer and average length east to west is 885 kilometer and breath north to south is 193 kilometer which accounts as 0.03 percent land of the world and 0.3 percent land of the Asia. The location of Nepal lies between  $26^{\circ} 22'$  to  $30^{\circ} 27'$  north latitude and  $80^{\circ} 4'$  to  $88^{\circ} 12'$  east longitude. Nepal is divided into three ecological regions: mountain, hill and terai. The terai region is known as “bread basket” of Nepal. It covers 17 percent of the total area, hilly regions covers 68 percent and terai mountain region covers 15 percent out of total land. Nepal is divided in to 5 development regions, 14 zones, 75 districts, 58 municipalities and 3,915 VDCs. The total population of Nepal is estimated to 2.64 million in 2010. [Source: Central Beauro of Statistics (CBS), 2011].

Nepal is one of the least developed countries in the world. It is an agricultural country where the agriculture sector absorbs more than 76 percent of the total labour force of the country. Most of the people who are engaged in agriculture have low income because of the law of diminishing return to scale on land, using the traditional method of cultivation. It has provided that agricultural sector is most important for economic development. Whatever model of development is being experimental in Nepal, the stark reality is that Nepal is being poor and more under development than other countries in South Asia.

Nepal is predominantly an agricultural country where more than 81 percent of their populations are engaged in agriculture. Agriculture is the “Backbone of Nepalese economy” due to contribution to the Gross Domestic Products (GDP). Being the backbone of the economy, this sector has still direct impact of favorable and adverse monsoon situation. The role of this sector has been the source of food and raw material for export and industries. In Nepal, monsoon wind normally enters from the eastern part during the second week of June and then spreads throughout the kingdom within a few days. Monsoon wind causes maximum rainfall during mid – June to mid – August. The intensity of monsoon generally becomes weak with low rainfall after the third week of September.

If we concern about the increase in agricultural productivity, we must think about the use of modern technology fertilizer, pesticides, improved equipment and seeds, credit facilities but co- operated with irrigation facilities. Mostly by using those necessities, improvement in the food demand but also supports the most important agriculture based industries of Nepal. Besides other factors, the cultivable land not supplied with adequate irrigation facilities, can produce crops in summer and monsoon season only. In winter season, due to the lack of rainfall, crop production is less.

The basic objectives of irrigation are to supplement the natural supply of water to land so as to obtain an optimum crop yield system is developed. It involves planning designing, construction, operation and maintenance of various irrigation structures required to bring water from the watershed to the irrigation field. There are sufficient irrigation facilities and many farmers depend on the rain – fed system and the monsoon rain. Hence, irrigation is necessary tool to achieve sustainable agriculture development. It plays vital role to change traditional

agriculture practices either land reform pattern, which affect the soil and economic factors of the society.

Agriculture production in Nepal largely depends upon the monsoon. Nepalese agriculture is of subsistence type. Due to the rapid population growth during the past few decades, fragmentation of land and population pressure on land has increased. Therefore, balance between forest and arable land has now been irreversibly disturbed. Environmentally unsustainable and economically unfavorable marginal lands have also been brought in cultivation resulting in rapid deforestation and erosion of the loamy soil but decreasing and cropping intensity has remained stagnant. Therefore, agricultural modernization is necessary to accelerate economic development of the country.

As in the previous years, development projects related to irrigation have been executed at the government level, and by the Agriculture Development Bank Ltd. (ADBL). In FY 2008/09, irrigation facility managed by the government reached 25,549 hectare of area under irrigation extended through the ADBL reached 301 hectare. In the first eight months of FY 2009/10, additional 3, 092 hectare of land have been brought under irrigation through ADBL projects, with total land brought under irrigation by 13,119 hectares. [Source: Economy Survey]

Nepal has not been able to establish many industries. So, it has become essential to emphasize on the irrigation development for the increased agricultural production from the limited land with the use of surface water and ground water resources available in the country.

Before the project there was a traditional Kulo which irrigated only few part of the command area and some households were benefited from that Kulo. That

Kulo irrigates the field only in summer season in winter season field remain follow. Usually, that Kulo used to break down by flood and it was difficult for maintenance only one cropping system was in practice.

The present study is conducted to explore the changes brought by Baruwa Khola Irrigation Project and its utilization in the project area of Udayapur District. Emphasis has been given to the immediate impacts rather than the long run social change in this study. This study will not only help to find out the actual direction of the impact and it's magnitude but also guide both the government personal and the farmers in correcting their respective course of action in the future.

## **1.2 Statement of the Problem**

Nepal is one of the least development countries of the world where about 82 percent of the total population is still lives in the rural area and their main occupation is agriculture (CBS, 2011). Agriculture plays a very significant role for the growth of Nepalese economy. But agriculture is facing so many problems in production and cultivation. In this sector, major problem arises from population growth and slow growth in agricultural production.

Irrigation means merely to give an additional amount of water to the paddy – fields after the monsoon has stopped. This technique is principally justified since additional water is most important for a good paddy harvest. So, it is called “hathia” period of rice growing season,

Nepal has about 6000 rivers and the total length of them is about 4500 km. About 100 rivers are more than 160 km. and 1000 rivers are 11 km. long. About 1700 million cubic water flows per year in these rivers (Panday, 1987). In this sense, Nepal is a country of river – locked island. These rivers are drawing in every

year but as the lack of instrument, technical expertise, finance etc. have not been utilized and flowing water wasteful. Therefore, irrigation development is the subject of the study in the context of water utilization for increase food grain production to feed rapidly increasing population.

Nepal is a developing country, majority of population reside in the rural area and they involved in agricultural occupation for their livelihood. Most of the people of Nepal are engaged in agricultural activities. But the agricultural production and productivity is not satisfactory which is only subsistence level and not going sustainable way but in another reside the population growth is going in upward direction which causes the living standard of the agrarian population toward the bottom. Agricultural food production on the one hand depends upon the mercy of the weather and on the other hand because of mountainous topography of Nepal. It has limited land for cultivation. Agricultural sector is the backbone of Nepalese economy and lifeline of the farmers but majority of population still depends on monsoon. Bad weather at it immediately causes adverse impact on agricultural production income, employment and purchasing power affects the development of non - agricultural sector. For increasing agricultural production and reduction of poverty through creation of rural employment opportunities, as perceived by the agriculture perspective program, requires extension of irrigation services even to marginal farms. This demands promoting of the conjunctive use of ground water and surface water irrigation system along with the initiation of new and non-conventional irrigation systems such as rain water harvesting, pond, paddle pumps and others irrigation system (Irrigation Policy 2060 B.S.).

Nepal, having an agriculture based economy has the great problem of poverty in all over the country. The majorities of people of our country are living

in rural areas and mostly depend upon the agriculture. But the population is increasing day by day in alarming rate and on the other hand, the productivity of land remains constant. Peasants follow the traditional pattern of agricultural operation, which has led to decline fertility of soil. There is lack of irrigation, fertilizers, agricultural credit, modern technology and improve seeds in agricultural sector. (Samiksha, 2011)

Due to high population growth and slow growth in production the world had been facing dire problem production is the outcomes of different inputs. Nepalese agriculture situation is characterized by low productivity due to the improved seeds unscientific technique and lack of chemical fertilizer as well as other economic problems. In Udayapur District, Triyuga Municipality is also facing many kinds of problems. There are main problem of the study is to find out the case of fluctuation in the production of paddy where most of the farmers use local seeds, depends on the monsoon, traditional attitude of the farmers, lack of capital investment etc which my causes that the productivity of paddy is decreasing in this area.

### **1.3 Objectives of the Study**

The general objectives of this study are to analyze the impact of Baruwa Khola Irrigation Project of Triyuga Municipality, Udayapur District. The specific objectives of this study are as follows:

- (a) to analyze the income and consumption level of the people after the irrigation facility,
- (b) to examine the change of land value after the irrigation facility and
- (c) to find out the socio economic impact of the study area.

## **1.4 Significance of the Study**

Irrigation is one of the important factors for the increased agricultural yield. However, irrigation facility alone can't increase production to the extent usually observed in well managed productive agricultural environment. Selection of crops and varieties, use of fertilizers, proper planting with respects to time, seeding age and density of crops are also among the few components for higher yield. This study would help to determine how much each of these inputs including irrigation has contributed to the final yield. It would also help suggest possible ways for further yield increase in the command area.

The under development nature of Nepalese agriculture is leading to low productivity of land. Due to high population, the demand for land use i.e. increasing for various purposes, by which cultivable land is decreasing. For the increase in agricultural production, irrigation plays a vital role. Considering this, Government has launched various irrigation projects in Nepal with the assistance of the several foreign agencies. These projects are expected to be effective in meeting the farmer's optimum production of crops, but the resulting agricultural is still low unfortunately.

## **1.5 Limitation of the Study**

This study has mainly concerned with one of the Municipality of the Udayapur District. So this study may not represent the problems of the district or country as a whole. This study has concerned only Baruwa Khola irrigation project on paddy production. And it has also observed social condition, economical conditions, and affordability of cost in micro level conducted within a limited time and based on primary data.

In the study area the total household is 237; out of which 174 household are surveyed because only 174 household in ward no.-4 directly benefited by this project. So, this study limits ward no-4 of municipality.

## **1.6 Organization of the Study**

This thesis has been organized into five chapters. The first chapter is the introduction of the study which deals with the background of the study, statement of the problem, objectives of the study, significance of the study, limitation and organization of the study.

The second chapter covers the reviews of literature which deals with the contribution made by Nepalese researcher and foreign researcher.

The third chapter deals with the research methodology. This chapter includes research design, nature and sources of data, study area, the universe and sample area, data collection and technique and data processing and analysis.

The fourth chapter concerned with the analysis and interpretation of survey result. In this section also describe the demographic and socio economic condition of the study area, irrigation status, land value, cropping yield, input and output analysis interpreted.

Similarly, the five chapter presents the overall summary, conclusion and recommendation of the study.



## **CHAPTER - II**

### **REVIEW OF LITERATURE**

Literature review is the most important component of the research from which the researcher gains the other's experiences from previous study. Also, it helps to gain insights on a particular research problems and acknowledging the previous efforts made by the scholars and researchers. It can be a strong bridge between the previous and the present efforts to carry out the fundamental assumptions without which a research work never can be original.

The role of irrigation in agricultural production is well recognized and several irrigation systems have been established all over the world. In the field of irrigation farming on agriculture, most of the research works have been carried out in India, China, England, USA and other Asian and European countries. But in context of Nepal, only few research works have been done. In this chapter, irrigation related various literatures are available. These literatures have been broadly categorized into two types:

- (A) Theoretical Frame work
- (B) Empirical Frame work

#### **(A) Theoretical Frame work**

The Now Encyclopedia (1973),The Egyptians used water from the Nile to irrigate adjacent fields as early as 5,000 B. C. Historical records indicate that early civilization developed along river that supposed irrigation water to the fields. Historical records also so that King Menes (who lived around 3,100 B. C.) had a large masonry dam built to control the Nile River and provided water for irrigation.

FAO (1992) has made one report about mechanization of irrigation as an crop production. The study concluded that agriculture and irrigation have worldwide importance how days, Agriculture and irrigation are the complimentary factors. Especially, the rate of population is increased where food supply and demand are not in balance. This states that irrigation project is generally utilizing the water in certain parts, which helps to increases the crop production. Farmers are benefited by their agricultural production and food supply can be balanced to maintain increasing population. It also emphasized the without proper irrigation facility the cash crops can't grown in high amount and the income of farmers also can't be increased in equal ratio.

World Bank (1996) has studied the agro – economic impact of irrigation in South East Asia. It has revealed only there countries for detailed study. They are Thailand, Myanmar and Vietnam. The information was collected that standard, per capita income others indicators of civilization of people are more satisfactory in the irrigated area than in non – irrigated areas. Farmers also hesitated to invest on fertilizer and other inputs in non – irrigated area and they have not found proper agricultural production. Due to low production of agriculture, Vietnam has faced several problems such as food deficiency, starvation, hunger and malnutrition etc.

UN (1991) has reported the development of irrigation and production area of Nepal. This study concluded that irrigation development was started in the past and continued, mostly in terai then in hilly region proper by topographic constraints. This report emphasized that without proper irrigation facility the production area may not be improved. The farmer knowledge about insecticide and pesticides is also an important factor to develop the agriculture production.

Grist (1975) has reported that irrigation implies not only an adequate and controlled water supply, but also sufficient drainage of excess water whenever desirable. Similarly, Garg (1981) defines irrigation as the science of artificial application of water to the land, in accordance with the crop requirements through the crop period for full fledged nourishment of the crops. Thus, we can sum up that any artificial device to supply of water to the cultivated land is irrigation. Therefore, irrigation is mainly a device to supply the necessary amount of water required to the plants of cultivated land.

