CHAPTER I
INTRODUCTION

1.1 General Background

Sandwiched between the Kingdom of Nepal in the west and the kingdom of Bhutan in the east lies a small stretch of rugged land of the Indian state known as Sikkim. On its northern border towers the platean of Tibet whereas it shares its southern bounder with west Bengal which is another state of India. Sikkim has a 220 km long border with Tibet, 100km with Nepal, 30 km with Bhutan and 80 km with west Bengal (Puri, 1985). On the world map it is a protectorate state, which lies between 27^0 00' 46" and 28^0 17' 48" North Latitude and 88^0 00' 58" to 88^0 55' 25" East Longitude.

Sikkim was earlier a protectorate of India with a monarchy government but in 1975 it metamorphosed as the twenty second state of the Indian union. Sikkim covers an area of 7096 sq.km. The state consists of four districts. North district with the district headquarter at Mangan, South district with the district headquarter at Namchi, west district with the headquater at Gyalsing and East district with the headquarter at Gangtok-which also is the capital of the state of Sikkim. Most of the population of Sikkim is concentrated in East and south Districts. The west District is moderately populated whereas the North District is very sparsely populated as a great portion of it lies above the snow land.

Mandarin orange (orange reticulate) is most common among orange fruits grown in India occupying nearly 50 percent of the total orange area. In the North Eastern Region of India, climate favors the production of quality mandarin. Orange is a good source of income for small and marginal farmers.

Orange represents the first important commercial fruits of Sikkim and have been cultivated from time immemorial. It is a native orange fruit of Sikkim and is very popular in the Kolkatta market. It is cultivated in an area of about 2300 hectares, with an average annual production of 17,190 tonnes per hactar. in Sikkim . Orange is grown in almost all parts of the state. Tashiding, Gyalshing, Omchung, Tijyah, lingchom, Bermiok, Barthang, Rinchenpong, Chintlang, Chakung, Zoom, Timberbong, Karthok in the west; Kewsing, Lingmoo, Sangmoo, Payong, Rateypani, Namthang, tarku, Turuk, sumbuk in the south, Nazitan, Song, Simiklingu, Khamdong, Sirwani, Samdong is the east and Dikchu and Hee-Gyathang in the North District of Sikkim are the important orange growing areas of Sikkim.

Mandarins grows successfully in all frost free tropical and sub-tropical regions. Besides climate, good nursery management of raising mandarins seedings also contributes towards producing healthy planting materials and maximum yield of fruits. The main harvesting period is during the month of November to January. It is suitable in an elevation of 600 to 1500 meters above sea level. Sikkim Mandarin can be best grown on slightly acidic soils with 5.0 to 6.4 pH range. It can tolerate acidity upto 4.0 pH (Akali Sema, 2006).

In Sikkim only one variety i.e. mandarin orange is cultivated since 300 years. It has a very high demand in the neighbouring centres. In the Khamdong Gram Panchayat unit the cultivation is increasing so is the farm size under orange cultivation. Maximum orange are used by fruit preservative factory located at Singtam. Orange squash "Sikkim Supreme" is the famous product of this factory. Other remaining fruits are destined for export to Siliguri and Kolkota. Thus, the Khamdong Gram Panchayat Unit is having suitable land for the cultivation of orange.

The Government of Sikkim is commited to the development of Horticulture. In the IX plan (1998-2002) Rs. 12.59 crore (1 % of the total outlay) was invested for the development of horticulture.

Agriculture contributed nearly 20.26 percent of the GSDP in 2002-2003 and this decrease to 18.97 percent in 2004-05. In resents years the sectoral composition has shifted to services.

In 2004-05 the total area under orange cultivation were 494 thousand hector and the output was around 662 thousand tones. The income generated from orange was Rs. 798.00 Lakhs. Agriculture and horticulture, combining the two share of total profit accounts to 16.89 percent where horticulture share of profit was recorded 83.11 percent in 2004-05.

1.2 Statement of Problems

Orange occupies an important place in the field of agricultural economy. Most of the people of Khamdong gram pandchayat unit depend upon agriculture. As compare to other crops like maize, wheat, millet, pulses, cardamom; orange occupies the first position in the study area. It has great popularity not only in the state but also in the national and international level. But today most of the farmers are facing lots of problems like lack of storage facilities unorganized market, lack of insecticides and pesticides which directly hamper its productivity.

Though the farmers are facing lots of problems but still today, they are attracted towards its cultivation due to high profit margin. The present study has raised the following issued to be discussed and analyzed related to orange cultivation.

- What is the production trend of orange in the study area.

- What is the relationship between farm size, horticulture loan, road accessibility and production of orange in the study area.
- What is the cost and benefit of orange.
- What are the problems and prospects of orange cultivation in the study area.

1.3 Objectives of the Study

The general objectives of the present study are to investigate the different aspects of orange cultivation and their problem and prospects in Khamdong Gram Panchayat Unit. The specific objectives are following ways:

i. To show the production trend of orange in the study area.
ii. To examine the relationship between farm size, horticulture loan, road accessibility and production of orange.
iii. To examine thoroughlly the market system for orange production
iv. To analyze the cost and benefit of orange cultivation.
v. To investigate the problems and prospects of orange cultivation.

1.4 Significance of the Study

Orange is cultivated in almost all parts of Sikkim. Nazitam, Song, Khamdong, Sirwani and Samdong are the main orange producing areas in the East District. So the present study focuses only on Khamdong Gram Panchayat Unit. Being a commercial crop, orange cultivation has contributed to the local farmers to improve their socio-economic life, but due to lack of knowledge, people are deprived of systematic guidance. Moreover in the study area no research work has been conducted yet now. The present work will be the first attempt to show the cultivation of orange in ward wise along with the general location of the Khamdong

Gram Panchayat Unit. This study will also help the local farmers regarding the agricultural knowledge and ideas. Fourthermore, this research will also be useful for the people, policy maker and planners in future. Thus, this micro-level study will focus only on Kamdong Gram Panchayat Unit.

1.5. Limitation of the Study

Any research work or researcher, has its own limitation. No studies can be made beyond its limitation. So following are the limitation of this study.

This study is carried out on a micro level and it is confined to Khamdong Gram Panchayat Unit only. This study is primarily concerned with orange cultivation. In order to obtain genuine information primary data was collected as well as secondary data was use for supporting facts of comparative analysis. To fulfill the aims and objective only 67 households from the Khamdong Gram Panchayat were being surveyed.

Orange cultivation is a dominant asset of the study area. It is important medium which sustain livelihood. Moreover this study deals with some selected aspects such as the relationship between farm size, horticulture loan, road accessibility and production, market system, cost and benefit, annual trend line, problem and prospect.

CHAPTER II
LITERATURE REVIEW

Review of literature is an essential part of any research work. While doing research the review of literature is needed in order to various literatures were reviewed concerning the on orange cultivation.

Sema (2006) focused that the Mandarin orange (orange reticulate) is most common orange fruits grown in India occupying nearly 50 percent of the total orange area. Besides this also focused about the good nursery management of raising mandarin seedlings contribute towards producing healthy planting material and maximum yield of fruit. His studies deals about the steps for the raising quality nuclear seedlings of mandarin from seeds like selection of mother plants, collection of seeds, primary nursery raising, secondary nursery raising and their controls measures. He also pointed out the importance of orange cultivation in national and international level.

DOH (2006) this book noted about the package and practices of different fruits. Among them, Sikkim mandarin orange is one of the most important and popular fruits grown in Sikkim. This book focuses about the soil and climate suitable for orange and their varieties, planting spacing, prunning and fencing of mandarin orange. It also explains the fertilization method according to the age of the plants, common fungal diseases which is seemed to be dangerous to orange plants as they infected the branches and finally tree. There diseases are controlled as soon as the infection are given on the tree. This book also deals about the pests and bacterial diseases and their major controls and remedies which is immediately needed for the mandarin orange in Sikkim.

Thapa (2005) has carried out the study on the topic of "orange cultivation in the western hill region of Nepal. He has marked orange is the orange fruit of Rutaceae family. He has conducted research in Shanker Pokhari VDC of Parbat District. The main objectives of his study was to analyze the determinants of orange cultivation, and to explain the access to market by using the primary data collected from different respondent of the study area. Moreover he has also pointed out that the orange cultivation was significantly raised the economic status of the study area. Due to the fluctuation in market price, role of middle man and unorganized market system basically creats the main problems to the people of the study area during the time of goods selling in market. Middlemen are the main profit earner than the producer. Lack of organized marketing system, storage facilities and processing industries are remarkable problems for the orange marketing.

Sharma (2004) in his book stated that Sikkim is a small state but it is a store house of sub-tropical fruits. There are different fruits cultivated in Sikkim. Mandarin orange is a native orange fruit of Sikkim and cultivated from time immemorial. Sikkim mandarin represents the first most important commercial fruit of Sikkim. It is cultivated in an area of about 2,300 hectors with a total average annual production of 17,190 tonnes in Sikkim. The important orange producing areas are the Tista and Rangeet valley within the elevation range of 600 to 1500m above msl. Tashiding, gnashing, Omchung, Bermiok, Chintang, Chakung in west; Turuk, Kewising, Namthay in the south, Khamdong, Song, Samdong Sirwani in east and Dikhu and Hee Cryathang in the North District of Sikkim are the important orange growing areas of Sikkim.

Rai (2003) has aimed to analyse the production and its productivity of orange by different groups of farmer. His study also focused on

marketing system, and found the problem and policy measures to encourage the orange growers. He found that only little amount of product are supplied in nearby the local market and about 75 percent of orange of Sikkim are supply in Sligmi and Kolkotta market of West Bengal. The marketing channel of orange is not well developed. As indicated in the problems of agricultural marketing, the cost of marketing is probably very high for the farmers in the study area. Due to lack of marketing association or farmer organization, farmers have to sell their products individually.

His book has also given the detail information about their physical characteristics, their varieties, methods for mandarin orange cultivation and system of marketing in Sikkim.

DOA (2003) explains that Agriculture is a backbone of Sikkim's local economy. The department of agriculture and horticulture have already adopted measures to discourage the use of artificial fertilizers and pesticides along with simultaneous substitution of requisite plant nutrients and plant protection measures through available organic alternatives. Sikkim, being a state with mixed farming system grows most of her crops more or less in organic conditions.

Sikkim's economy is mainly dependent on agriculture. Almost 80 percent of the total population of Sikkim live in rural areas and were dependent on agriculture. Moreover agriculture has a significant role on livelihood of rural people and forestry for the economic development of the state.

Shrestha (1998), the book deals about the government horticulture farms and private nurseries in Nepal. His studies found that in 1993 the supply of fruit sapling have been meet by both the government

horticulture farms and private nurseries. But in 1998, total private nurseries are 271 which are distributed all over Nepal because Government of Nepal has encouraged for establishment of the private sector nurseries. There nurseries produces fruit sapling in tropical, sub-tropical and temperate areas based on the location. As a result, increase in farm sizes throughout the country differs from one region to another region. Lastly his studies found that the number of private farms or nurseries increased tremendously in the western and mid-western region of Nepal.