Jha (1994) evaluated the Tribeni Canal in India. The productivity of irrigated land was compared with that of non- irrigated land. He concluded that one of the important effects of irrigation was different types of crop pattern has been found in irrigated area than that of the non – irrigated area. His survey result revealed that irrigated area to a great extent grew paddy and less sugarcane.

Pandey (1978) has studied about the impact of irrigation on rural water development to distinguish between irrigated and non – irrigated area. In order to meet the objectives he collected primary information through the field survey by using questionnaire. He states that small size land holding families are higher in the irrigated area rather than non – irrigated area. In the irrigated area, different varieties of crops are cultivated where employment, literacy and income are higher than that of non – irrigated area. The use of fertilizer is going to increase where as the use of traditional manure has been declining. There is a great variation in the use of fertilizer due to several factors such as high price, lack of knowledge etc. It shows that the chemical fertilizers have not been used in large quantity, although crop production is higher due to the availability of irrigation facility.

Kumar (1997) has made a study on the topic “Economics of Water Management” in the Orissa’s Sambalpur district of India and summarized that the application of manure and fertilizers, the project measures was higher. The higher yield per acreage of both high yielding varieties and local varieties of paddy was found in the village with field channels in both kharif and rabi seasons. This in turn resulted in high gross return higher than that from business and family labour income and net income in the improved village.

Kannaiyan (1995) has described that there are two types of paddy, early paddy and main seasonal paddy. Early paddy matures in between 100-200 days. This usually is harvested in June – July. Early paddy is transplanted mainly in irrigated land. The second main seasonal paddy is planted after the break of monsoon in June – July and transplanted in July – August and harvested in October – November.

According to Pant and Jain (1979) in their book “Agriculture Development in Nepal” bad distribution of land ownership, sub – division holding and lack of efficient rental cultivators in making greater efforts for increasing agricultural production. The rise in agricultural production is directly affected by the use of various inputs and irrigation facilities. According to them, to achieve the rapid growth in agricultural sector, not only modern agricultural technique should be made available to farmers but the necessary pre condition for their wider adoption i.e. infrastructure has also to be developed simultaneously.

## **(B) Empirical Frame work/ National Context**

In the context of Nepal, Mallick (1981) has asserted that the history of irrigation at least in Kathmandu Valley is as old as its adjacent land (Gangatic Valley and Pamir). Mallick adds that rice was cultivated since 2800 BC, which mentioned in 'Veda' was written in 1500 BC, which proves that Nepal has a long history of irrigation practices.

Our recorded history shows that in Lichhivi era, there was a good deal of provision for agriculture. Feudal lord Amshuverma, Jishnu Gupta etc had contributed a lot to improve agriculture. They had made a number of Rajkulos (indigenous traditional canals) to irrigate the arable land (CDC, 1976)

Poudel (1985) in the process of food grain farming water is one of the most essential elements for a plant. Food cannot be produced without land and fresh water. Increased output depends on more intensive and effective use of the land and water. In this respect, water can be made available to the farming through different ways, natural and artificial water is normally supplied to the plants by nature through the agency of rain or precipitation which includes natural supply of water and artificial supply of water in a cultivated land. This process is known as irrigation.

Shrestha (1988) Kathmandu valley and its periphery were irrigated during Malla dynastry. By the middle of the 12<sup>th</sup> century, king Shivdev had built a dam at Balkhu Khola near Kirtipur for irrigation. Several other Rajkulos were constructed during Malla regime. Naikes were appointed for regulation, governing, maintenance and operation of Rajkulos.

Pagni (1986) has studied the impact of Chitwan Irrigation Project on agricultural production with reference to Narayanpur VDC. He has used random sampling technique and primary data, which was collected through sample survey. Both quantitative and qualitative methods were used for analysis. He has concluded that, in the study area before Chitwan Irrigation Project was developed paddy cultivation depended upon monsoon rainfall and covered only 25 percent of total land irrigation. After project was developed paddy cultivated area was increased to 55 percent of the total land. The paddy yield has also been raised to 19 quintal per bigha.

Dahal (1991) has studied to know the impact of Rampur Irrigation Project such as an cropping pattern, cropping intensity and crop yield in Chitwan district. He has used that random sampling technique to collect data and concluded that there is significant change before and after irrigation on crop pattern. In the study area before irrigation project about 62 percent of the cultivated area districts. All these conditions have changed after the availability of irrigation facility people were able to produce more crops in two seasons. Their annual income and social status have highly developed due to the increase of agricultural production.

Dhakal (1990) has studied the Socio- economic Impact of Kamala Irrigation Barmajhiya VDC in Dhanusha district. He has used primary sources to fulfill his objectives. He has concluded that people of Barmajhiya village are not satisfied by was irrigated mostly in monsoon season. The cropping intensity was high and most of the cultivated land was covered by Mono- culture cropping pattern, crop yield was low and also the cropping pattern was of self sufficient type. After the availability of irrigation facility 82 percent of the cultivated land had been irrigated.

APROSC (1987) has studied the impact on Sunsari – Morang Irrigation Project on crop production using primary and secondary data sources. APROSC has concluded that after the availability of irrigation facility, multiple crop patterns in the study areas have increased. Further, cropping intensity and productivity also increased but labour use intensity has not been increased at the same rate. Finally, the study also notes that the gross income from crop production has been increased by 80 percent of baseline study.

APROSC (1978) has made study on the topic of manusmara Irrigation Project and concluded that productivity increased by 79 percent and cropping intensity increased only by 21 percent relatively higher magnitude in the case of medium farmer due to irrigation facility.

APROSC (1978) has made another study of Gajuri Irrigation Project and explained that the cropping intensity in the irrigated khet land was 16 percent higher than in the non- irrigated khet land. It has also mentioned that increase in productivity of paddy crop exceeds the target by 0.04 muri/ropani but that of wheat crop is below target by 0.55 muri/ropani.

APROSC (1979) has made an evaluation study of Mahakali Irrigation Project and mentioned that productivity of paddy and wheat in irrigated is higher than in non – irrigated land. Also mentioned, farmers pay more attention to irrigated land, which has higher productivity than non – irrigated ones and per family income has found to be higher in that area and also both farm and family expenditure remained higher in project area.

Upreti(1989) has also made a similar study on the topic of impact study of Kankai Irrigation Project on Paddy Production. He has summarized in his report

that the rate of paddy production has increased with the increase of irrigation facility and that irrigation bring the higher intensity in the cropping pattern. He has concluded that there is positive relationship between irrigation and paddy production.

Karki (1997) has also made a study on the topic of the impact study of Hemaja Irrigation Project in Kaski district. He was summarized in his report that due to the irrigation facility crop production, cropping pattern, and socio – economic condition of farmer in command area, have increased. But due to the lack of sufficient irrigation the paddy and vegetables in most monsoon periods, farmers remain deprived to get optimum benefit from their land and labor.

Dhakal (2000) has estimated a paddy production function in Singiya VDC of Sunsari District. His conclusion is that chemical fertilizer is positive but insignificant. Its elasticity is Negative which means there is an increase relationship between chemical fertilizer and output due to the improper use of chemical fertilizer.

Acharya (2000) has studied the impact of Chapakot Tar Irrigation Project on Paddy Production in Ratanpur VDC, Syangja. He concluded that land productivity increased significantly due to irrigation facility. He also found out that productivity is affected by water distribution land ownership (own or rented), family size and farming community.

Khanal (2000) has studied the impact of Rainstar Irrigation Project on Paddy Production in chakratirtha VDC, Lamjung. He has concluded that irrigation facility has helped to increase paddy production and paddy cultivation area. It was also found out that income generation and output of the farmers underwent a rapid



change after the irrigation. Due to the irrigation project, the socio – economic condition of the study area changed for better.

Lamsal (1990) has studied the impact of Handetar Irrigation Project and concludes that after the augmentation of irrigation facilities, the proportion of total irrigated land and its scale of production have been increased. He also pointed out that due to the increased irrigation facilities, the cropping pattern also has been changing and people have adopted intensive agriculture and multiple cropping system.

Bhandari (1996) has studied the Impact of Kandai Irrigation Project on Paddy Production and concluded that the production of paddy has increased with 79 percent, where as the cultivable land has increased 43.5 percent. He also mentioned that the living standard of people in this area has increased after the construction of irrigation project.

Baidya (1965) has described that the irrigation is an important factor which was started in ancient time and has been continued till now. He also stated that there has been positive relationship between irrigation and crop production. And scientific irrigation can't be developed without the skill manpower, modern technology, modern equipment and capital.

Khatri (2001) has described the process of utilization of this water involves the construction of engineering works of applicable magnitude, it would be called artificial irrigation and we can sum up that supply of water to the cultivated land through the use of any artificial devices is called irrigation. Therefore, irrigation is mainly a device to supply the necessary amount of water required to the plants of cultivated land.

## **CHAPTER – III**

### **RESEARCH METHODOLOGY**

This chapter describes the method adopted in the present study. It includes the research design, nature and source of data, study area, the universe and sample, technique of data collection, data processing and analysis of the study.

#### **3.1 Research Design**

An analytical as well as descriptive research design had been used in this study. Analytical research design was applied for the measurable factors of the sample households. These include land ownership, land value etc. Descriptive research design was applied for social condition of the sample households. These include population characteristics, family size, cast and ethnic group, female status and social relationship of people.

#### **3.2 Nature and Source of Data**

In order to fulfill the objectives, this study is mainly based on primary and secondary data.

##### **Primary Data**

Primary data has been collected through source or focus group and area by using major procedure of data collection namely questionnaires, interviews and focus group discussion. In this research purpose, primary data is the major method of data collection and whole study is made on the basis of primary data.

## **Secondary Data**

The secondary data has been used where collected various sources like Department of Irrigation Office (DIO) Kathmandu, District Irrigation Office Udayapur, Published and unpublished materials, Publications of Central Bureau of Statistics, World Development Report, Ministry of Agriculture etc.

### **3.3 Study Area**

Baruwa Khola Irrigation Project is one of the small size of irrigation project of Udayapur district, which is constructed by the loan assistant of Irrigation Line of Credit (ILC). It was started in 047/048 B.S. and completed in 2052/053 B. S. ward no-4 of Triyuga Municipality of Udayapur district are the command area of the project. The cultivable command area of this project is 175 hectares. The project area is 3 km. east from the Gaighat, district headquarter of Udayapur district.

### **3.4 The Universe and Sample**

The universe of the study was comprised of all the beneficiary households of Baruwa Khola Irrigation Project. There were 174 households and 950 total populations. The universes were heterogeneous in terms of socio-economic characteristics i. e. ethnic composition, occupation, education, age and sex composition. The universe had been studied ward no. 4 of the command area. It was assumed that a sample of 52 households, out of which 30 percent from the universe would represent the entire universe. The size and composition of the universe and sample is presented in table 3.1 given below.

**Table - 3.1, Size of the universe and the sample**

| Sample Frame | Total households | Sampled households |
|--------------|------------------|--------------------|
| Ward no. 4   | 174              | 52                 |

Source: field survey 2010

A random sampling method was applied to select the sample of 52 households from the sample frame computing of 174 households. These sample frame was separated lists of the entire beneficiary households of this ward were separated then sample were selected by using random sampling method. These lists have been taken as sampling frame of their respective universe. Since the study does not intend to estimate the standard error. A large sample of 52 households has been randomly taken for the study assuming that a large sample is normally distributed and hence the sample statistic will represent the population characteristics.

### **3.5 Data collection and Techniques**

Primary data have been collected by using various tools and technique. The techniques are described below:

#### **Interview Method**

In this method, some information interview has been taken to the chief person of the Sample households and chairman of the project. It was interviewed with the help of interview schedule during household survey.

## **Observation Method**

Observation is a very useful technique for collecting information such as observes the location of the study area. The researcher observed the command area through the field survey to check and supplement the physical condition of the system i. e. intake structure, construction of canal, length of the main canal on command area etc. Settlement patter, road and other infrastructure of the command area had also observed. During the study period researcher has collected information on the basis of field observation in the study area.

## **Questionnaire Method**

The major information of the study area are collected from the head of the household or well informed about family member with the help of the well structured questionnaires. The sample size of the study area was selected about 30 percent or 52 households to collect the primary data.

### **3.6 Data Processing and Analysis**

After completing the households or field survey, the qualitative data was converted into quantitative data. Then quantitative data was compile and classified according to cast/ethnic group, family size, age/sex, occupation, landholders and households of the study area. The next step had done according to manual processing. Manual processing involves several phase field editing, coding and data entry operation in the computer.

## CHAPTER – IV

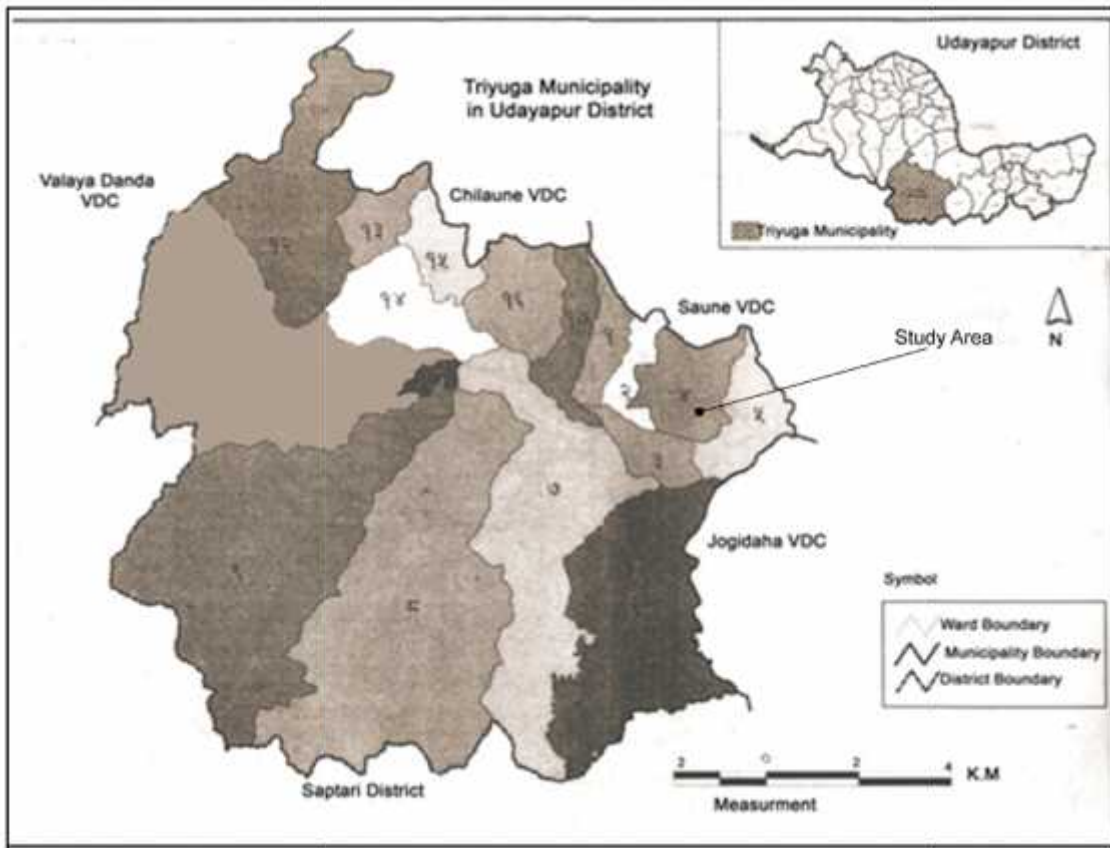
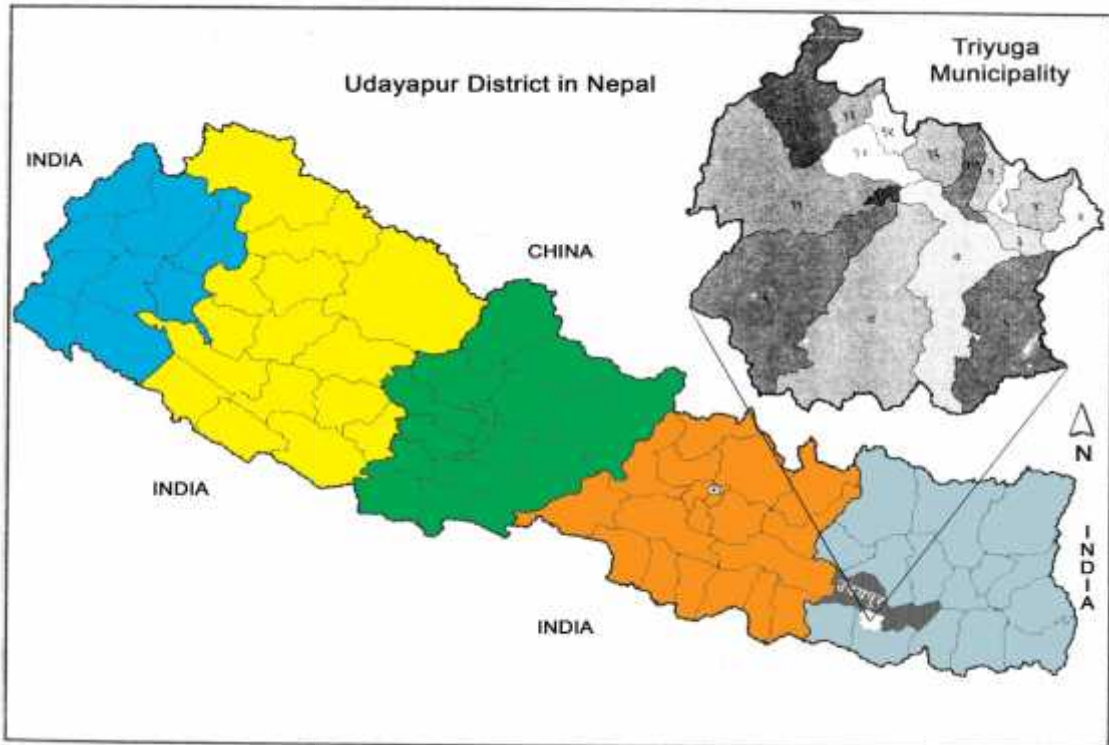
### DATA ANALYSIS AND INTERPRETATION

#### 4.1 Geographical Location

The study area lies in Triyuga Municipality of Udayapur district which is situated in the Sagarmatha Zone of eastern development region of Nepal. The district extends between  $26^{\circ} 39'$  to  $27^{\circ} 1' 10''$  latitude in the north and  $86^{\circ} 0' 9''$  to  $87^{\circ} 1' 0''$  longitude in the east. The total area of Udayapur district is 2063 sq. km. and the size of population is 3, 24,139. According to area, Udayapur district falls under the 2<sup>nd</sup> position on the Sagarmatha zone; 4<sup>th</sup> position on the eastern development region and 27<sup>th</sup> position on the Nepal. This district divided into two ecological regions: hill and terai. Not only it is surrounded by Sunsari, Dhankutta and Bhojpur in the east, Dhanusha and Sindhuli in the west, Okhaldhunga and Khotang in the north and Sirha and Saptari in the south. (Municipality Profile, 2067).

There are three parliamentary constituencies, 44 village development committees and one municipality in this district. On the Triyuga Municipality, there are 10,506 total households and total population are 55,291. The study area is 3 km. east from the Gaighat district headquarter of Udayapur whereas electricity and telephone facilities available. The location of Triyuga municipality is shown in the map of Udayapur district which is given in map number 1.

Map No. - 1



## 4.2 Socio- Economic Condition

### 4.2.1 Cast/Ethnicity Composition of the study area

The cast and ethnicity play important roles for socio-economic development in Nepalese society. Sample household consisted of various ethnic groups as depicted in table 4.2.1 and figure 4.1. The table 4.2.1 and figure 4.1 shows total sample household head in the study area are 52 where as 26.92% (14) HHs belongs to Tharus followed by 36.54% (19) Brahman, 28.84% (15) Hill Chhetri and 3.84% (2) Rai. The number of Terai Chhettri and Shrestha, distributed as 1.92% (1), 1.92% (1) respectively.

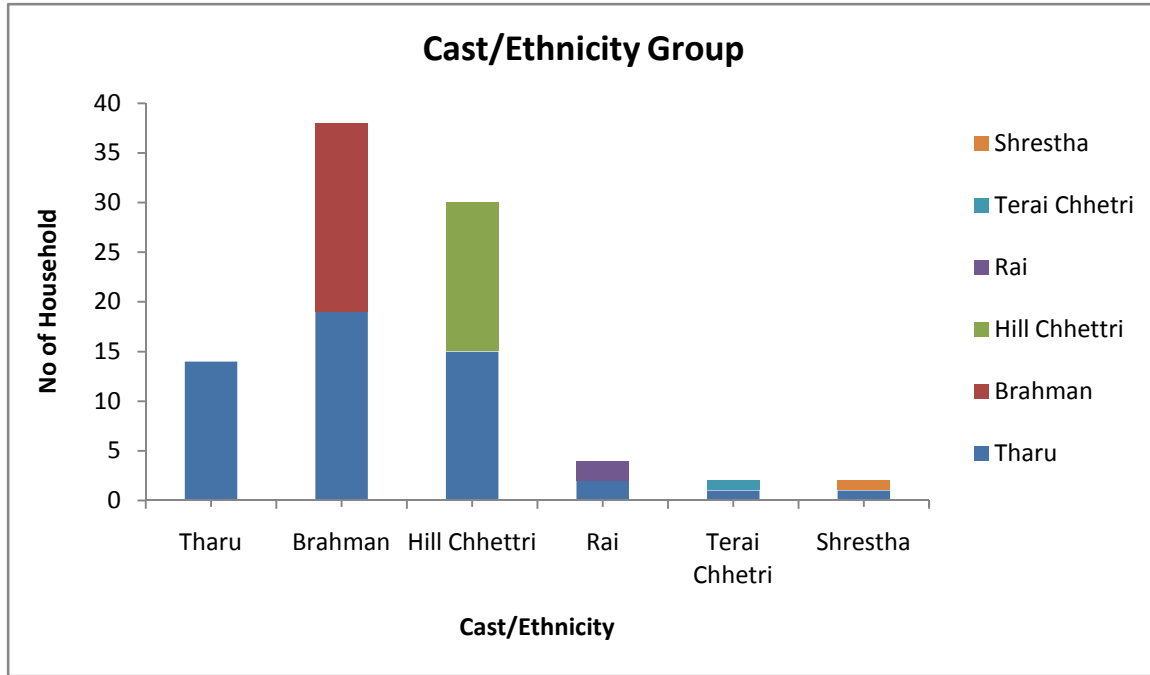
**Table 4.2.1 Distribution of Household by Cast/Ethnicity in the study area**

| S.N.  | Cast/Ethnicity Group | Household | Percent (%) |
|-------|----------------------|-----------|-------------|
| 1     | Tharu                | 14        | 26.92       |
| 2     | Brahman              | 19        | 36.54       |
| 3     | Hill Chhetri         | 15        | 28.84       |
| 4     | Rai                  | 2         | 3.84        |
| 5     | Terai Chhetri        | 1         | 1.92        |
| 6     | Shrestha             | 1         | 1.92        |
| Total |                      | 52        | 100         |

Source: Field Survey, 2010



**Figure No- 4.1**



Source: Based on the table no-4.2.1

The figure no. - 4.2.1 indicate that majority of households are followed by Brahman and Chhettri. Different Cast/Ethnic groups of people settled in the study area. There has been a good relationship among all cast groups in the study area. Lower casts have also been involved in social and development work.

#### **4.2.2 Age and Sex composition**

Sex composition is also an important demographic feature for the planners separate data for male and female are important for various types of planning. The balance of sex affects the social and economic relationship in a community.

On the basis of economic activities, population distribution of sample household has been classified into four age groups. The age and sex composition is given in the table no-4.2.2.