Rajbanshi (1997). carried out research in Mandain orange farming in Manakamana VDC. His studies focused on the productivity and production trend of mandarin Orange. He also explains about the various physical and non-physical factor influencing orange farming and practises of post harvesting. The study has found that the lack of organized marketing system as well as traditional management system of orchards are the main factors which has created hindarance in this field. The studies concluded that orange fruits as a major fruits has become one of the important agricultural activities. The income of farmers has not enhanced to a desired level due to marketing problems and assurance of disease and pests. Farmers or owner made seller store for junar storage for five months period by using paddy straw, leaves of pine for packing and storing the harvested orange. The study also has given various recommendation for removing the problems related to the orange cultivation.

Adhikari (1995-96) focused the agricultural and horticultural cash crops of Sikkim this study focused on the market system from the urban assembly, markets of Sikkim to the transit market of siliguri, west Bengal. The techniques used by Rapid Market appraisal were emphasized

on collecting the relevant data that already existed in the private sector through the use of informal interviews and the better understanding of the complex market system. Basically this investigation focused on supply and price pattern, product quality, Sikkim trade flows and trade pattern used in Sikkim. Regarding the fruits and vegetables market system the RMA's investigation found that Sikkim has high volume of import then exports. Since the exports of Sikkim are agricultural based and are highly seasonal. He had collected the data recorded in two cheak - post i.e. Melli and Rangpo.

Banerjee et.al (1995) deal with the agricultural marketing system of India. Agriculture in India has been on the subsistence level since long time. The green revolution of the late 1960's no doubt, brought about great improvement, but mainly these who had large land holding. On the other hand, the small farmers who form a large segment of the cultivation, individually do not have much marketable surplus for obvious reasons, although their combined surplus came to large figures. The little surplus has forced to sell their goods either in the village or haat Bazar due to poverty and need to purchase other essentials thing of family living. In the meantime, the large landholder farmers were hold their for sometime then ultimately sell their stock to middlemen due to lack or organized markets of their own. So the fact remains that, though the cultivation has undergone considerably improved but the marketing of crops continue to be in the old primitive stage dominated by middlemen. And lastly this study shows that, due to lack of organized marketing facilities, middleman were the main profit earner than the producer.

Shrestha (1996) found in his dissertation that out of total production, about 55 percent is supplied in market and 45 percent is used for home consumption. In orange marketing the middleman are the main

profit earner than cultivators. The cultivators sell their products on the basis of 100 piece (Saikara) or Garden Selling.The package system is old and traditional method in study area due to the lack of rural-urban linkages.

Bose (1990) stated that informative and useful number of fruits crops widely grown in tropical and sub-tropical region in many countries of the world. Beside other specific information on different aspect of all fruit crops are also included. There are more than hundred specis of fruit crops grown in both tropical and sup tropical region, among them orange is one of the important orange fruit. Orange is broadly divided into two types i.e. sweet orange and bitter or sour orange. Mandarin orange is one of the special varieties of sweet orange which are widely grown in North Eastern region of India.

C. Sininsis (sweet orange) is highly polyembryoni species of Chinese origin. the species have great economic importance for its excellent quality as well as for its rootstock value. USA, Israel, Egypt, Spain are some of the commercially important cultivators. Moreover C. aurantium i.e. bitter orange is a highly polyembryori and cold hardly species. The colour of orange is flesh and acidic in taste with better after taste. The species were primarily used as one of the principal rootstock and flowers were used for perfume purpose. His studies also remarked the details about the origin and distribution of mandarin orange.

Ghosh (1987) studied the quality of Khasi Mandarin. According to him, mandarin orange with very thin cover is the most commercial type of orange in North eastern part of India. The Khasis mandarin is mostly confined to sub mountain tracts with an altitude of about 1000m above mean sea level. The Khasi mandarin is a high quality mandarin variety

which have been found to be more juicy with high acid content in the juice. The mandarin orange of entire north eastern region are seedling origin. Still today rarely budded planting material is used for commercial orcharding of mandarin orange. But due to inadequate nutrition, neglect of orchards, absence of proper care gradually decreases the orange fruit production.

Subba (1984), focused on historical development of agriculture and system of agriculture in Sikkim. "Santara" commen name of mandarin orange are grouped in orange reticulate. Humid and subtropical climate is suitable for mandarin orange with an elevation from 600 to 1450 meter above mean sea level. His study mainly focuses on the orange cultivation in Sikkim. Orange is cultivated for 300 years ago, in almost all parts of Sikkim. Due to high demand in national and international market and increase in price shows that the mandarin orange is a dominant cash crop of Sikkim.

Upadhya (1979), studied possibilities of fruit cultivation in eastern hill region of Nepal, and also emphasized about the problem in market system of Nepal. However, the improvement and achievement from fruit production in poor due to many problems like lack of organized markets and marketing information lack of transportation and storage facilities. etc. The study explains method of marketing of fruits and also tried to identify the major problems and remedies for the improvement of the marketing of orange in Nepal. And lastly he had concluded by pointing out that the fruit cultivation plays a significant role to achieve the major purpose of occupation in the eastern region of Nepal.

Feliciano (1974) carried out research in some main fruits and vegetables markets of Philippines about the impact of marketing laws and

regulations, i.e. the legal framework implemented by the government. According to Feliciano, the marketing laws and regulations made by the government were to improve the efficiency of the marketing systems for fruits and vegetables. The fruit wholesaler and retailer from different terminal market centers were interviewed along with five leading supermarkets were incorporated into the study. He found that, although the government tried to regulate the increase in the prices of fruits and vegetables, which encourage the farmer to increase their production.

The previous studies conducted mostly caters to the socio-economic condition marketing production, export volume. However very little study has been conducted on a micro level. This study mostly concentrate in Khamdong Garm Panchayat Unit. The present study aim to identify the relationship between farm size, insecticides, horticultural loan, road, accessibility and production, annual trend line, cost and benefit and market system and problem and prospect

CHAPTER III
RESEARCH METHODOLOGY

This chapter deals with the research methods that have been adopted in this study. In research methodology, this chapter includes the sampling design, tools of primary data collections and data analysis techniques.

3.1 Selection of the Study Area

Khamdong Gram Panchayat Unit has been selected for conducting the study of orange cultivation. With an area of 954.00 sq. km Gangtok district lies in the eastern part of Sikkim. Out of four districts i.e. North, South, west and East, east district is the most densely populated district of Sikkim. Each district has various revenue block which further divided into many gram panchayat units. Each Gram Panchayat unit has different wards. Due to limited time and resources, only one gram panchayat unit has been selected which is situated above the Tista River. Khamdong is the noticeable area for the orange cultivation comprising of five wards.

Orange is cultivated since 300 years ago in Khamdong Gram Panchayat unit. Out of the crops like maize, millet, pulses, cardamom, orange and ginger occupy the first position in the study area. Both are a major source of income in the study area. Due to suitable climate, soil, relief, etc khamdong has bright future prospect. The location map of the study area has been shown in Map 1.

3.2 Source of Data

The study has been based on primary data, which is obtained from field survey. Respondents of study area are the major sources of primary

information. The secondary data have been collected from different concerned office of Sikkim.

3.2.1 Primary Source of Data

Primary source of data is very much important in any research work. In this study primary data are collected through field survey of the sampled households by constructing standard questionnaires. In the fields both qualitative and quantitative information are collected to fulfill the specified objective of this study.

3.2.2 Sampling Method and Sampling Size

As for the primary data collection, field survey was held from 16th June to 5th July 2006. Khamdong Gram Panchayat unit has been selected for the study area. This GPU altogether have 544 households. Among them 341 households cultivate orange in their farmland. From the total orange growing population, 20 percent i.e. only 67 households have been taken randomly as the sample size. This sample size seems to be sufficient to represent the detailed study of the area. The data were collected from both large and small farm holders in the study area.

The choosen numbers of households are the samples of each ward. Table 1 shows the ward wise distribution of sample units of the study area.

Table 1 : Distribution of total Household, Orange Grower and Sample Households

Name of GPU	Ward No.	Ward Name	Total No. of HH	No. of Orange grower	Sampled HH	Percentage of sample HH
Khamdong	1	Dungdung	106	61	12	20.00
	2	Thangsing	117	70	14	20.00
	3	Beng	98	82	16	20.00
	4	Lower Khamdong	115	76	15	20.00
	5	Upper Khamdong	108	52	10	20.00
Total			544	341	67	20.00

Source: Khamdong Gram Panchayat Unit East District, Sikkim, 2006.

3.2.2.1 Tools of Primary Data Collection

In order to collect the required and relevent data from the surveyed household, the following tools were used.

i. Questionnaire

A set of questionnaire was prepared to acquire information about the production trend, cost and benefit of orange cultivation production affecting facts and the problems and prospect associated with the orange cultivation. Mainly interviewing the household heads filled up the questionnaires and in case of non-availability of household heads few interviews were carried out with one of the elder, responsible and knowledgeable members of the households. Questionnaire used for collecting data have been attached in the Appendix I.

ii. Interview

Some selected senior farm manager, officer; local knowledgeable people were interviewed regarding the orange cultivation for the reliable and constructive information. The interview with the farm manager of the study area is shown in the photo 1.

Photo 1: Researcher with Respondent

iii. Observation

Field observation is the key factor for observing the overall situation of the study. We come to learn about many facts which is not filled even in the questionnaire. We collect information by observing the ground situation of orange cultivation and thereby we come to analyze the facts observed by us. These facts can be different from the respondent's response.

iv. Field Diary

A field diary was maintained to record the necessary information, which was not included in our questionnaire. To get a more reliable and accurate information people from other crops growers were also interviewed. Moreover, every incidents and discussion during the field survey were also noted in the field diary.

3.2.3 Source of Secondary Data

Secondary source of data is also important and it is used whenever relevant to complete this study. Secondary data is used for knowing the previous orange cultivation in Sikkim as well as in the study area. Secondary data provides detailed information about orange cultivation in the previous years.

Hence, such data have been collected from different offices, such as Population Census Office (Tadong, 2001), Krishi Bhawan, Tadong, Department of Horticulture (DOH), Sub-dividision Horticulture Department of Pakyong, maps were Forest Department taken from Gangtok, prepared Survey of India (SOI).

Moreover, other information related to this study have been collected from different libraries like, Police Department Library (Sikkim), Sikkim Government College (Gangtok), Central Library (Gangtok), Central Library of Tribhuvan University, Kirtipur,

3.2.4 Data Analysis

The data obtained in the questionnaire from the field survey has been transformed to a master sheet manually and dummy table contains all information have been prepared. The manually processed data have been tabulated according to requirements of the objectives in the study.

Both qualitative and quantitative techniques have been used to analyze data and information. Simple statistical tools such as ratio, percentage, and average have been used to analyze the quantitative data. Maps, tables, charts diagrams are used to analyze the findings of the study.

Least square method of time series analysis ahs been used in order to find out the production trend of orange cultivation in the study area. The equation of least square line has been express as follows.

$Y_c = a + bt$

Where

Y_c = trend value of orange production

a = Y - intercept, when the slope is 0.

b = slope of the least square line.

t = time in year

3.2.5 Experiences from the Field Survey

Actually fieldwork is an interaction between the researcher and the respondents. Sometimes, the real information cannot be found from the respondent due to the attitude of the researchers. So the researcher must be very careful while taking an interviews.

The orange farm manager the Gram Panchayats staff and local people helps to complete this work without any difficulties. Every respondents is not, ready to give reliable data due to hesitation, irritation and lack of knowledge. In such cases, again the next day an interview had to be fixed with another elder, who is knowledgeable members of the household. Thus, it is impossible to obtain detail information unless the researcher has established good relationship with the respondents. However the quality of the information depends on the mutual understanding of the respondent and the researcher. Winning the trust and good will of the respondent is vital.

CHAPTER IV

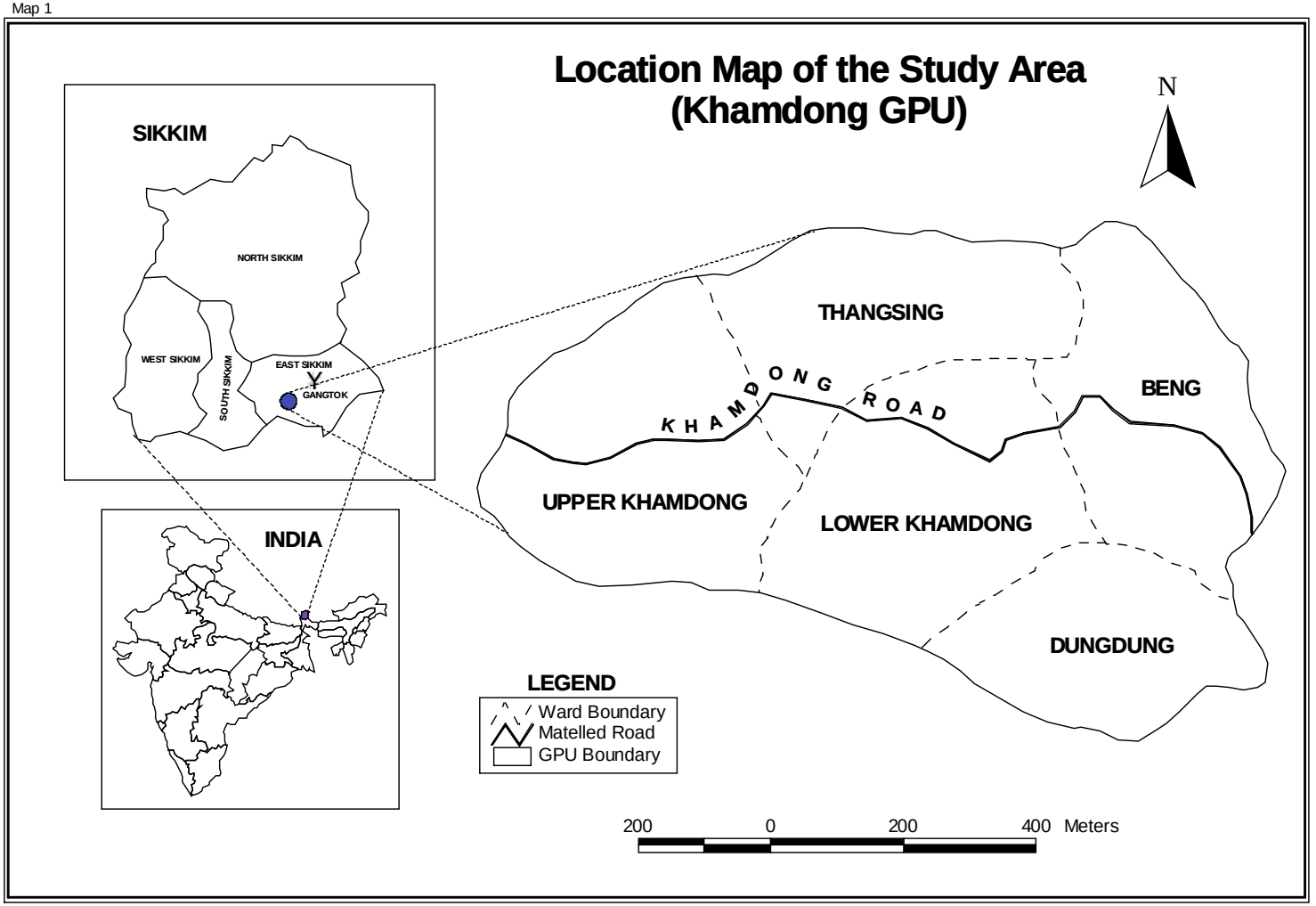
GENERAL BACKGROUND OF THE STUDY AREA

4.1 Physical Setting

Khamdong Gram Panchayat unit is situated in eastern part and parallel to the Tarku Gram Panchayate Unit of South District of Sikkim. The study area comes under the 44 unit Revenue Block. The study area is rectangular in shape and bounded by Tista River in the South.

Khemdung Gram Panchayat Unit consists of five wards i.e. Dungdung, Thangsing, Beng, lower Khamdong and upper Khamdong. The total households of the study area is 544 out of which 341 household are engage in orange cultivation and the total population is 2816 out of which 1609 and 1207 are males and females respectively. Map 1 clearly shows the location of the study area.

Map 1



Prepared by: Lalita Ruchal, 2006

Source: Topo-sheet 1977, Survey of India

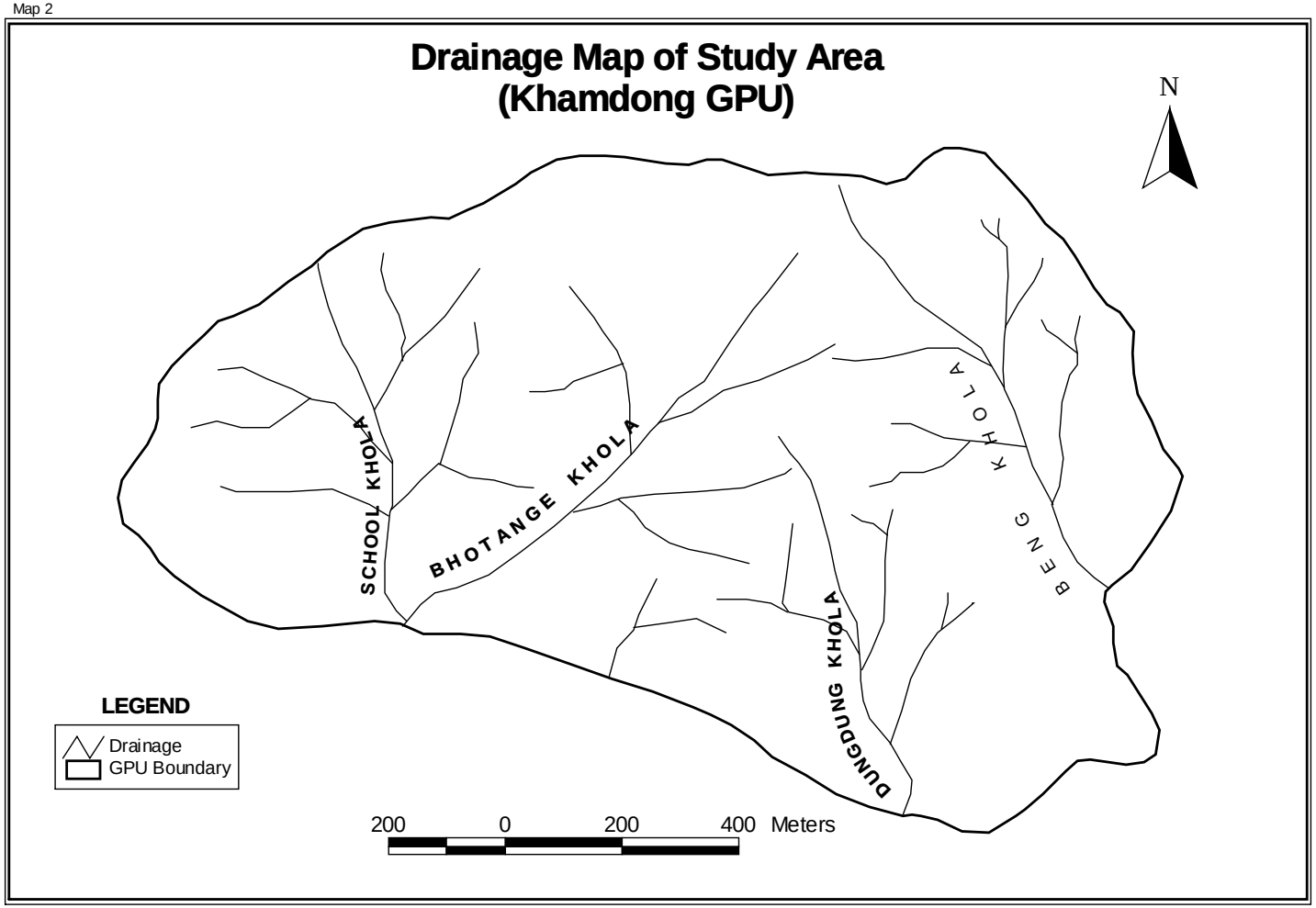
4.1.1 Relief

The elevation of the study area ranges from 650 to 1600 above mean sea level. Entire physiography of the study area is hilly. Cultivation is done in almost all parts of the study area. About 9.5 percent of the study area is covered by forest where the farmers cultivated cardamoms, vegetables etc. though, its climate and elevation shows that this area is suitable of orange cultivation.

4.1.2 Drainage

The study is drained by four important streams i.e. School Khola, Bhotange Khola, Beng Khola and Dungdung Khola. All these streams are perrenial and they are important for the irrigation process. School Khola and Bhotange Khola are the biggest Khola in the study area. These two Khola are in upper Khamdong ward. With the help of these Khola, the local people of the study area cultivated crops and these Khola provide water for household purposes. Thus, the people of Khamdong GPU are highly depends upon these Khola. The volume of water fluctuates from season to season. These streams flows into the main river of Sikkim i.e. Tista. Some of the major river and Khola are clearly shown on the map 2.

Map 2



Prepared by: Lalita Ruchal, 2006

Source: Topo-sheet 1977, Survey of India

4.1.3 Natural Vegetation

Natural vegetation is flora of the given area. It depends upon the soil texture and climatic condition of the particular area. Out of the total area of Sikkim about 270,000 hectare in covered by forests. Similarly in the study area 9.5 percent of the total area is covered by forest. Out of which half area of forest is under the government the local people of the study area manage jurisdiction of half area. The forest type is almost tropical.

In the lowlands, where altitude ranges below 900 meters, due to exteme temperature, Pipal (ficus sirsos), Simal (Bembox-Malbaricum), sirish (Albizzia stipulata), Maua, (Engel Lardtia spicata) Poiyou (Prunus Cevasaides), Panisaj are the main species of the vegetation. In the high altitude where it ranges upto 1600 meters, which lies in the upper parts of the study area, Katus (Castanopsis indica), utis (Alnus nepalensis), chilannae (Schima wallichii), Lapsi (Choeropendias asellaries) Nigalo (Arundinaria intermedia), Okhar (Juglans regia), Chap (Magnolia Chumpbelli) are the main species of the vegetation. Some of the important herbs and grasses such as Shishnu (urtica dioca), tite patti (corchorus capsularis), Amliso (Thysanolaena maxima) and Chireto (Swertia Chirayita) are also found in the study area.

4.1.4 Climate

Small though it may look, one would be surprised to learn that Sikkim possesses diverse climates right from the tropical to tundras. Places in Sikkim with a moderate altitude have a more or less good climate. Though temperature decreases with the increase in altitude, so the upper part of the study area experience cool and pleasant climate

whereas the lower part of the study area is hot. The climate of the study area is tropical and sub-tropical in nature where altitude ranging from 700- 1500 meters above sea level. The valleys of Tista and Rangeet River and their tributaries offer an ideal Himalayan climate for the cultivation of Sikkim mandarin.