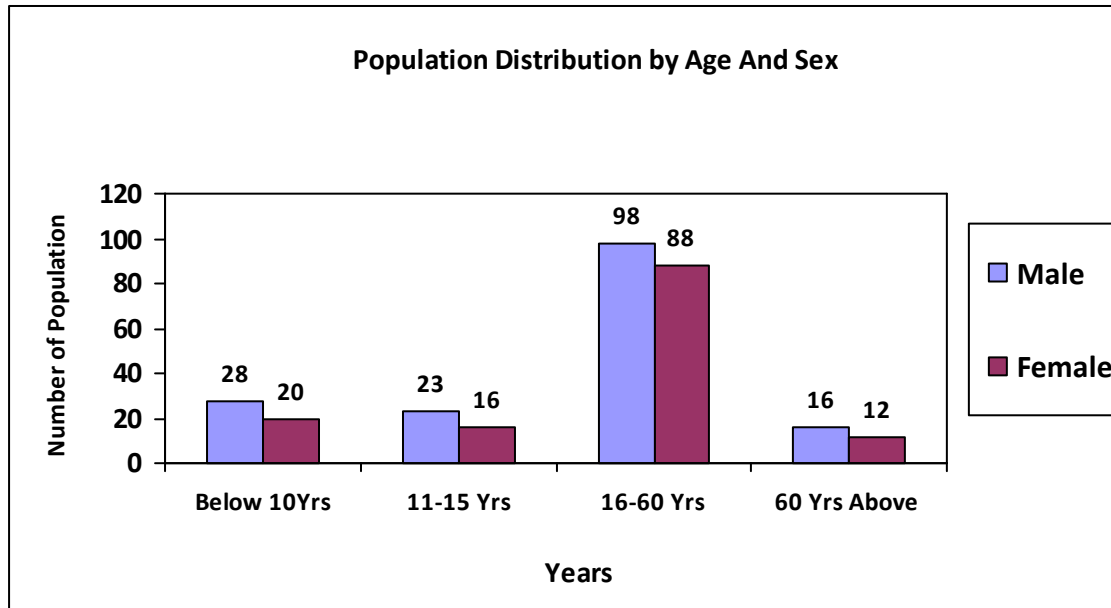
**Table - 4.2.2, Population Distribution by Age and Sex**

| Age groups     | Male   |             | Female |             | Total  |             |
|----------------|--------|-------------|--------|-------------|--------|-------------|
|                | Number | Percent (%) | Number | Percent (%) | Number | Percent (%) |
| Below 10 Years | 28     | 17          | 20     | 15          | 48     | 16          |
| 11-15          | 23     | 14          | 16     | 12          | 39     | 13          |
| 16-60          | 98     | 59          | 88     | 65          | 186    | 62          |
| 60 above       | 16     | 10          | 12     | 8           | 28     | 9           |
| Total          | 165    | 100         | 136    | 100         | 301    | 100         |

Source: Field Survey, 2010

Generally, the age group of economically active manpower is considered to be 16-60 years. Thus, the percentage of economically active population (working Population) is estimated as 62% and the rest 38% are dependent on them. Here 59% males and 65% females are economically active population.

**Figure No-4.2**



Source: Based on the table no. – 4.2.2

The figure 4.2 shows that the people below 15 Years and above 60 Years fall under economically inactive (dependent) population. But in this area, due to rural agro-based economy, they are observed to be involved in various types of household works viz. rearing of cattle and goat, looking after children, fetching water, cooking etc. Among the dependant population 29% are children i.e. below 15 years and 10% old, which are dependent, which indicates the major able condition of the study area in terms of demographic characters. Low percentage viz. 9% of old age group i.e. Above 60 years population denotes the relatively short life expectancy in the study area.

### 4.2.3 Educational Status

Food, shelter, clothing and education are the basic need of the people. So, we must be conscious farmers as well as the school going children. Even primary education is a principal mechanism of fulfilling the minimum learning needs of the people needed for effective participation in the economic, social and civic activities. In this study, we divided the sample population above 6 years in to two groups i. e. literate and illiterate. The literate group was further sub- divided into different classes according to their acquired level of formal education as primary (1-5) classes, secondary (6-10) classes and higher (10+....). Those who can read and write but do not have formal education in school are placed under literate class. The following table 4.2.3 shows the educational status of the study area.

**Table – 4.2.3, Educational Status of Sample Population**

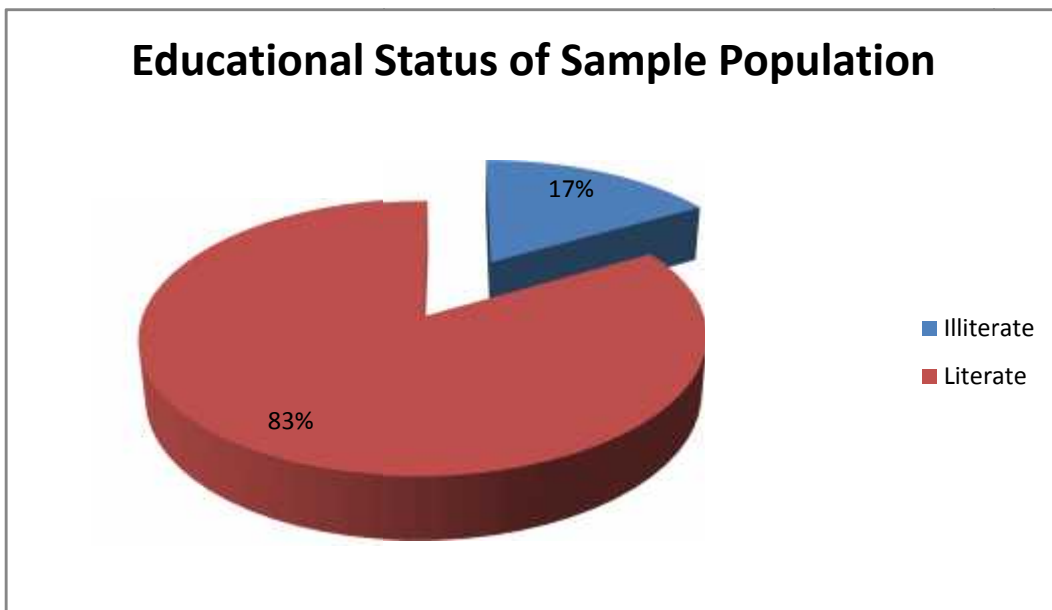
| Level of Education | No. of Persons | Percentage (%) |
|--------------------|----------------|----------------|
| (A) Illiterate     | 50             | 17             |
| (B) Literate       | 251            | 83             |
| Primary            | 102            | 34             |
| Secondary          | 124            | 41             |
| Higher             | 25             | 8              |
| Total (A+B)        | 301            | 100            |

Source: Field Survey, 2010

From the table – 4.2.3, it is observed that the literacy rate in the study area is (83%) higher than that of national average (65%). Only about 17% of total populations are illiterate and rests of them are literate. Out of total literate

population, 41% are studying in primary level, 49% in secondary level and 10% have completed school level education or even more. In the study area 17% people are illiterate and 83% of people are literate. There is one higher secondary school so the literacy rate is higher than that of national average. Out of total school going children around 34% have completed primary school level, 41% have completed secondary level and 8% have higher secondary school level education.

**Figure – 4.3**



Source: Based on the table no. – 4.2.3

From the above pie- chart diagram 4.3, it is shown that the study area has significant literacy rate as compared to other ward of Triyuga Municipality. Again, the chart shows that the secondary school going children are higher in portion as compared to primary and higher secondary level. Higher secondary school going children are very low in the above chart.

#### 4.2.4 Occupation

Agriculture has been the main stream for employment and hence income generating activity. Thus, it can be said that agriculture is a way of life for this ward. On the basis of primary occupation, the dwellers can be divided into six different categories such as agriculture, services, business, student and others. The occupational structure of population based on sampling household is given below.

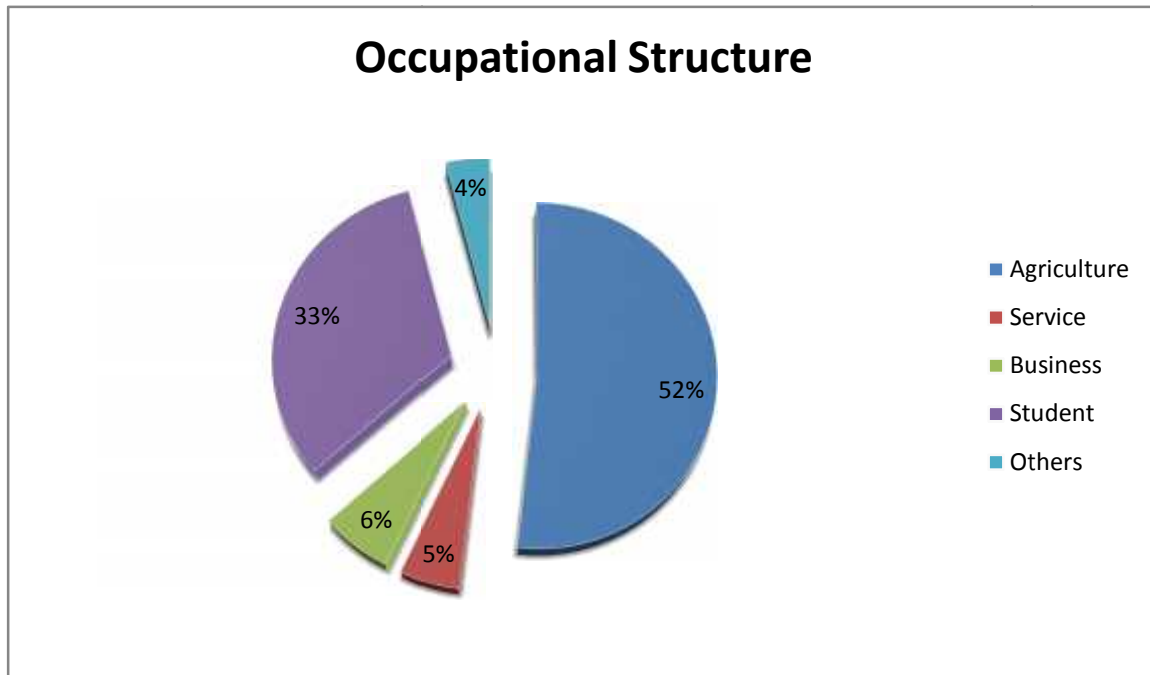
**Table – 4.2.4, Occupational Structure**

| Occupation  | No. of Persons | Percentage (%) |
|-------------|----------------|----------------|
| Agriculture | 156            | 52             |
| Services    | 16             | 5              |
| Business    | 19             | 6              |
| Student     | 98             | 33             |
| Others      | 12             | 4              |
| Total       | 301            | 100            |

Source: Field Survey, 2010

According to the table – 4.2.4, the highest number 52% of population are engaged in agriculture. Student includes the second highest number 33% of population are engaged. Business and service included 6% and 5% respectively engaged. A remarkable number 4% of population are engaged in the other activities that includes tailoring, carpentry, masonry and foreign workers. Among the remaining other economically active people, some are school boys and some are unemployed. The occupational chart would illustrate clear picture of the occupational structure of household in figure – 4.4.

**Figure-4.4**



Source: Based on the table no. – 4.2.4

### **4.3 Size of Land Holding**

Land is the important natural resources for practicing agriculture. It is also the most important factor for rural income and partly for employment generation. The rural investment made by the government is freely available irrespective of the type of farmer. It is natural that the income of the greater land holders is likely to increase at the faster rate than that of small land holder.

The size of land holding of farmers in the study area is unequal land distributed. Small farmers are those who the lands up to 0 - 15 kattha of the sample households, medium farmers are those who own the land up to 16 - 30 kattha and who own the land above 30 kattha those are big farmers. The number of small

holders is expected to be much higher in the terai region. The land holders are categorized according to the size of cultivated land owned.

**Table – 4.3.1, Distribution of Land Holding Size (in kattha)**

| Categories          | Land Holding Size | No. of household | Percentage (%) |
|---------------------|-------------------|------------------|----------------|
| Small land holders  | 0-15 kattha       | 29               | 56             |
| Medium land holders | 16-30 kattha      | 15               | 29             |
| Large land holders  | Above 30 kattha   | 8                | 15             |

Source: Field Survey, 2010

The table – 4.3.1 shows that the number of small land holders are greater 56 percent in the study area and 29 percent are medium land holders and 15 percent are large land holders in the study area.

#### **4.4 Land Value**

Land value is determined by cropping pattern, cropping intensity and productivity of the land mainly depended on the land fertility and irrigation facility. An irrigation facility plays a vital role in increasing the land's productivity as such. Because of the lack of an irrigation facility, the command area has single cropping pattern before the implementation of canal. It's cropping intensity and productivity was also less than the operation of canal. Therefore, the land value of command area was less in the past stage. But the implementation of irrigation project changed the cropping intensity as well as productivity of the land. The land value increased more rapidly every year after the implementation of Baruwa Khola Irrigation Project.



**Table – 4.4.1, Change in the Land Value (in Kattha) Before and After the Project**

| Description            | Before (2053) | After (2067) | Change  |
|------------------------|---------------|--------------|---------|
| Value of Land / Kattha | Rs. 1024.02   | Rs. 10561.18 | 331.34% |

Source: Field Survey, 2010

From the above table 4.4.1, we see that the value of land has also increasing drastically due to the road, electricity, marketing and irrigation facility provided by the project. The average land value per Kattha has increased by 331.34 percent after the irrigation project. It is mainly due to the increase in agricultural production specially paddy which is the crop in that area.

#### **4.5 Changing Pattern of Agriculture Inputs**

In the study area from the settlement period farmers were using traditional agriculture inputs in farming. However, in spite of so called traditional knowledge in farming due to high productivity of land crop production was positive. But not the productive power of land is decreasing day by day. So, now a day's farmers are attracted to grow much food in small area of land. There are using modern seeds, fertilizers, equipment and insecticide in farming.

##### **(A) Seeds**

After the availability of irrigation facility people have increasingly used improved seeds. The table 4.5.1 shows the use of different seeds before and after the BKIP.

**Table – 4.5.1, Use of Seeds in Household (2053-2067)**

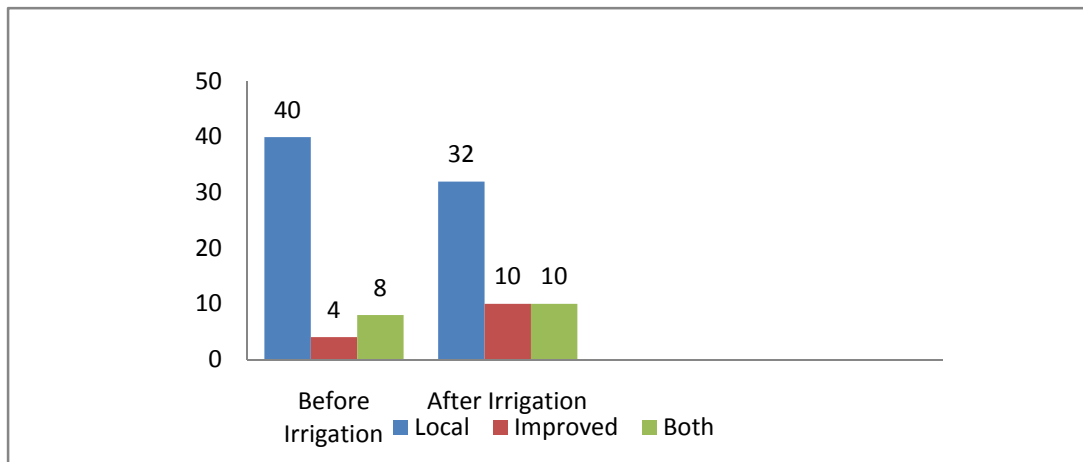
| S.N. | Before Irrigation (2053) | Percent (%) | Types of seeds | After Irrigation (2067) | Percent (%) |
|------|--------------------------|-------------|----------------|-------------------------|-------------|
| 1    | 40                       | 77          | Local          | 32                      | 62          |
| 2    | 4                        | 8           | Improved       | 10                      | 19          |
| 3    | 8                        | 15          | Both           | 10                      | 19          |
|      | 52                       | 100         | Total          | 52                      | 100         |

Source: Field Survey, 2010

Table 4.5.1 shows that, before availability of irrigation, 40 (77%) households have been found to have used local seeds, 4 (8%) households have been found to have used improved seeds and 8 (15%) households have been found to have used both seeds whereas, this table changed to 32 (62%), 10 (19%) and 10 (19%) households respectively after irrigation or now a days.

**Figure – 4.5**

**Use of Seeds**



Source: Based on the table no. – 4.5.1

## (B) Fertilizer

When we talk about agricultural development fertilizer is a most important component. The table 4.5.2 Shows that the type of fertilizers used by the households.

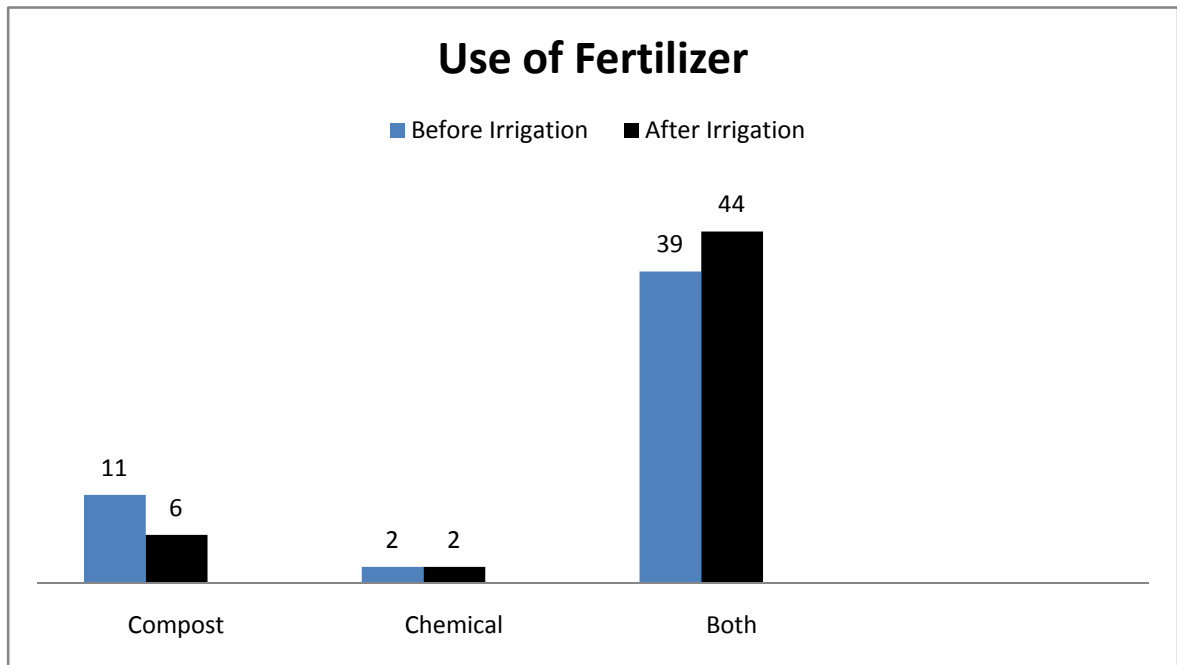
**Table – 4.5.2, Use of fertilizer in Household (2053-2067)**

| S.N.  | Before Irrigation<br>(2053) | Percent<br>(%) | Types of<br>Fertilizer | After Irrigation<br>(2067) | Percent<br>(%) |
|-------|-----------------------------|----------------|------------------------|----------------------------|----------------|
| 1     | 11                          | 21             | Compost                | 6                          | 11             |
| 2     | 2                           | 4              | Chemical               | 2                          | 4              |
| 3     | 39                          | 75             | Both                   | 44                         | 85             |
| Total | 52                          | 100            | Total                  | 52                         | 100            |

Source: Field Survey, 2010

Table 4.5.2 shows that before the availability of irrigation facility, 11 (21%) households have been found to use compost fertilizer whereas table has changed to 6 (11%) households. In the same way 2 (4%) households have been found to use chemical fertilizer and 39 (75%) households have been used both before the availability of irrigation whereas, this table above change of 2(4%) and 44 (85%) after the availability of irrigation facility in the study area.

**Figure – 4.6**



Source: Based on the table no. – 4.5.2

### **(C) Equipment**

Equipment means agricultural inputs which are used on the process of production. The following table 4.5.3 shows the types of equipment used before and after the availability of irrigation. Here, traditional equipment means, traditional spade, plough etc. whereas, modern equipment means ironed plough, modern spade etc.

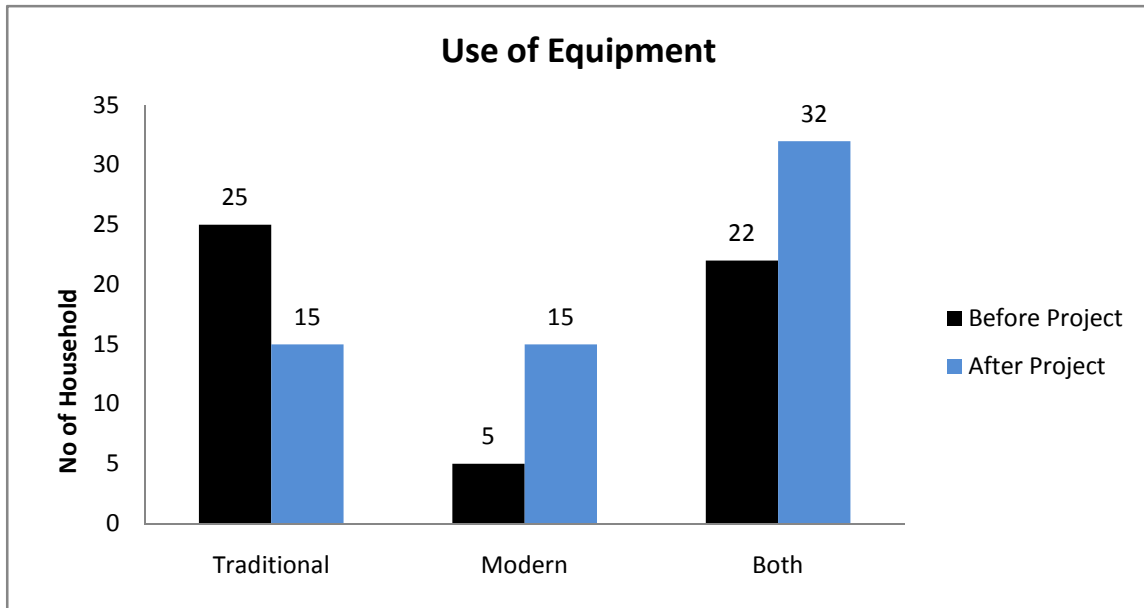
**Table – 4.5.3, Use of Equipment in Household (2053-2067)**

| S.N. | Before Irrigation<br>(2053) | Percent (%) | Types of<br>Equipment | After Irrigation<br>(2067) | Percent (%) |
|------|-----------------------------|-------------|-----------------------|----------------------------|-------------|
| 1    | 25                          | 48          | Traditional           | 5                          | 10          |
| 2    | 5                           | 10          | Modern                | 15                         | 29          |
| 3    | 22                          | 42          | Both                  | 32                         | 61          |
|      | 52                          | 100         | Total                 | 52                         | 100         |

Source: Field Survey, 2010

Table 4.5.3 shows that, before the availability of irrigation facility, 25 (48%) households have been found to have used traditional equipment, 5 (10%) households have used modern equipment and 22 (42%) households have been found to have used both equipments. But after the irrigation facility this table have been changed to 5 (10%), 15 (29%) and 32 (61%) households respectively in the study area.

**Figure – 4.7**



Source: Based on the table no. – 4.5.3

#### **(D) Insecticide**

Most of the farmers use insecticide in the study area where 39 households used them in their paddy and 13 households are not used after the irrigation facility. But, before irrigation facility 32 households are used insecticide and 20 households are not used it. So, from the above data it is concluded that use of insecticide farmers are increased to 7 households and then decreased also. According to the respondents who didn't use insecticide said that it is not necessary in their field.

#### **4.6 Income Status of the Study Area**

Agriculture is the main sources of income in the study area. Most of the people are involved in agriculture occupation and few are involved in others services. The status of people's households clearly shows by below table.

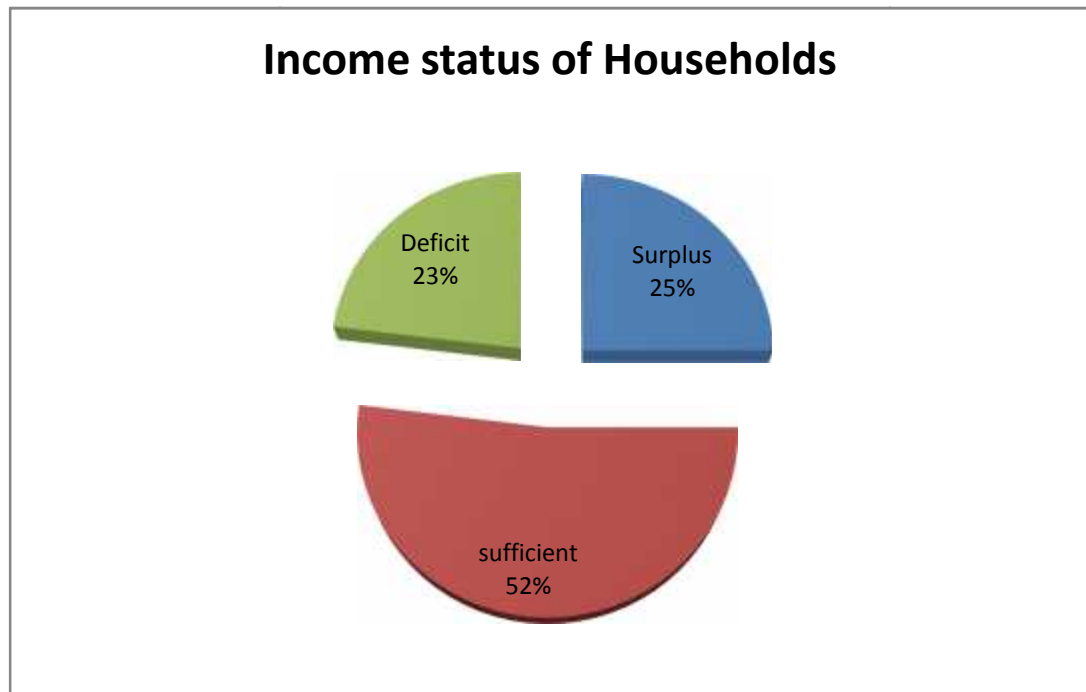
**Table – 4.6.1, Income Status of Households**

| Income Status | Households | Percent (%) |
|---------------|------------|-------------|
| Surplus       | 13         | 25          |
| Sufficient    | 27         | 52          |
| Deficit       | 12         | 23          |
| Total         | 52         | 100         |

Source: Field Survey, 2010

Table no. 4.6.1 shows that the total sample households are 52 out of which 25% (13) HH are able to save money or they have made profit. These households are able to save some money for their future. 52% (27) HHs represent sufficiency condition. Only 23% (12) HHs are in deficit condition. They cannot manage their expenditures with income earned. They obtain loan because their income level does not support to do such things. 23% of households represent deficit in their income/expenditure.