Temperature of the study area has not been given exactly due to the absence of meteorological station. Although, in general the temperature varies between 10^0 to 34^0 C which is suitable for orange cultivation in the study area. Rainfall however varies considerably from place to place because of the hilly features. Rainfall starts from June to last of September in the study area. The summer is hot and having high rainfall and winter is dry and warm in the study area. Sometimes, the rainfall and availability of moisture also influence the decision making process of the farmers about a crop to be sown.

4.1.5 Soil

The National Bureau of Soil Survey and Land use planning Regional center, Kokata, Surveyed the soils of Sikkim and furthermore dessified the soils into three taxonomic orders of inceptisol, Entisols and Mollisols and 12 great sub-groups on the basis of nature and properties of soils.

Thus, Soil constitute the physical base for any agricultural enterprises. Soil of Sikkim are slightly acidic with 5.0 to 6.4 pH range. Majority of mandarin growing areas in this GPU are covered by black loamy soil and gravelly hill brown soil. Black loamy soil is found in the lower part of the study area i.e. in lower Khamdong and Beng ward. Similarly gravelly hill brown soil is found in the upper part of the study area i.e. upper Khandang ward and Dungdung ward. Due to favorable,

soil types in lower parts of the study area, it seems to be ideal for mandarih orange cultivation. People growing mandarin use mainly compost (organic) manures only for preserving the soil fertility in the study area. The first three feet of soil are most important in orange growing as they form the major feeding root zone of the tree.

4.2 Socio-Economic Condition

Sikkim has a great diversity in religion, language culture and ethnicity. Under this gram panchayat unit, same condition is observed i.e. distribution of population and these peoples follows different culture and religion.

4.2.1 Population

According to the census of 2001, the total population of Sikkim is 540,851 where male accounts 288575 and female accounts 25276. The density of population is 76 per sq.km.

The total area of the East District is 954.00 sq.km. According to the census of 2001, the total population of the east district is 245040 where male accounts 132,917 and female accounts 112123.

Similarly in the context of the study area, the total population is 2816 out of which 1609 were males and 1207 were females. The study area consisted of 544 households according to the report of the of Khamdong Gram Panchayat Unit.

In comparison to the census of 1991 and 2001, the population of the study area has increased along with number of households. Mjaority of the households of the study area cultivate mandarin orange except few households.

Hence, in order to have a clear understanding of ward wise distribution of household population see the table below.

Table 2 : Wardwise Distribution of Households Population 2001

Name of GPU	Ward No	Ward Name	Total No. of HH	Population			Percentage of Population
				Male	Female	Total	
Khamdong	1	Dungdung	106	213	191	404	14.3
	2	Thangsing	117	336	232	568	20.2
	3	Beng	98	196	152	348	12.4
	4	Lower Khamdong	115	457	290	747	26.5
	5	Upper Khamdong	108	407	342	749	26.6
Total			544	1609	1207	2816	100

Source: Khamdong Gram Panchayat Office

As per Table 2, the Khamdong Gram Panchayat Unit consists of five wards with 544 households unit with total population of 2816, where male accounts 1609 and female accounts 1207 respectively. Each ward holds the population in different number.

Khamdong Gram Panchayat Unit consists of five wards i.e. Dungdung ward, Thangsing ward, Beng ward, lower Khamdong ward and upper Khomdong ward. Dungdung ward consists 14.3 percent of population followed by Thangsing ward with 20.2 percent of population, Beng ward with 12.4 percent of population, lower Khandong ward with 26.5 percent of population and upper Khamdong ward with 26.6 percent of population.

According to the table Upper Khamdong ward leads with maximum population with 26.6 percent followed by lower Khamdong

ward with 26.5 percent. Due to the favourable climate, most of the population are concentrated in these two wards. The population of lower Khamdong, upper Khamdong and thangsing ward is higher than the population of Beng and Dungdung wards.

From this table it has been observed that the Khamdong GPU is a densely populated area in the East District.

4.2.2 Ethnic Composition

These are different ethnic groups resided in the study area. Among such groups Brahmin, Chhetri, Newar, Tamang, Bhutia, Bhujel, Kami, Rai etc are scattered in different parts of the study area. Table 3 has shown clearly the distribution of population according to the ethnic groups.

Table 3 : Ethnic Composition of Population by wardwise

Ward No	Total Sample Population	Brahmin	Chettri	Newar	Tamang	Bhutia	Bhujel	Kami	Rai	Other	Total
1	82	44	-	28	-	10	-	-	-	-	82
2	87	9	26	-	18	5	11	16	2	-	87
3	89	-	-	-	21	-	10	-	58	-	89
4	101	6	7	7	19	20	9	5	-	-	101
5	63	20	-	-	-	2	4	33	-	4	63
5	422	79	33	33	58	37	34	54	60	4	422

Source: Field Survey, 2006.

Table 3 shows the different ethnic groups scattered in the Khamdong Gram Panchayat Unit. Among all different ethnic groups, Brhnmin in the dominant group followed by the Rai community in the study area. In ward No, 4 i.e. lower Khamdong ward high concentration of ethnic groups is observed. i.e. 101 persons. Brahmin represents 79 persons of sampled population followed by Rai community of 60 persons,

54 persons of Tamang Community, and other remaining are from Newar, Bhutia, Kami, Bhujel and other community.

Here, different ethnic groups followed different religions. Such as Hindu, Buddhism and Christians. Most of the Tamang, Bhutia, follow Buddhist. Among all ethnics groups Bhutia community speak their own language and other groups speak Nepali as their mother tongue. Hence the study area is inhabited by different ethnic groups.

4.2.3 Status of Education

In comparison to the census of 1991 and 2001, the literacy rate of Sikkim was 56.94 percent in 1991 but in 2001 it increase to 68.61 percent. Due to the competitive age, education has become fundamental, Available data shows the sharp difference in literary rate between male and female. To understand in details about the literacy rate of the study area, table 4 have been prepared.

Table 4 : Educational Attainment of Sampled Population

S. N	Status	Academic classes	Total No. of Population	Percentage
1	Illiterate	-	74	17.5
2	Primary level	0-5	69	16.4
3	Secondary Level	6-10	131	31.04
4	Higher secondary level	11-12	128	30.33
5	Above collage	Above college	20	4.7
	Total		422	100

Source: Field Survey, 2006

Figure 1 : Educational Attainment of Sampled Population

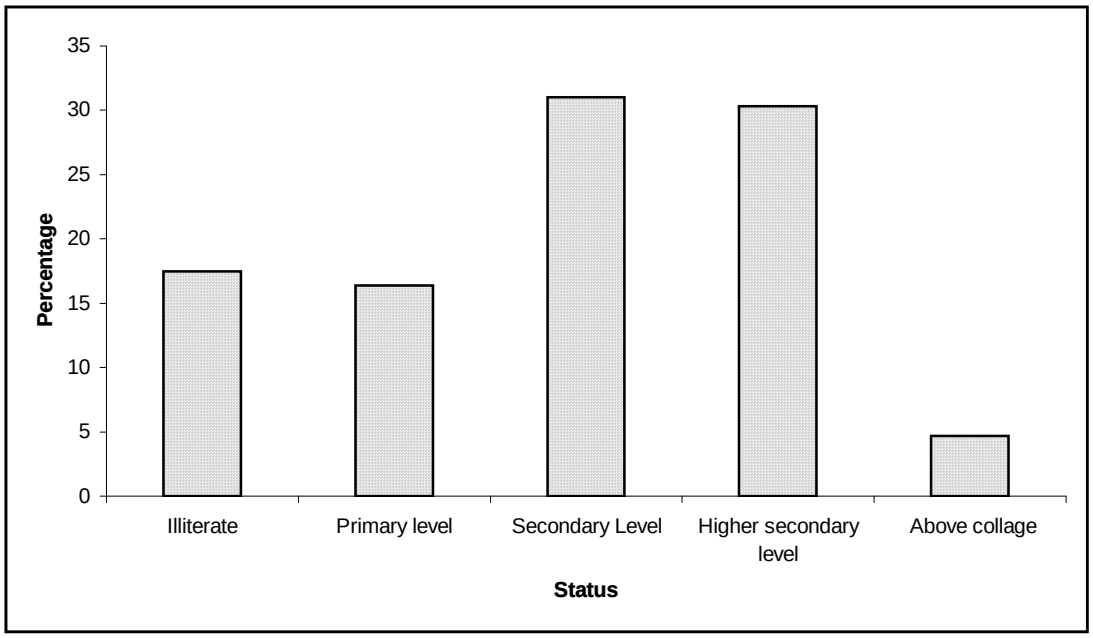


Table 4 has clearly showed that, 17.5 percent of people are totally illiterate in the study area and 82.47 percent of the total sample households are literate including all persons who can write at least their name. The educational attainment of sample population has been divided into five level. They are illiterate, primary level (0-5 class), secondary level (6-10) senior secondary level (11-12), and above college. Majority of the masses lies in the secondary level i.e. 31.04 percent. The majority of the illiterate people are aged and from poor family due to absence of schools in their early childhood.

However, while doing research it has been found that even illiterate farmer are very much conscious regarding the education of their children. They are of the opinion that quality and good education creates lots of opportunities.

4.2.4 Occupational Status

Agriculture is a dominant economic activity of Khamdong GPU. The study area is rural in nature where maximum people of this GPU are

engaged in Agriculture. About 51.18 percent of population of the study area are engaged in agriculture. There is no single market centre within the study area. Their main market is singtam which is 20 km away. Singtam is the second largest market center of Sikkim next to Gangtok. For the selling and purchasing essential goods the people of the study area venture to singam.

People of Khamdong GPU cultivate different types of crops like maize, paddy, millets, wheat, vegetables, ginger etc. A large number of commercial cash crops are grown in tropical and sub-tropical regions but their cultivation and concentration depends on the geo-climatic requirements of the crops. Orange and ginger are the dominant cash crops of the study area. Due to the cultivation of orange the economic status of the farmer from the study area has increased. Its cultivation is beneficial then other crops. Within this Khamdong Gram Panchayat Unit only 46 persons are engaged in government service and maximum people are engaged in agriculture. Maximum job holders people are from upper Khamdong ward and Dungdung ward.