**Figure No. – 4.8**



Source: Based on table no. 4.2.12

Above figure no. 4.8 shows that in total 25% households represent surplus in case 23% households are in deficit condition and 52% households are represent a balance in their income and expenditure.

#### **4.7 Crop Yield Before and After BKIP**

The table no. 4.7.1 shows that the effect of irrigation (BKIP) on different crops and irrigation project has effected mostly on paddy production which has increased by 103.18 Percent. Again it has also affected to increase the production of wheat and maize. But the production of pulse in two different situation shows that the affect of irrigation on pulse production is not significant.



**Table - 4.7.1, Crop Yield Before and After the Irrigation Project**

| Crops      | Before           |               |                   | After            |               |                   | % change |
|------------|------------------|---------------|-------------------|------------------|---------------|-------------------|----------|
|            | Production (Kg.) | Area (Kattha) | Yield (Kg/kattha) | Production (Kg.) | Area (Kattha) | Yield (Kg/kattha) |          |
| Paddy      | 64,960           | 1059.54       | 61.30             | 1,31,970         | 1059.54       | 124.55            | 103.18   |
| Wheat      | 6,605            | 174           | 37.95             | 23,840           | 530           | 44.98             | 18.52    |
| Maize      | 21,153           | 760           | 27.83             | 27,920           | 615           | 45.39             | 63.09    |
| Pulse      | 7,052            | 245           | 28.78             | 12,080           | 385           | 31.37             | 8.99     |
| Vegetables | -                | -             | -                 | 1,815            | 150           | 12.10             | -        |

Source: Field Survey, 2010

Table 4.7.1 also shows that the vegetables which was not produced before and is being produced with irrigation availability.

#### **4.8 Changes in Paddy Production and Income before and after the Irrigation Project**

Water is one of the vital inputs needed for successful plant growth and development. Plant productivity is directly dictated by plant growth and development. Therefore, any factor that restricts plant growth and development will automatically reduce crop productivity and yield. Need of water for plants at various critical stages of development, it can fulfilled from supplementary irrigation.

Before the construction of BKIP, there was not any regular means of irrigation and farming system was depended upon the monsoon. Generally, farmer cannot plant the paddy in certain period without favorable monsoon. Lack of sufficient water, people were unable to transplant paddy in due time. Lack of

sufficient water sometime resulted in conflict between peasants before BKIP was constructed.

**Table – 4.8.1, Change in Income and Paddy Production**

| S.N. | Description                      | Before | After  | (% ) Change |
|------|----------------------------------|--------|--------|-------------|
| 1    | Income/kattha (in Rs.)           | 735.6  | 1494.6 | 103.18      |
| 2    | Paddy Production/kattha (in Kg.) | 61.30  | 124.55 | 103.18      |

Source: Field Survey, 2010

Note: Income has been taken at current market prices.

The table – 4.8.1, shows that the impact of irrigation on paddy production is extremely high. It is seen that after the irrigation project, the production of paddy has increased by more than double. In the same way, the income of the people through paddy has improved. It is clear from the above table that the paddy production and income of people is higher after the irrigation project. Before the irrigation project the studied area was found covered under the water during the monsoon which was unnecessary for paddy. The time when the water was essential the land did not use to get sufficient water due to unreliability of water. Thus, after the irrigation project these shortcomings were removed and hence the production has improved significantly.

## 4.9 Impact of Irrigation on Consumption Expenditure

It is usually said that the farmers generally do not spent money on food – grains as they have their own production to meet their consumption. But here it is found from table - 4.9.1 shows that the food – grains produced by the farmers do not meet their requirements.

**Table – 4.9.1, Impact of Irrigation on Consumption Expenditure**

(in Rs.)

| S. N. | Description  | Before  | After   | % change |
|-------|--|---------|---------|----------|
| 1.    | Food Expenditure   |         |         |          |
|       | (a) Total  | 21775   | 38513   | 76.86    |
|       | (b) Paddy  | 12223   | 18626   | 52.38    |
|       |  | (56.13) | (48.36) |          |
| 2.    | Non – food Expenditure   |         |         |          |
|       | Clothes  | 1966    | 3846    | 95.62    |
|       | Fuel   | 120     | 345     | 187.50   |
|       | Education  | 234     | 401     | 71.36    |
|       | Medicine   | 799     | 1315    | 64.58    |
|       | Others: (seeds;fertilize; equipments; insecticides; festival etc.) | 611     | 1305    | 113.58   |

Source: Field Survey, 2010

Table - 4.9.1 shows that the expenditure on food and beverages increased drastically i. e. by nearly 77 percent after the irrigation project. At the same time, the expenditure on non – food has increased by nearly 93.35 percent. Thus, it is

found that the income increases. The farmers start to increase their non- food expenditure in higher proportion. Again, among the non- food expenditure, they spend more on clothes. After the irrigation expenditure on paddy is decrease by nearly 8 percent. This shows that economic condition of farmer has improved after the irrigation project.

#### 4.10 Livestock

The population of livestock counts on the day of the enumeration of the sample households. The table 4.10.1 below gives the number and percent of livestock according to the sample households.

**Table -4.10.1, Population of Livestock before implementation of project (2053)**

| Types   | Small land holders |     | Medium land holders |     | Large land holders |     |
|---------|--------------------|-----|---------------------|-----|--------------------|-----|
|         | No.                | (%) | No.                 | (%) | No.                | (%) |
| Cow     | 35                 | 9   | 28                  | 10  | 18                 | 10  |
| Ox      | 28                 | 7   | 12                  | 5   | 8                  | 5   |
| Goat    | 86                 | 21  | 46                  | 17  | 32                 | 18  |
| Buffalo | 12                 | 3   | 9                   | 4   | 6                  | 3   |
| Hen     | 94                 | 23  | 52                  | 19  | 43                 | 24  |
| Pigeon  | 150                | 37  | 120                 | 45  | 70                 | 40  |
| Total   | 405                | 100 | 267                 | 100 | 177                | 100 |

Source: Field Survey, 2010

Above table 4.10.1 shows that the number of livestock in the study area, it shows land holders have more livestock 405 in numbers among the others. Large land holders had at least an ox in each householder but most of the small land

holders and some of the medium land holders had no ox. Because large land holders had more land than others so they need more ox than others. Among the types of livestock goat, hen, pigeon and cows were greater in number in comparing to others in the area. Buffalos were lowest number in the table.

**Table – 4.10.2, Population of Livestock after implementation of project (2067)**

| Types   | Small land holders |     | Medium land holders |     | Large land holders |     |
|---------|--------------------|-----|---------------------|-----|--------------------|-----|
|         | No.                | (%) | No.                 | (%) | No.                | (%) |
| Cow     | 20                 | 6   | 18                  | 7   | 16                 | 8   |
| Ox      | 28                 | 9   | 24                  | 9   | 16                 | 8   |
| Goat    | 67                 | 20  | 51                  | 19  | 27                 | 12  |
| Buffalo | 7                  | 2   | 9                   | 3   | 4                  | 2   |
| Hen     | 64                 | 20  | 64                  | 23  | 30                 | 14  |
| Pigeon  | 142                | 43  | 108                 | 39  | 120                | 56  |
| Total   | 328                | 100 | 274                 | 100 | 213                | 100 |

Source: Field Survey, 2010

The table 4.10.2 shows that small land holders have more livestock 328 in numbers among others. Large land holders had more ox (16) than others. They have a couple of ox (hal goru) in each household. Not only had every livestock had large land holders than others. But the number of cow and goat are decreasing day by day. Because of the implementation of the project most of the grazing field were turn into khet this has affected the number of cows and goat in the area.

## CHAPTER – V

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Summary

Baruwa Khola Irrigation Project (BKIP) is one of the major irrigation project in Udayapur District, aimed at providing irrigation facilities to the cultivable land of Triyuga Municipality ward no. 4 in the Udayapur District. The project has been providing irrigation facilities to about 175 hectares of cultivated land. After the implementation of the project there is considerable increase in the crop intensity and yield giving rise in the living standard of the farmers.

Irrigated agriculture has developed most extensively in dry regions where natural precipitation is inadequate for the production of many crops. Irrigation is one of the instruments to increase agricultural production but irrigation water is expensive and larger irrigation schemes are not justified unless best use of the water is guaranteed.

In the study area, irrigation has been provided since 2053 which helped to improve the economic condition of the people. People of the study area have been migrating to the study area due to the irrigation facilities, there has been increased in crop production.

After the BKIP, irrigation facilities have provided in Triyuga Municipality ward no. four so far have received the irrigation facility. Total area under irrigation is 175 hectares, but the land is supplied with sufficient water in only spring season. With the help of BKIP farmers of this ward trying to maximize their production by diversified farming methods. But the operation and maintenance aspect of the

canal is poor due to various causes like leakage and seepage of water and insufficient volume of water in dry season.

The general objective of present study is to study the impact of BKIP in agriculture. However, the specific objectives are: to identify the socio economic condition of the farmers before and after the project, to evaluate the land value and income level of the study area. The present study is based on analytic research design. Primary and secondary data have been used and various data collection technique such as interview schedule, observation, was applied to collect primary data for the study. In the study area, there are 174 households and 950 are total population. The total sample household head in the study area have 52 where as 26.92% (14) HHs belongs to Tharus followed by 36.54% (19) Brahman, 28.84% (15) Hill Chhetri and 3.84% (2) Rai. The number of Terai Chhetri and Shrestha, distributed as 1.92% (1), 1.92% (1) respectively.

The main occupation of the people of the study area is agriculture; the percentage of main occupation agriculture is about 52 percent followed by the others service 5 percent, business 6 percent, student 33 percent and others only 4 percent. The literacy rate of the study area is about illiterate 17 percent and literate is about 83 percent. The land holding of the farmers have been divided by three categories, these are: small land holders (0-15 kattha) are 56 percent, medium land holders (16-30) are 29 percent and large land holders (above 30) are 15 percent households respectively. The land value after the irrigation project increases by 331.34 percent and the most of the farmers are used both equipment which are 61 percent and local seeds user farmers decrease.

## 5.2 Conclusion

Agriculture in Nepal depends on the monsoon. This is a basic constraint in Nepali agriculture. This absolute dependence on the monsoon has halted progress on agriculture in the country. This dependency due to largely to the inadequate growth of irrigation works in the country. It has now been agreed upon by all concerned that extension of irrigation facilities to the vast rural under cultivation is a pre- condition of agriculture development of Nepal. It is therefore necessary to develop extensive irrigation facilities to stability in agriculture.

There is rapid change in income, output after the irrigation project in the study area. Before (2053) the irrigation project, paddy cultivation was depended upon monsoon rainfall and production was only 61.30 kg. per kattha but after the irrigation project production of paddy has increased to 124.55 kg. per kattha. It shows that the paddy production yield has increased due to the Baruwa Khola Irrigation Project.

After the irrigation project the expenditure of the households on food and beverages increased drastically i. e. by nearly 77 percent in the ward no. 4 at the same time non- food expenditure has increased by nearly 93.35 percent. It shows that the food grains produced by the farmers do not meet their requirements. Before the irrigation project the average land value was Rs. 1024.02 Per kattha and after the irrigation it has increased to Rs. 10561.18 per kattha, which is 331.34 percent per more than in 2053.

The irrigation facility has helped to increase the paddy production in the ward by 103.18 percent. Again it has also increased helped to the production of maize and wheat. After the irrigation facilities the production of maize, wheat and



pulse has also been increased by 63.09, 18.58 and 8.99 percent respectively. The production of pulse is low if it is compared to other crops. It shows that the impact of irrigation in the production of pulse is not satisfactory. The vegetables, which were not seen before the BKIP, are now produced excessively. After the irrigation, the income of family has been increased by 68 percent. Thus, the productions of paddy, wheat and vegetables have increased excessively after the irrigation project in that ward. Chemical fertilizers are used in the production of paddy, wheat and vegetables. But they are not yet used in the production of maize and pulse.