To show the different occupational status of sampled population of the study area in different sector table 5 have been prepared

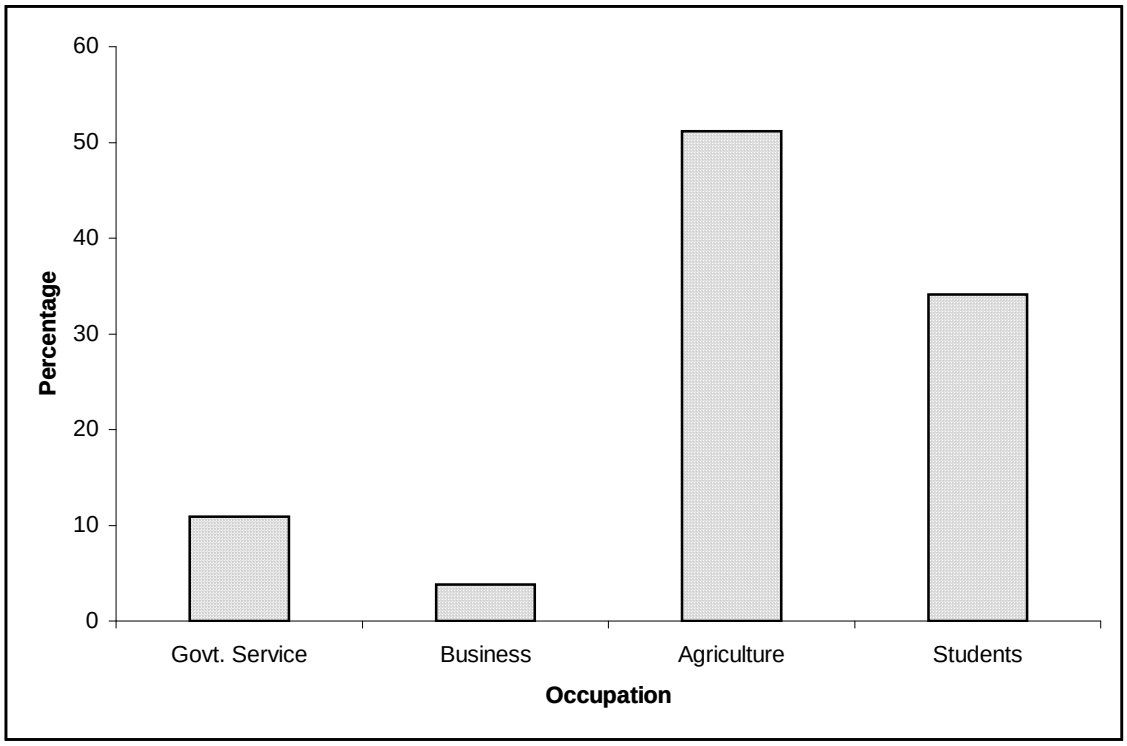
Table 5 : Occupational Structure of Sampled Population

S.N	Occupation	no. of People engaged in different occupation	Percentage (%)
1	Govt. Service	46	10.90
2	Business	16	3.8
3	Agriculture	216	51.18
4	Students	144	34.12
	Total	422	100

Source: Field Survey, June 2006

Table 5 shows the different occupational activities of the sampled households in the study area. According to the table, about 51.18 percent of the total sampled population are engaged in agriculture. In the same way 10.90 percent are engaged in Government services like teacher, nurses, drivers and government employees etc. About 34.12 percent are students in the study area. Similarly, It shows that only few people i.e. 3.8 percent of total sampled population are engaged other occupation like poultry fisheries, and shop-keeping etc. Even the private sectors workers are also included in the business category.

Figure 2 : Occupational Structure of Sampled Population



It has been concluded that the maximum people in the study area are engaged in Agriculture because agriculture is the dominant occupation in comparison to other activities.

4.2.5 Animal Husbandry

Animal Husbandary is important for the economic upliftement of the people. Animals and animals products provide extra income tot he people of the study area. Cattle rearing is gaining momentum because of the drawing demand for milk and milk products from the nearby urban center. Animal waste is a fertilizer which increase production of various crops. Bullocks are instrumental in ploughing the agricultural field. Animals are part of the festivals and religious significance is also attached. Table 6 shows the number of animals and its average size of holding in the study area.

Table 6 : Number of Animals in the Sampled Households

S.N	Types of Animals	Total No. of Animals	No. of Households	Average size
1	Cattle	385	65	5.9
2	Pig	76	35	2.2
3	Goat	318	45	7.1
4	Other	104	28	3.7

Source: Field Survey, 2006

Above table shows that, in the study area, almost all farmers or Households keeps animals. The farmers keep atleast one pair of cow and bullocks. Being a farmer, bullocks and used for plouging their agricultural land. The majority of cow are found in the house of Brahmin, Chettri, community because for milking purpose Rai community keep pig, which is important source of income. Other community keeps almost all types of animals. Goats is another source of income and almost all people in the study area kept goat. Selling of animals is mostly dominant

during the festive season (Dashain). Hence animal husbandry helps to the farmer in agriculture as well as helps him to earn extra cash.

4.2.6 Settlement

The number of households of the study area have been increased with the increased of population. This has been clearly shown in census report of 1991 and 2001. The study area is basically a rural area with dispersed settlement. The distance between two houses are merely 30 meters. These types of settlement are found in three wards i.e. Bang ward, Thangsing ward and Dungdung ward. But remaining two wards have semi-clustered settlement due to senior secondary school, health centre, telephone exchange, panchayat office, and food godown. Out of five ward upper Khamdong is much more developed. Students of other wards have to come to this ward for secondary studies.

4.2.7 Transport and Communication

Transport and communication are a lifeline of any given area. They help in the easy movement of goods and people. All the ward are connected by metalled read except Dungdung which is deprived of read network. Telecommunication is available in all the words. Communication plays a vital role in transferring information. The metalled road of Khamdong is connected with Gangtok. Postal facility is avail in lower Khamdong ward. Numerous public and private vehicles ply between Khamdong and other parts of Sikkim.

CHAPTER V
ORANGE PRODUCTION AND ITS DETERMINING FACTORS

Orange is a dominants cash crop of study area. It has been influenced by various factors like socio-economic and physical factors. As considering the socio-economic factor, farm size, horticultural loan, the use of pesticides and insecticides are dominant influencing factors. Similarly among the factors, elevation has been considered as one of the substantial. The relationship between orange production and influencing factors have described as following ways.

5.1 Economic Factor

Economic factors is the another factor which influences the orange cultivation. All the inputs depends upon the economic status of the farmers. The farmers with high economic status affords all the inputs which are required during the cultivation period and increase their production. On the other hand farmers with low economic status cannot use any imputs as a result it effects production. This is all, due to the lack of income source. Orange farming needs fertilizers, pesticides, sprays etc for high yield in production. As considering the economic factors, farm size, horticulture loan, the use of pesticides and insecticide are dominant influencing factors. The relationship between orange production and individual factors have been described as following ways.

5.1.1 Farm Size and Use of Pesticides and Insecticides

Uses of pesticides and insecticide highly depends upon the farm size. Table 8 shows clear relationship between farm size and the uses of pesticides and insecticides.

Table 7 : Farm Size Group Using Insecticides and Pesticides

Farm Size (acre)	Using Insecticides and pesticides (n=67)				Total	
	No	Percent	Yes	Percent	No.	Percent
0-0.5	8	11.9	10	14.9	18	26.9
0.5-1.0	13	19.4	15	22.4	28	41.8
1.0-1.5	2	3.0	7	10.4	9	13.4
1.5-2.0	1	1.5	9	13.4	10	14.9
2.0-2.5	0	0	1	1.5	1	1.5
2.5-3.0	0	0	1	1.5	1	1.5
Total	24	35.8	43	64.2	67	100

Source: Field Survey, 2006.

Figure 3 : Farm Size Group Using Insecticides and Pesticides

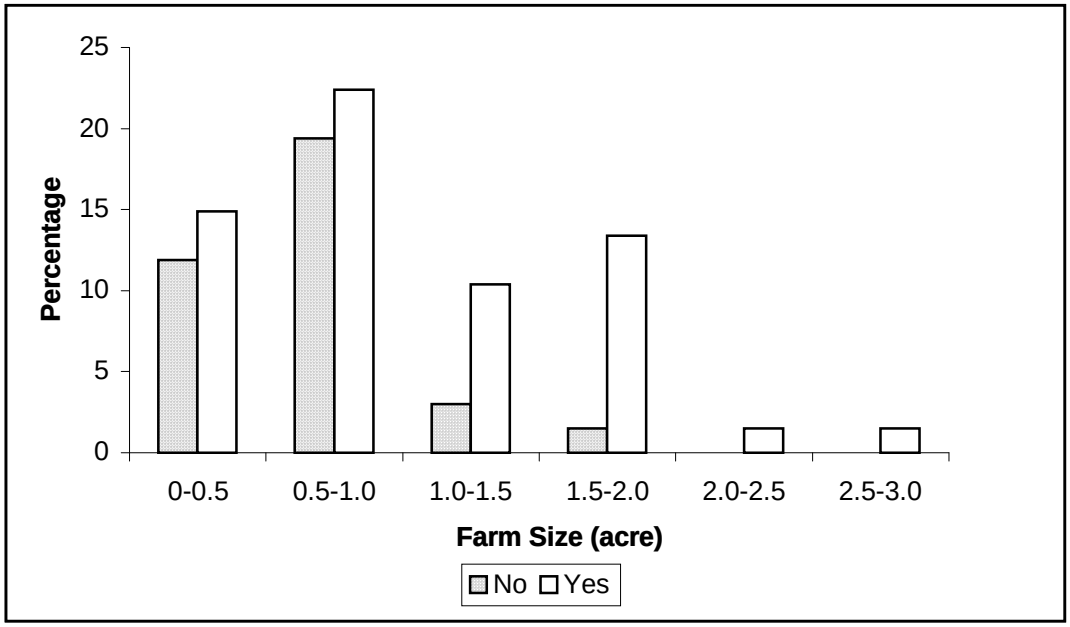


Table 7 shows the relationship between the farm size and the households having the use of insecticides and pesticides. Orange grower having farm size between 0.5-1.0 acre uses maximum insecticides and pesticides inside their orange field followed by farm size between 0-0.5

and 1.5-2.0. It indicates that 64.2 percent of total households uses pesticides and insecticides and remaining 35.8 percent of total households are deprived of such facilities.

5.1.2 Relationship between Farm Size and Income Earned

Table 9 depicts the relationship between farm size of orange field and earning from the orange production.

Table 8 : Income Group and Farm Size Group

Income Group ('000 IC)	Farm size group						Total
	0.0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	
10-20	18 (26.9)	6 (9.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	24 (35.8)
20-30	0 (0.0)	21 (31.3)	3 (4.5)	0 (0.0)	0 (0.0)	0 (0.0)	24 (35.8)
30-40	0 (0.0)	0 (0.0)	6 (9.0)	3 (4.5)	0 (0.0)	0 (0.0)	9 (13.4)
40-50	0 (0.0)	1 (1.5)	0 (0.0)	3 (4.5)	0 (0.0)	0 (0.0)	4 (6.0)
50-60	0 (0.0)	0 (0.0)	0 (0.0)	4 (6.0)	1 (1.5)	0 (0.0)	5 (7.5)
60-70	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.5)
Total	18 (29.9)	28 (41.8)	9 (13.4)	10 (14.9)	1 (1.5)	1 (1.5)	67 (100)

Source : Field Survey, 2006.

Table 8 shows highest number of orange is earning the income of Rs. 20-30 thousand from size of farm ranging from 0.5-1.0. Similarly, the lowest farming have been concentrated in the income group of 50-60 thousand from size of farm ranging from 2.0-2.5.

5.1.3 Relationship between Income and Loan Obtain from Government

Horticulture loan has been essential inputs for more orange production.

Table 9 : Income Group Loan from Government for Horticulture

Income Group ('000 IC)	Horticulture Loan				Total	Percent
	No	Percent	Yes	Percent		
10-20	12	17.9	12	17.9	24	35.8
20-30	13	19.4	11	16.4	24	35.8
30-40	4	6.0	5	7.5	9	13.4
40-50	2	3.0	2	3.0	4	6.0
50-60	1	1.5	4	6.0	5	7.5
60-70	1	1.5	0	0	1	1.5
Total	33	49.3	34	50.7	67	100

Source: Field Survey, 2006.

Table 9 shows the relationship between income group and horticulture loan from government It has been found that 50.7 percent of the households are having the horticulture loan from state government whereas 49.3 percent farmers are getting facilities. Such loan facilities are equally distributed among all farmers in study area.

5.1.4 Income Group Road Accessibility

Orange are sell in the market which basically depends on the access to the road. In the study area some of the houses are not having the road facility result low income obtained.

Table 10 : Relationship Between Income group and Road Accessibility

Income Group ('000 IC)	Road Accessibility				Total	Percent
	No	Percent	Yes	Percent		
10-20	2	3.0	22	32.8	24	35.8
20-30	4	6.0	20	29.9	24	35.8
30-40	2	3.0	7	10.4	9	13.4
40-50	4	6.0	0	0	4	6.0
50-60	0	0	5	7.5	5	7.5
60-70	0	0	1	1.5	1	1.5
Total	12	17.9	55	82.1	67	100

Source: Field Survey, 2006.

Table 10 indicated that 32.8 percent of the total household within the income group of Rs. 10000-20000 is getting road facility which is the maximum in comparison the other income group. Whether 17.9 percent of the total households are deprived of road facilities.

5.1.5 Road Accessibility and Use of Pesticides

Majority of households uses pesticides where there is road accessibility. Road network plays a significant role in uses of pesticides and insecticides of the study area. Below table shows clearly about the relationship between the road accessibility and uses of pesticides and insecticides.

Table 11 : Relationship Road Accessibility and Insecticides and Pesticides

Road Accessibility	Using insecticides and Pesticides				Total	Percent
	No	Percent	Yes	Percent		
No	3	4.5	9	13.4	12	17.9
Yes	21	31.3	34	50.7	55	82.1
Total	24	35.8	43	64.2	67	100

Source: Field Survey, 2006.

Table 11 signifies that in the areas with no road accessibility the amount of pesticides is used by 13.4 percent of households to that of 50.7 percent of households where there is road accessibility. Likewise 4.5 percent of household do not use commercial pesticides in areas with no road accessibility while at the same time in areas of road accessibility 31.3 percent of household do not use pesticides.

5.2 Physical Factors

Orange cultivation in the study area is highly influenced by physical factors like Altitude, soil and its types and climate. Among the various physical factors altitude, soil and climate has explains in terms of orange production influencing factors.

5.2.1 Altitude

Cultivation generally depends upon the altitude. In a study area, most of the respondent reported that the cultivation of orange is highly influenced by the physical factors. Orange grows well in an altitude of 600-1500 m from mean sea level. The study area is most suitable for its cultivation. Regarding temperature, 20 to 24 f is good with an average annual rainfall of 1200 mm to 1800 mm. Among five wards lower Khamdong and Beng produce more orange to remaining than other three wards.

Table 12 : Altitude of Orange Growing Farms

Altitude (m)	No. of Growing Household	Percent
700	32	47.8
800	12	17.9
1200	13	19.4
1500	10	14.9
Total	67	100.00

Source: Field Survey June, 2006

Table 12 shows the percentage distribution orange grow at different of altitude in the study area. It has been found that the maximum households of orange grown lies in the altitude of 700m and minimum number of growers are located at 1500m from mean sea level. It can be concluded that no. of orange grown has been related to altitude at which orange can be grown.

5.2.2 Soil

Orange grows well in the hilly area but its soil type should be favourable for its cultivation. Sandy to medium loamy soil is ideal for Sikkim Mandarin with slightly acidic in nature ranging between 5.5 to 6.5 pH. Mandarin orange can be grown successfully in a wide range of soils. It should be well drained and fertile. In the context of study area, light black and loamy soil along with the gradient is faveurable for orange cultivation.

Abundant soil moisture and rain result high juice concentration and low acid content. Orange trees are sensitive to high concentrations of salt and water stagnation. The first three feet of soil is most important in orange cultivation as they form the major feeding zone for the roots of the tree.

5.2.3 Climate

The mandarins grow well in humid summer and warmer winter. All the tropical and subtropical with elevations from 600 to 1500 m about MSL and rainfall ranging from 85 to 300 cm uniformly distributed from march to November are suitable for its cultivation. Temperature ranging of 32^0 C is best for orange cultivation.

But in the context of the study area, temperature ranges from 12^0C to 34^0C. Light, and wind are also important for the plant. Low humidity gives good colour and appearance. According to the respondents excessive rainfall and extreme heat damaged the prospects of good harvest.

5.3 Nursery Management of Orange

According to the respondent of the study area, maximum cultivation is based on seedlings and propagation method is carried out largely through seeds than vegetative methods like budding. The advantages of seed propagation are uniformity in growth and bearing times, and initially free from any transmissible diseases including viral diseases. For raising quality nucellar seedlings of mandarin from seeds, the followings steps are required.

5.3.1 Selection of Mother Plants

In the context of study area healthy with highly bearing tree between 20 to 50 years of age should be selected. Tree should be healthy with green leaves which is free from diseases. The bearing capacity of selected tree should be 1000 oranges and above. These healthy mother trees should be selected as the sources for collection of seeds during the months of November - December when the fruit reaches fully mature stage which is clearly visualized in Photo 2.

Photo 2: View of mature orange

5.3.2 Collection of seeds

After picking the fruits from matured mother plants, farmers extract the healthy fully developed seeds from the fruits by removing the peels. Then after seeds should be washed with clear water and discard the seeds that floats on the water. Seeds should be dried under shade and treat the seeds with medicine "Thiram" (1gm/kg of seeds) to avoid infection. Seeds should be sown as early as possible after extraction and preferably within 7 days otherwise they may loose their viability (Dr. Akali Sema. 2006).

5.3.3 Primary Nursery Raising Methods

5.3.3.1 Sowing of Seeds on Ground/bed

In Sikkim, the best sowing season is spring.. Seed beds are prepared for sowing seeds for large scale purpose. firstly, clear the weeds and plough the soil properly by breaking the clods. Place the dried leaves and dead twigs on top of ploughed soil and burn it. The indigenous practice is done to reduce the incidence of diseases like damping-off of seedings and rotting. Separate beds of 3m x 60 cm should be made. The size of bed especially the breadth of bed should not be large as it gives problems to nursery man for weeding and uprooting of seedlings.

Seeds are sown at a depth of 1 to 1.5 cm with spacing of 2.5 to 3.0 cm in rows. After sowing, light shower watering should be given. The seed take about 20-25 days to germinate after sowing. Optimum soil temperature in between 80-90^{0}F but even 55^{0}F is enough for good germination. During germination seedlings should be protected by plastic covers or shade nets. (50 % shade).

5.3.4 Secondary Nursery Raising

When the seedlings reached 4 - 5" tall with 8 - 10 leaves, they are ready for transplanting. Farmers discard all markedly smaller or taller seedlings to ensure uniform nucellar seedlings before transplanting to polybags. The selected seedlings should be treated with "Rhidomil". Seedlings with twisted tap roots should be avoided for secondary nursery. When the seedlings are 6 to 9 months old, they uprooted with the help of fork carefully to minimize the root damage and then transfer it to the polybags, filled with sterilized soil mixture.

Photo 3: Showing seedling transfer to the Polybags

5.3.5 Planting and Spacing

The seedling plants of mandarin orange with 120 to 150 cm high and 2 to 3 years old are ready for planting in the orchards. As the study area is moist place, the plants are dug out with bare roots or with a small ball of earth. The topmost soil is mixed with compost fertilizers. After planting watering should be done if there is no possibility of immediate rainfall.

Normally irrigation is not done in the study area. However, irrigation is necessary from November onward. Irrigation can be done either by basin or ring or drip system, because cannel method of irrigation

is not recommended due to frequent landslides. Table 13 clearly shows the planting spacing adopted by the farmers.

Table 13 : Planting Spacing Adopted by Farmers in Study Area

Type of Seedling	Unit	Pit Size	Row to Row	Plant to Plant
Budded Plant	Feet	2.5 x 2.5 x 2.5	12	12
Seedling Plant	Feet	3x3x3	18	18

Source: Field Survey, June 2006

Table 13 Shows the planting spacing adopted by the farmers in the study area. Almost 85 percent of the total sampled households cultivated seedling orange. Only 15 percent cultivate budded orange. Budded plant needs 2.5x2.5x2.5 ft. pit size whereas seedling plants needs 3x3x3 ft. pit size. That means the pit size is different among budded and seedling plant. Budded plant spacing is 12 ft. apart from one plant. But seedling plant need 18 ft of spacing. Hence spacing is depend upon the varieties of roots tock.

5.3.6 Fencing

Fencing is very important for protection of the plants. Newly planted seedling required fencing to protect the seedling from peoples and animals. In the study area, farmers fences their plant by Bamboo which is 4 to 6 ft. high.

5.3.7 Manuring and Fertilization

In the study area especially people prefers to apply compost fertilizer due to the loss of fertility of soil. This is the traditional system of nutrient application practiced by the farmers of Sikkim so far. However, with the increase in the demand for orange to the farmers in recent years, have realized the importance of organic fertilizer. The

farmer prepares organic fertilizer by themselves. Orgnic fertilizer is a mixture of nine items, they are banmara, angari, gante, dhokraphul, garlic, alchohole, chilli, titapatthi and leaves.

The department started taking up rejuvenation programme since 1976. Since then the farmers have started adopting scientific method of orange cultivation in Sikkim. In the study area soils is deficient in zinc, magnesium and boron and as such micro-nutrient spray is very essential for better growth and cropping of orange fruits. Fertilizer and manure should be applied before mulching during March and September. The field trials show that orange needs mainly nitrogen fertilizer for normal growth. The application of either 45 kg FYM or 1.5 kg N per tree gives almost double yield of fruits over control to semi-decline 40 years old mandarin trees. For young trees (12-15 years) 20 kg FYM +500 gm nitrogen per tree also give the economical fruit productivity. Doses of fertilizer are according to the age of plants. Table 14 shows the system of fertilization.

Table 14 : Doses of Fertilization

Age of orange tree (Year)	Compost (kg)	Nitrogen (gm)	Phosphorus (gm)	Potash (gm)
1	10	60	30	30
2	15	120	60	60
3	20	180	90	90
4	25	240	120	120
5	30	300	150	150
6	35	360	180	180
7	40	420	210	210
8	45	420	240	240
9	50	540	270	270
10	55	600	300	300
Above 10	60	700	350	350

Source: Horticulture Department, Gangtok, 2005.

Table 14 defines the doses of fertilizer used for orange cultivation. It shows that the doses of fertilizer and manure are applied according to the age of the orange plant. Table 16 doses are in ascending form, smaller the age less will be the dose of fertilizer. One year of orange tree needs only 10 kg compost, Nitrogen 60 gm, phosphorus 30 gm and potash 30 gm. similarly 10 years of orange tree needs 55 kg compost, Nitrogen 600 gm, phosphorus 300 gm and potash 300 gm. Matured tree needs more fertilizer so that the quantity in the production of fruits does not decrease.