Before project, farmers used compost manure, local seeds and only few households used insecticide but after the project most of the farmers used chemical fertilizer insecticide and improved seeds. It helps to increase the crop production. Urea, DAP and Potash are the popular fertilizer of the command area. We can conclude that after the implementation of the project, agricultural prosperity was accelerated, income of rural cultivators had raised, level of food sufficiency was increased and standard of the people was also increased. The socio economic condition of farmers is also influenced by irrigation project. Living standard of the people is being improved after the implementation of the project.

### **5.3 Recommendations**

After the Baruwa Khola Irrigation Project crop production has increased but crop management operation of the irrigation system are not handled in a proper way. Therefore, the following recommendations have been made on the basis of the study.

The main objective of the country is to promote the agricultural production as well as productivity. We know that irrigation is one of the main ways to increase agricultural production and productivity. So, to increase the agricultural production, the farmers should give attention in the field of irrigation and management.

According to farmers of the study area, there is a lack of chemical fertilizers, improved seeds and insecticides in the cropping season. Government should take the necessary steps for the supply of required chemical fertilizer, improved seeds and insecticides in time.

The farming system of the study area is still traditional and the farmers are unable to use modern techniques like the use of chemical fertilizers, insecticides, modern tools etc. So that the government should provide technical manpower like J. T. for applying new technologies.

The paddy production can be increased at higher rate than its present rate by using chemical fertilizers and agricultural tools. So that government should provide subsidies and loan at minimum interest rate even small farmers can apply to their land.

It is recommended that all the farmers must be very conscious about their responsibilities to call the meeting and attain compulsory for betterment of the project and farmers.

To distribute water systematically by on their turns.

When the tunnel leak or damage repair it timely which increases the farmers productivity.

## APPENDIX- I

### A Survey of the Impact of Baruwa Khola Irrigation Project on Paddy Production, Nepal

Questionnaire related to Household Survey

T. M. – 4, Gaighat, Udayapur.

1. General Information:

Date:..../...../.....

District: .....

VDC/Municipality: .....

Ward No.: .....

Name of the respondent: .....

Age: .....

Sex: .....

Education: (i) [ ] Illiterate

(ii) [ ] Literate

(iii) [ ] Primary

(iv) [ ] Secondary

(v) [ ] Higher

Birth Place: Local/Migrate

Cast: .....

Signature: .....

2. General information of the Households:

| S. N. | Name of Households members | Sex (M/F) | Age | Education | Occupation | Training |
|-------|----------------------------|-----------|-----|-----------|------------|----------|
| 1.    |                            |           |     |           |            |          |
| 2.    |                            |           |     |           |            |          |
| 3.    |                            |           |     |           |            |          |
| 4.    |                            |           |     |           |            |          |
| Total |                            |           |     |           |            |          |

3. Was irrigation facility available in your land?

[     ] Yes

[     ] No.

4. If yes, how much of your land is irrigated in the project?

| Irrigation type | Area (Kattha) |
|-----------------|---------------|
| Permanent       |               |
| Seasonal        |               |
| Total           |               |

5. How much cultivable land do you have at this place?

| Ownership  | Irrigated | Non-irrigated | Area of land (in kattha) |
|------------|-----------|---------------|--------------------------|
| Own land   |           |               |                          |
| Rented in  |           |               |                          |
| Rented out |           |               |                          |

6. Production status of crops:

| Types of crops | Total land under cultivation (kattha) | Khet (in mann) | Total |
|----------------|---------------------------------------|----------------|-------|
| Paddy          |                                       |                |       |
| Maize          |                                       |                |       |
| Wheat          |                                       |                |       |
| Pulse          |                                       |                |       |
| Oilseeds       |                                       |                |       |
| Vegetable      |                                       |                |       |
| Total          |                                       |                |       |

7. What is the situation of food grain of your households?

| Situation  | Paddy | Maize | Wheat | Pulse | Oilseed | Vegetable |
|------------|-------|-------|-------|-------|---------|-----------|
| Surplus    |       |       |       |       |         |           |
| Deficit    |       |       |       |       |         |           |
| Sufficient |       |       |       |       |         |           |

8. If the food grain was deficit, how did you maintain your daily expenditure?

- By borrowing from others.
- By taking loan.
- By earning wages.
- Others (Specify).....

9. If you have surplus, then what is the amount of Surplus?

| Variety   | Quantity (Mann) | Price | Amount |
|-----------|-----------------|-------|--------|
| Paddy     |                 |       |        |
| Maize     |                 |       |        |
| Wheat     |                 |       |        |
| Pulse     |                 |       |        |
| Oil seed  |                 |       |        |
| Vegetable |                 |       |        |

10. Livestock analysis:

| Types of livestock | Number | No. of sold | Unit price | Total income |
|--------------------|--------|-------------|------------|--------------|
| Cow /ox            |        |             |            |              |
| Buffalo            |        |             |            |              |
| Goat               |        |             |            |              |

|        |  |  |  |  |
|--------|--|--|--|--|
| Hen    |  |  |  |  |
| Pigeon |  |  |  |  |
| Total  |  |  |  |  |

11. Total agriculture production:

| Variety   | Quantity produced | Consume | Sold | Total income (Rs) | Total expenditure (Rs) |
|-----------|-------------------|---------|------|-------------------|------------------------|
| Paddy     |                   |         |      |                   |                        |
| Maize     |                   |         |      |                   |                        |
| Wheat     |                   |         |      |                   |                        |
| Pulse     |                   |         |      |                   |                        |
| Oilseed   |                   |         |      |                   |                        |
| Vegetable |                   |         |      |                   |                        |
| Buffalo   |                   |         |      |                   |                        |
| Goat      |                   |         |      |                   |                        |
| Cow/ox    |                   |         |      |                   |                        |
| Hen       |                   |         |      |                   |                        |
| Pigeon    |                   |         |      |                   |                        |
| Clothes   |                   |         |      |                   |                        |
| Festival  |                   |         |      |                   |                        |
| Medicine  |                   |         |      |                   |                        |
| Others    |                   |         |      |                   |                        |
| Total     |                   |         |      |                   |                        |

12. What types of agricultural inputs did you use in the field (including the crops)?

(i) Seeds:                [        ] local                [        ] improved                [        ] both

(ii) Fertilizers:        [        ] compost        [        ] chemical                [        ] both

(iii) Tools:             [        ] traditional [        ] modern                [        ] both

Insecticides:        [        ] yes                [        ] no.

13. If you have improved seeds, insecticides, chemical fertilizers and agricultural equipments, please mention their type of quantity:

| Description | Paddy |    |    | Maize |    |    | Wheat |    |    | Pulse |    |    | Oilseeds |    |    | Vegetable |    |    |
|-------------|-------|----|----|-------|----|----|-------|----|----|-------|----|----|----------|----|----|-----------|----|----|
|             | Qt    | Ty | Pr | Qt    | Ty | Pr | Qt    | Ty | Pr | Qt    | Ty | Pr | Qt       | Ty | Pr | Qt        | Ty | Pr |
| Seeds       |       |    |    |       |    |    |       |    |    |       |    |    |          |    |    |           |    |    |
| Chemical    |       |    |    |       |    |    |       |    |    |       |    |    |          |    |    |           |    |    |
| Equipment   |       |    |    |       |    |    |       |    |    |       |    |    |          |    |    |           |    |    |
| Insecticide |       |    |    |       |    |    |       |    |    |       |    |    |          |    |    |           |    |    |

14. What types of irrigation facilities were available before the irrigation project?

[        ] Mul                [        ] Rainfall        [        ] Streams        Others.....

15. How much additional land has been irrigated after the completion of this irrigation project? (in kattha)

(i) in summer

(ii) in winter

16. What is the change in the land value because of the irrigation project?

From Rs. .... To Rs. .... (per Kattha)



17. In your opinion, what are the major factors responsible for the increment of land value?

- (i) [        ] Irrigation facility.
- (ii) [        ] Road facility.
- (iii) [        ] Population growth.
- (iv) [        ] Marketing facility.
- (v) [        ] Electrification.
- (vi) [        ] Others. ....

18. Occupation and structure of household members above 10 years and their annual income before and after irrigation:

**Before the Irrigation**

| Occupation   | No. of persons involved | Primary occupation | Secondary occupation | Annual income (Rs.) |
|--------------|-------------------------|--------------------|----------------------|---------------------|
| Agriculture  |                         |                    |                      |                     |
| Services     |                         |                    |                      |                     |
| Business     |                         |                    |                      |                     |
| Student      |                         |                    |                      |                     |
| Others ..... |                         |                    |                      |                     |

**After the Irrigation**

| Occupation  | No. of persons involved | Primary occupation | Secondary occupation | Annual income (Rs.) |
|-------------|-------------------------|--------------------|----------------------|---------------------|
| Agriculture |                         |                    |                      |                     |
| Services    |                         |                    |                      |                     |
| Business    |                         |                    |                      |                     |

|              |  |  |  |  |
|--------------|--|--|--|--|
| Student      |  |  |  |  |
| Others ..... |  |  |  |  |

19. Which crops did you produce before the irrigation project and which crops are you producing after the irrigation project?

**Before the Irrigation Project**

| S. N. | Summer crops | Winter crops | Spring crops | Area (kattha) | Production (mann) |
|-------|--------------|--------------|--------------|---------------|-------------------|
| 1.    |              |              |              |               |                   |
| 2.    |              |              |              |               |                   |
| 3.    |              |              |              |               |                   |
| 4.    |              |              |              |               |                   |
| 5.    |              |              |              |               |                   |
| Total |              |              |              |               |                   |

**After the Irrigation Project**

| S. N. | Summer crops | Winter crops | Spring crops | Area (kattha) | Production (mann) |
|-------|--------------|--------------|--------------|---------------|-------------------|
| 1.    |              |              |              |               |                   |
| 2.    |              |              |              |               |                   |
| 3.    |              |              |              |               |                   |
| 4.    |              |              |              |               |                   |
| 5.    |              |              |              |               |                   |
| Total |              |              |              |               |                   |

20. Have you purchased any food items before and after irrigation project?

If yes, what kind of food have you purchased?

**Before the Irrigation Project**

| Items        | Yes | No | Unit | Rs. |
|--------------|-----|----|------|-----|
| Cereal       |     |    |      |     |
| Pulse        |     |    |      |     |
| Meat         |     |    |      |     |
| Milk         |     |    |      |     |
| Vegetable    |     |    |      |     |
| Others ..... |     |    |      |     |
| Total        |     |    |      |     |

**After the Irrigation Project**

| Items        | Yes | No | Unit | Rs. |
|--------------|-----|----|------|-----|
| Cereal       |     |    |      |     |
| Pulse        |     |    |      |     |
| Meat         |     |    |      |     |
| Milk         |     |    |      |     |
| Vegetable    |     |    |      |     |
| Others ..... |     |    |      |     |
| Total        |     |    |      |     |

21. Have you purchased any non- food items before and after the irrigation project?

**Before the Irrigation Project**

| Items         | Yes | No | Unit | Rs |
|---------------|-----|----|------|----|
| Kerosene      |     |    |      |    |
| Diesel        |     |    |      |    |
| Medicine      |     |    |      |    |
| Cosmetic      |     |    |      |    |
| Clothes       |     |    |      |    |
| Matches       |     |    |      |    |
| Tooth paste   |     |    |      |    |
| Soap, shampoo |     |    |      |    |
| Others .....  |     |    |      |    |
| Total         |     |    |      |    |

**After the Irrigation Project**

| Items    | Yes | No | Unit | Rs |
|----------|-----|----|------|----|
| Kerosene |     |    |      |    |
| Diesel   |     |    |      |    |
| Medicine |     |    |      |    |
| Cosmetic |     |    |      |    |
| Clothes  |     |    |      |    |
| Matches  |     |    |      |    |

|               |  |  |  |  |
|---------------|--|--|--|--|
| Tooth paste   |  |  |  |  |
| Soap, shampoo |  |  |  |  |
| Others .....  |  |  |  |  |
| Total         |  |  |  |  |

22. In your opinion, what are the direct benefits of irrigation to your family?

- (i)  ] To increase the cultivated land area.
- (ii)  ] To increase paddy production.
- (iii)  ] None of the above.
- (iv)  ] Others (specify). .....

23. Achievement after the construction of Baruwa Khola Irrigation Project:

- (i)  ] Increase in crop production.
- (ii)  ] Decrease in crop production.
- (iii)  ] Constant in crop production.

24. If increase in crop production, what are the causes?

- (i)  ] Achievement of irrigation facility.
- (ii)  ] Utilization of improved seeds.
- (iii)  ] Increase in cultivated land.
- (iv)  ] Utilization of fertilizer.

25. If decrease in crop production, what are the causes?

- (i)  ] Canal has damaged in time to time.
- (ii)  ] Due to the lack of regular water supply in all season.
- (iii)  ] Irrigation office has not equally distributed the water.

26. What are the major problems of the irrigation project?

- (i) [     ] Lack of regular irrigation facilities.
- (ii) [     ] Insufficient volume of water.
- (iii) [     ] Unequal distribution of water.
- (iv) [     ] Others. ....

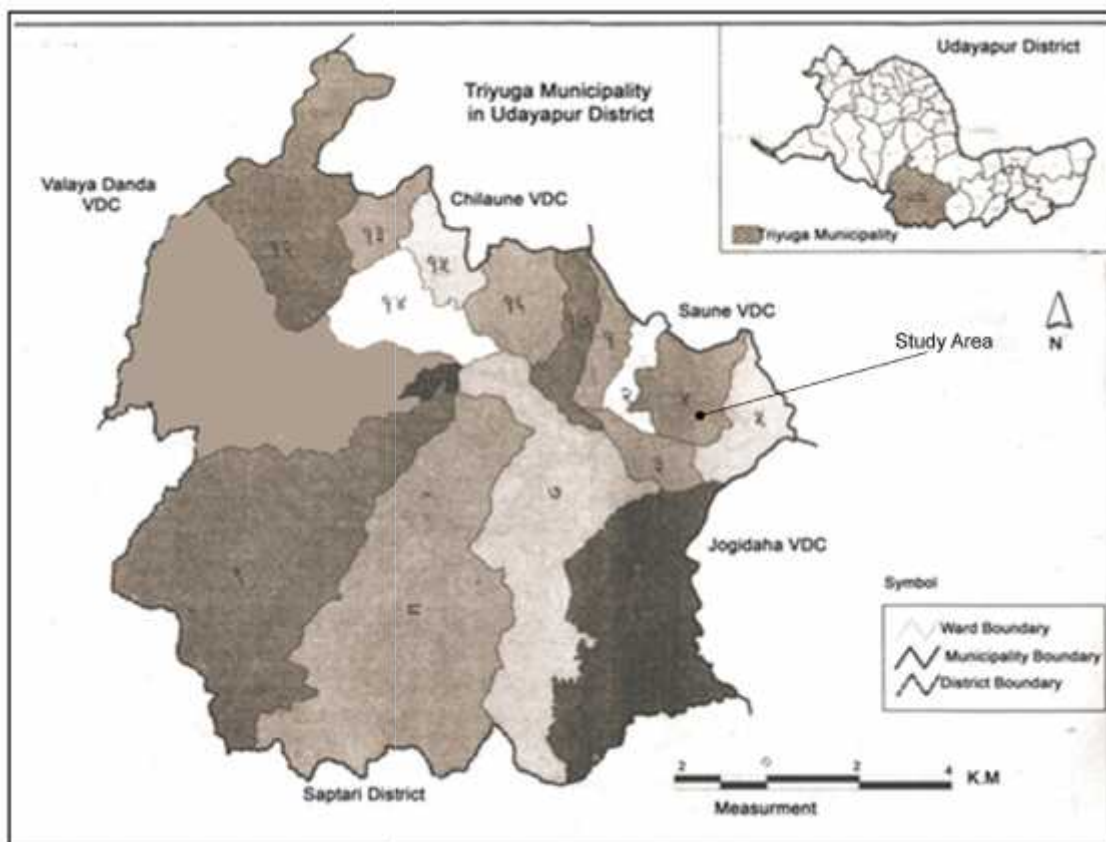
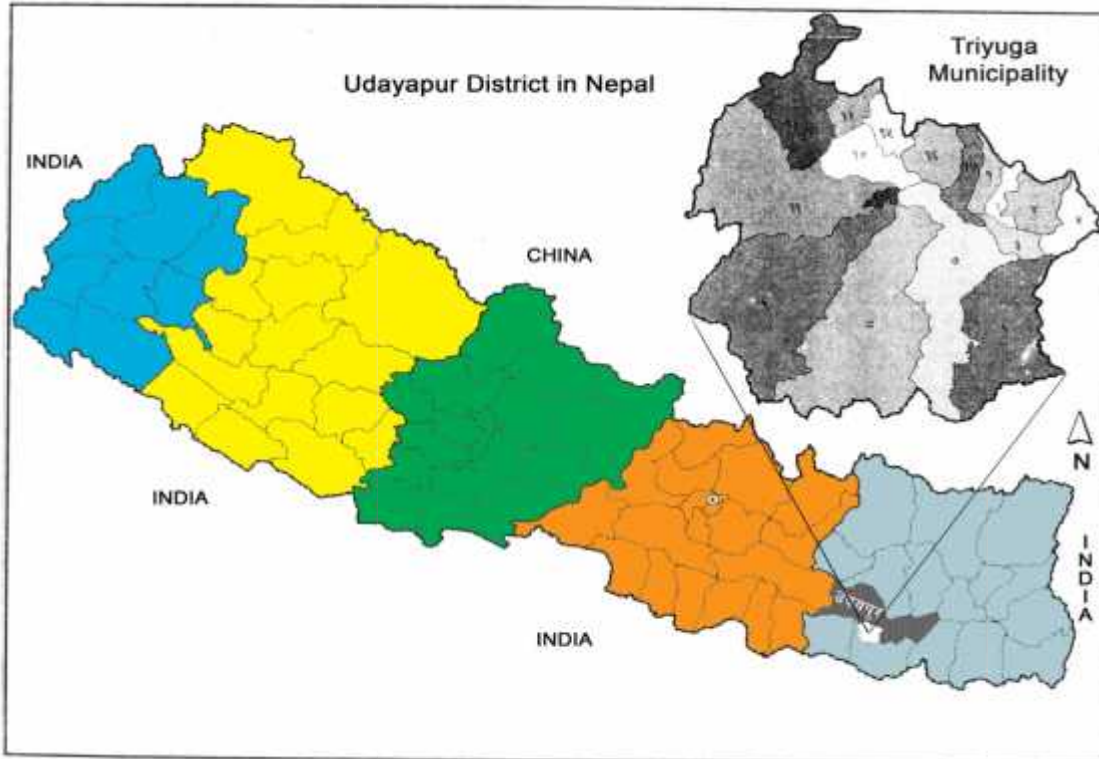
27. Can you give any suggestions of improve the irrigation project?

.....  
.....  
.....

**Thank you !**

## APPENDIX – II

Map in study area



### APPENDIX - III

#### Total Paddy Production Before and After the Irrigation Project

| S. N. | Land (Kattha) | Before (Kg.) | After (Kg.) |
|-------|---------------|--------------|-------------|
| 1     | 12.0          | 580          | 1260.00     |
| 2     | 15.0          | 1200         | 1,800.00    |
| 3     | 22.0          | 1920         | 2,640.00    |
| 4     | 60.0          | 3420         | 7,200.00    |
| 5     | 04.8          | -            | 432.00      |
| 6     | 18.0          | 1240         | 1,800.00    |
| 7     | 12.0          | 960          | 1,200.00    |
| 8     | 4.10          | -            | 328.00      |
| 9     | 23.0          | 780          | 3220.00     |
| 10    | 10.0          | 800          | 1600.00     |
| 11    | 10.0          | 800          | 1,600.00    |
| 12    | 37.0          | 1680         | 3700.00     |
| 13    | 19.0          | 1140         | 2280.00     |
| 14    | 10.0          | 600          | 1600.00     |
| 15    | 20.0          | 960          | 2400.00     |
| 16    | 41.0          | 2720         | 4920.00     |
| 17    | 40.0          | 2560         | 4800.00     |
| 18    | 03.0          | -            | 480.00      |
| 19    | 30.0          | 1760         | 3800.00     |
| 20    | 28.0          | 1440         | 3360.00     |



|    |      |      |          |
|----|------|------|----------|
| 21 | 09.0 | -    | 1440.00  |
| 22 | 30.0 | 1920 | 2800.00  |
| 23 | 13.0 | 780  | 1,820.00 |
| 24 | 5.14 | -    | 820.00   |
| 25 | 07.0 | 560  | 1120.00  |
| 26 | 05.0 | 500  | 800.00   |
| 27 | 15.0 | 960  | 1500.00  |
| 28 | 15.0 | 900  | 1,800.00 |
| 29 | 30.0 | 1780 | 3600.00  |
| 30 | 06.0 | 720  | 960.00   |
| 31 | 12.0 | 960  | 1920.00  |
| 32 | 12.0 | 1200 | 1440.00  |
| 33 | 80.0 | 4840 | 8420.00  |
| 34 | 06.0 | 720  | 840.00   |
| 35 | 02.5 | -    | 350.00   |
| 36 | 05.0 | 480  | 650.00   |
| 37 | 15.0 | 960  | 2100.00  |
| 38 | 60.0 | 3600 | 7400.00  |
| 39 | 13.0 | 1040 | 1880.00  |
| 40 | 72.0 | 4320 | 9360.00  |
| 41 | 19.0 | 1140 | 2470.00  |
| 42 | 06.0 | 720  | 960.00   |
| 43 | 30.0 | 1440 | 3500.00  |

|       |         |       |          |
|-------|---------|-------|----------|
| 44    | 24.0    | 1200  | 3280.00  |
| 45    | 04.0    | 400   | 640.00   |
| 46    | 15.0    | 1260  | 2100.00  |
| 47    | 05.0    | 560   | 800.00   |
| 48    | 30.0    | 1800  | 4200.00  |
| 49    | 26.0    | 1560  | 3380.00  |
| 50    | 12.0    | 820   | 1,920.00 |
| 51    | 24.0    | 1500  | 3120.00  |
| 52    | 33.0    | 1760  | 4160.00  |
| Total | 1059.54 | 64960 | 131970   |

## APPENDIX - IV

### Impact of Irrigation on the Land Value

| S. N. | Before (Rs.) | After (Rs.) |
|-------|--------------|-------------|
| 1     | 25,000.      | 2,00,000.   |
| 2     | 25,000.      | 2,00,000.   |
| 3     | 17,000.      | 2,50,000.   |
| 4     | 30,000.      | 3,00,000.   |
| 5     | 16,000.      | 2,00,000.   |
| 6     | 25,000.      | 2,50,000.   |
| 7     | 20,000.      | 1,50,000.   |
| 8     | 25,000.      | 2,00,000.   |
| 9     | 20,000.      | 1,50,000.   |
| 10    | 25,000.      | 2,50,000.   |
| 11    | 18,000.      | 2,40,000.   |
| 12    | 20,000.      | 2,20,000.   |
| 13    | 17,000.      | 1,80,000.   |
| 14    | 26,000.      | 3,00,000.   |
| 15    | 20,000.      | 2,80,000.   |
| 16    | 25,000.      | 3,20,000.   |
| 17    | 22,000.      | 2,20,000.   |
| 18    | 25,000.      | 2,50,000.   |
| 19    | 25,000.      | 3,00,000.   |
| 20    | 20,000.      | 2,00,000.   |

|    |         |           |
|----|---------|-----------|
| 21 | 20,000. | 1,70,000. |
| 22 | 22,000. | 2,20,000. |
| 23 | 20,000. | 2,20,000. |
| 24 | 20,000. | 2,00,000. |
| 25 | 25,000. | 3,00,000. |
| 26 | 25,000. | 2,00,000. |
| 27 | 18,000. | 2,20,000. |
| 28 | 22,000. | 3,00,000. |
| 29 | 18,000. | 2,00,000. |
| 30 | 20,000. | 1,50,000. |
| 31 | 22,000. | 2,50,000. |
| 32 | 16,000. | 1,50,000. |
| 33 | 15,000. | 1,20,000. |
| 34 | 15,000. | 1,20,000. |
| 35 | 16,000. | 1,50,000. |
| 36 | 16,000. | 1,50,000. |
| 37 | 18,000. | 1,60,000. |
| 38 | 20,000. | 2,50,000. |
| 39 | 30,000. | 2,80,000. |
| 40 | 30,000. | 2,80,000. |
| 41 | 16,000. | 1,20,000. |
| 42 | 20,000. | 2,20,000. |
| 43 | 25,000. | 2,50,000. |

|       |                 |                    |
|-------|-----------------|--------------------|
| 44    | 16,000.         | 2,50,000.          |
| 45    | 22,000.         | 2,50,000.          |
| 46    | 17,000.         | 2,20,000.          |
| 47    | 18,000.         | 2,00,000.          |
| 48    | 20,000.         | 2,50,000.          |
| 49    | 20,000.         | 1,80,000.          |
| 50    | 15,000.         | 2,30,000.          |
| 51    | 22,000.         | 2,50,000.          |
| 52    | 20,000.         | 2,20,000.          |
| Total | Rs. 10, 85,000. | Rs. 1, 11, 90,000. |

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