5.3.8 Intercrops with Orange

Almost all people of the sampled households, sow other crops like pulses, maize, soybean, ginger chili, turmeric, tapioca etc. in side the orange field for extra income which is clearly shown in photo (…). Among all, intercropping of maize is common in the study area. Soybeans is also sown because the feather roots of the soybean is good manure for orange tree. Only 20 percent of the total sampled household do not sow any crops inside their field. Actually the interspaces in an young orchard can be economically utilized by growing short duration crops till the orange plant bear fruits.

Photo 4: Showing inter crops with maize

5.3.9 Weeding and Hoeing

Weeds occur naturally. Frequent hoeing and weeding are essential in keeping down the weed growth and to maintain porosity during the

summer season. Hand digging should be done to avoid injury to the roots. Frequent hand weeding and light tillage thrice a year is recommended by farmers. Better will be the cultivation in the absence of weeds. Light hoeing in mandarin is essential in order to prevent weed growth and to maintain a good physical condition of the soil. However weeds determine the future prospect of orange and very harmful for plant growth.

5.3.10 Prunning

Generally prunning is necessary to open up the trees for proper ventilation and to provides more chances for the branches to bear fruit. Prunning is to remove the diseased and dry branches. From November onward pruning is done. Prunning of a young orange tree results to the development of the mechanically strong tree. No prunning is usually done after the tree starts bearing fruits except prunning of dried and diseased branches. Prunning is not widespread in the study area.

5.4 Distribution of Orange of Sampled Household by Wardwise

Orange is the dominant cash crop of Sikkim. In the study area, Ginger and orange occupies important position. The altitude of the study area is between 650-1600 meter. Almost all the inhabitants of the study area cultivate orange. Farms of the orange are not equally distributed among the wards. Production depends upon the farm size of the of the study area so the production of these wards are varied. Due to favorable soil or altitude, lower Khamdong and Beng produces more. The ward-wise distribution of orange in Khamdong Gram Panchayat units have been shown in Table 15.

Table 15 : Wardwise Distribution of Orange

Ward No.	Sampled HH	Percent	Area in Acre	Percent	Orange Production in 100 piece	productivity in 100 piece per arce
1	12	17.9	16	22.8	480,000	30,000
2	14	20.9	12	16.9	381,600	31,800
3	16	23.9	18	25.3	583,200	32,400
4	15	22.4	17	23.9	561,000	33,000
5	10	14.9	8	11.3	259,200	32,400
Total	67	100	71	100	2,265,000	1,59,600

Source: Field Survey. 2006.

Table 17 shows the area and ward-wise production of orange in the study area. The production and the area of these wards are not similar. The area and production of ward no 3 and 4 is higher in comparision to the other wards. This is so, due to the favorable altitude and other geographical features. 67 households produce orange in an area of 71 acre in the study area. The main occupation of the study area is orange cultivation People are very conscious doing cultivation because orange is very beneficial than other crops.

CHAPTER VI

PRODUCTION TREND OF ORANGE CULTIVATION AND MARKET SYSTEM

6.1 Trend of Orange Production from 2000-2005

Orange is cultivated since long ago in the study area. Among the total cash crops of the study area, Ginger and orange occupy high priority. Farmers are more interested towards their production and try to increase their farm size due to its high commercial value. Moreover, some household reported that in 1995 their farm size was small but now size of farm are larger, that means the farmers of the study area are more interested about their production. But due to some geographical condition, diseases, pests, hailstone, results to a gradual decrease in vigor and trend of its production. The condition seems to be more prevalent in old orchards rather than in new ones. Thus, it has been concluded still today they are more interested towards orange cultivation.

Table 16 : Area and Production of Orange from 2000-2005

Years	Area in Acre	Orange production in 100 piece	Percentage increase of orange production
2000	42	13860	-
2001	46	15180	9.52
2002	58	19100	38.09
2003	66	21780	57.14
2004	68	22440	61.90
2005	71	23430	69.04

Source: Field Survey, 2006.

Figure 4 : Production Trend of Orange from 2000-2005

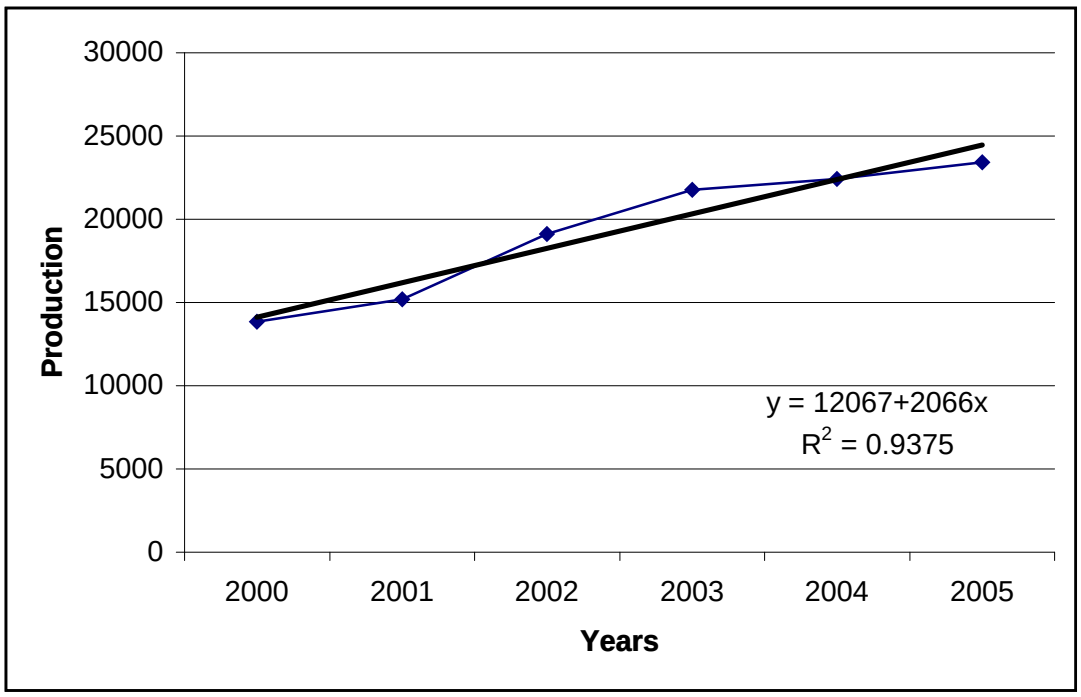


Table 16 signifies the area, production and trend of orange in Khamdong Gram Panchayat Unit. Six years of orange production has been studied i.e. from 2000 to 2005. It shows that the trend of production has been increased during these six years. The orange production is increased from 9.52 to 69.04 percent within six years i.e. from 2001 to 2005. The production increased with the increase the farm size. Most of the farmers those who have plenty of land increased their farm size yearly due to its high market value.

The linear trend of orange production has been examined and measured by using least square method of time series analysis. The determined description of equation has been explained methodology chapter 3. The linear increment of production of range is found to be 2066 piece in hundred. The rate of increase in every indicated by the slope of least square line. The determine of correlation coefficient (R^2) shows that the independent variables (time) has explained the 93 percent of variable to found in dependent variable that is production of orange.

While doing research, it has been found that small farm holder of few houses has decreased in their production due to lack of input. But the trend is increasing due to increased in farm size. Economic status plays a vital role in orange production. Poor farmers cannot use sufficient inputs which is needed for orange and hence decrease in production.

According to the farmers interviewed in the study area, orange cultivation is practising since 300 years ago. In the case of the area, it has been increased from 42 acre in 2001 to 71 acre in 2005. Large landholders planted orange every years and mostly engaged in orange farming. Table 16 shows that the trend of orange is increasing. Hence there is a better prospect for orange cultivation in Khamdong .

6.2 Market System of Orange Cultivation

Market plays a significant role for the development of fruit farming of a particular place. One of the important factors that determine the price is market information. However development of infrastructure is vital. Good quality of fruits are sold in good price. It is a accepted norm that marketing starts when products are produced. Marketing of fruits depends upon the transportation, storage facilities etc.

Most of the orange fruits of the study area finds its way to Kolkotta, Silguri and Gangtok. The fruits are brought to important marketing centers such as Singtam, Jorthang, Melli, Legship and Rangpoo. In the study area, because of quality of the orange the farmers need not to carry their product to the market. Talking about the past they had to do so. For the past few years it is the business men who used to come and make purchase from the farms. This provides opportunity for farmers to sow winter crops at the time of harvesting.

Much of Sikkimese orange fruit is destined for export to Bangladesh and Kolkota. This is due to huge production during the month of November and December. Farmer of the study area supply their productions to the traders. Prior to harvest the farms are leased out for a fix amount sold. Orange in the local market are supplied by the farmers having small farm size.

Considerably quantity of fruits is consumed by fruit preservation factory located at Singtam, east district, nearest market of Khamdong Gram Panchayat units. Orange squash Sikkim "supreme" is a famous product of this factory. The fruits are stored for about a month even at ordinary room temperature. However, they loose their marketable appearance, after a month of harvest.

6.3 Channel of Marketing in the study Area

Marketing channel of the study area is very simple. Maximum farmers follow the similar tracts of channel i.e. the channel through which the product reaches to the market are the producers to wholesalers to contractors and not the farmers themselves. Hence the pre-harvesting contractors and middleman are the most important marketing channel in the study area. The pre-harvest contractors in the study area dealing in large quantities and sell the products directly in the Siliguri market and the small farmers used to sell their products in the Lall market of Gangtok (capital of Sikkim) . It is the brokers or the middle men that have been getting much benefit than the real producers. The marketing channel of orange in the study are has been shown in figure ….

6.3.1 Farmers/Producers

Producers refer to the orange growers of the study area. Maximum producers of the study area use to sell their total production to the pre-harvest contractors. Only the small garden holders sell their products in

the local market centre i.e. Singtam. The orchards are purchased by the pre-harvest contractors about two or three months before to the maturity of fruit, known Garden selling. The small farmers sell their products in the market place i.e. Haat Bazaar and purchase their family necessary items.

6.3.2 Pre-harvest contractors/Brokers

In the study area, maximum sampled household sell their product to the preharvest contractors. Pre-harvest contractor plays a significant role in marketing. They have a good knowledge about the fruits. By estimating total production, they take the orchards on contracts before the harvesting period. After harvesting they sell orange directly to the wholesalers and sometime they sell their orange in the local markets like Singtan. According to the respondent, the labor for picking orange comes from neighboring country, Nepal.

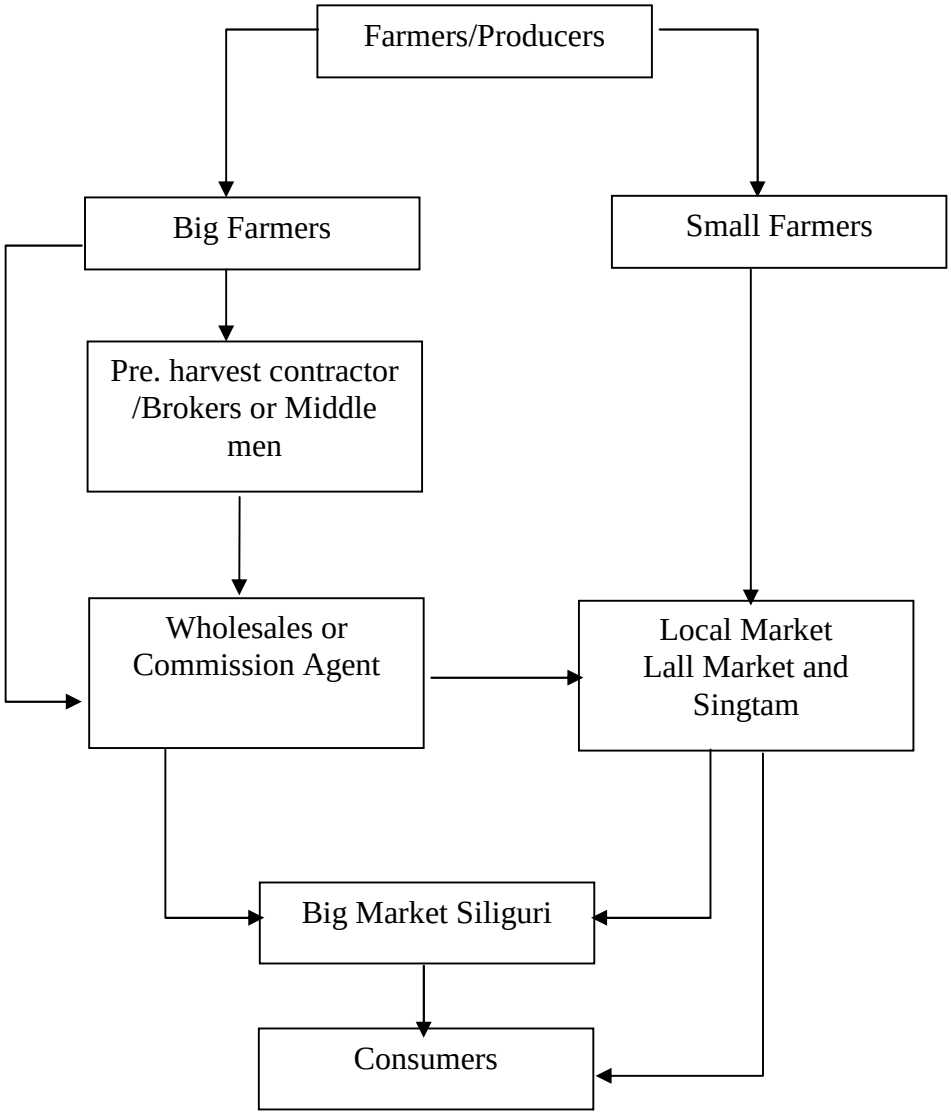
6.3.3 Commission Agent

Commission agent are generally called as 'wholesalers'. These people are quite different from pre-harvest contractors. They collect the fruits. from producers or pre-harvest contractors and the collected fruits are transported from Sikkim to Silguri. And lastly they sell to the retailers. Hence they play a vital role in marketing of orange.

6.3.4 Local Traders/Retailers

These activities are very common in the periodical market. They sell fruits on footpath, roadside etc. They take fruits directly from commission agent and the pre-harvest contractors. These types of activities are prominent in the urban centers. They sell fresh quality of orange. Major quantity of orange pass through the hands of retailers and local traders

Figure 5 : Marketing Channel of Orange



6.4 Selling method adopted by farmers of study Area

In the study area, the maximum farmers sell the fruits by garden selling on contract basis. Sometime the small garden holders sell their products in nearby market. Sometimes farmers themselves carry products and sell in 100 pieces at Rs. 30. Table 17 shows the methods of selling orange.

Table 17 : Methods of Orange Selling by Farmers

Methods of selling	Sampled	Percent
Garden selling	30	44.8
Market selling	20	29.9
Selling in 100 piece	17	25.4
Total	67	100

Source: Field Survey, 2006.

Table 17 shows the methods of selling adopted by the farmers of the study area. About 44 percent of the total sampled household lease out their garden on contract basis. About 29 percent sell to wholesaler or market selling and only 25 percent sell in 100 piece. Moreover maximum number of farmers sell their product in Garden. Due to the transportation problem, high cost of labor, unorganized marketing and due to lack of time, the maximum producers adopted the method of Garden selling.

6.5 Economic Change by Orange Production

According to the respondent of 67 sampled household of the study area, due to the fluctuation in price and production, the economic return is not stable. This is due to the geographical conditions and other internal problems.

While taking an interview, about their economic change by orange cultivation, out of the total sampled household only 66 percent got changed households were benefited and other 34 percent are remain constant. Thus, this disparity is due to a number of reasons, like small farm size, low income, lack of knowledge and so on.

6.6 Causes for Orange Cultivation in the Study Area

Mandarin Orange farming is a very good source of income generation and studies have revealed that orange farming is much more profitable than other cereal crops farming. Most households followed this farming as a way to escape from poverty and traditional subsistence farming. Numbers of household engaged in this farming are steadily increasing.

Mandarins is the important commercial fruit of Sikkim. Mandrain is a high quality variety of orange. It covers the largest area in Sikkim. In Sikkim only one varieties of orange is cultivated which is generally propogated from seed. The tropical or sub-tropical climate is very suitable for its good cultivation. Actually the main reason for orange cultivation is that it can adopt itself to different kinds of soil. But it should be fertilized.

Orange is the main cash crops of Sikkim. For its good extra appearance, it needs little heat to ripe. According to the respondent, maximum number of farmers gave importance to orange farming due to its commercial value. Table 18 shows the causes for orange cultivation in the Khamdong Gram Panchayat Unit.

Table 18 : Cause for Orange Cultivation in Khamdong G.PU

Causes	No. of sampled HH.	Percentage
Traditional practice	9	13.4
Income more	41	61.2
Self interest	17	25.4
Total	67	100

Source: Field Survey, 2006.

From Table 18 indicates that only 13.4 percent of the people cultivate orange as traditional practice and 25.4 percent for their self interest. The remaining 61.2 percent of the people cultivate orange to gain income which is the highest number among varied causes. So, we come to know that the main causes for the people of Sikkim to cultivation orange is to earn extra income for their survival.

6.7 Cost and Benefit of Orange Cultivation

The cost of cultivation differ according to the soil, slope, altitude, labors. The cost depends upon the use of different inputs. required for orange cultivation. "Output depends upon the inputs" Good inputs, better will be the outputs.

In the study area, orange and ginger are the dominant cash crops. Maize, paddy, millet, wheat cardamom are also grown in the study area. Orange occupies vital position in the study area due to favourable attitude, soil, climate etc. Table 19 shows the cost and benefit which is calculated from the information collected from the sampled households during the field survey.

Table 19 : Cost and Benefit of orange

Crop	Production cost per Arce (in Rs)	production in 100 piece per Acre	Mareet price per 100 piece	Output	Beneift per acre
Matured mandarin Orange	8200	330	80	26400	18200

Source: Field Survey, 2006.

Table 19 shows that due to high price 90 percent of the total sample household in the study area sell their products in full maturity stage. There are different varieties of orange, but in Sikkim, only mandarin orange is cultivated. Because Sikkim is favorable only for mandarin. According to this Table 19 cost for orange production in 1 acre is Rs 8200.

According to the farmers interviewed in the study area, 55 trees are successfully grown in 1 acre land. The average yield production of mandarin orange is 600-700 fruits per tree. But a healthy tree can yield upto 2000 fruits.

As per Table 19 the market price of mandarin orange is 80 Rs. per 100 piece during harvesting period due to high production. But it doesn't remain constant, the price fluctuates due to various factors like natural calamities, fertilizers, unscientific planting process, improper cultural practices, unscientific intercropping, under nutrition and ageing of the tree. Moreover in the summer, the price is increasingly high i.e. Rs 200 per 100 piece. Though the cost of production of mandarin orange is high, nevertheless the benefit earned is also high. So in terms of cost and benefit of orange cultivation, it is highly profitable than the other crops grown in the study area.

CHAPTER VII

PROBLEMS AND PRESPECT OF ORANGE CULTIVATION

7.1 Problems of Orange Cultivation Faced by Farmers

Though orange plays a significant role in the economy of the khamdong gram panchayat unit but still today the farmers are facing some problems in orange cultivation. Moreover this research is aimed to identify the problems and prospects of orange cultivation. Some of the problems faced by the farmers of the study area are discussed in priority order. Using priority Index (Dale, 2004) weighted direct ranking is one of the most widely sued tools for prioritization of the problems faced by farmers in the study area.

In weighted direct ranking, the pattern of priorities in arrived at by calculating the total number of scores. In most instances, the information providing units are households or individuals. The information is gathered by constructing questions in three priority order during the field survey. Information are gathered by taking the survey of 67 households and each households has been asked about the problem in priority basis. The scores have been weighted by the weight numbers, 3 for the first, 2 for the second and 1 for the third priority option, biased on which an index of aggregated priorities, (Priority index) has been calculated. The mathematical formula of the index is:

$$\text{Priority index} = [(f_1 \times 3) + (f_2 x) + (f_3 \times 1)/r]$$

where,

f_1 = number of first priority

f_2 = number of second priority

f_3 = number of their priority

Table 20 shows that altogether 63 of the 67 respondent complained that store house as one among their three priorities, 35 of whom had it as their first priority, 25 as their second priority and 3 as their third priority order.

The order of priority is specified by the number I, II and III priority option respectively. The aggregated result of the study area is shown in table 20.

Table 20 : Weighted Ranking of Problem Associated to Orange Cultivation

Problems of Orange Cultivation	Scores			Total	Priority Index	Rank
	3	2	1			
Store house	35	25	3	63	2.44	I
Marketing	10	13	35	58	1.35	II
Capital	13	9	11	33	1.01	IV
Improved varieties	9	17	18	44	1.17	III
Total	67	67	64		198	

Source: Field Survey, 2006.

The priority indexes range from 2.44 to 1.01. Here maximum number of households were deprived of storage facilities followed by marketing, improved varieties and capital. Ranks are given to the problem based on the absolute values of priority index.

7. 1.1 Lack of Storage

First rank is given to the lack of storage obtains from priority index value 2.44 indicating seriates the problems among the all other problem.

Due to the lack of storage producers have to sell their products soon after the harvesting. Some farmers made seller store for four-five month by using paddy straw, leaves of pine. But this is only for few months. After that they have to sell. Thus maximum farmers were of the opinion that if there is good storage facilities in the study area they can sell their products any time specially in summer season at high price. But due to lack of storage facilities, orange grower have to sell their products at low price.

7.1.2 Lack of Organized Market

Lacks of organized markets obtained from the priority index value of 1.35 and stands for rank II indicates relatively less severe as compared to storage problem. Maximum household reported that the first problem face by the farmers in marketing. Market plays a significant role for the development of orange farming. Due to illiteracy and unawareness the farmers have not good knowledge about market. So they to sell their product to the middle men. Moreover they do not have a co-operative. Only the few sell their products directly to the consumer but maximum farmers adopted the method of garden selling due to unorganized market system. Even in all the district of Sikkim, farmers faced the problem of marketing. Hence the middleman are the main profit earner due to lack of organized market in the study area.

7. 1.3 Problem of Financial Institution

In Table 22 capital is stand as 3rd rank of priority order of problems faced by orange growers in the field. In the study area, maximum farmers are poor. "Output depend upon the inputs". So due to poverty, farmers are not able to afford every needs which are required for

orange production. Hence, they are forced to adopted the traditional method of cultivation. As the result low income has been obtained.

7. 1.4 Lack of Improved Varieties of Seed

One of the important problem face by the farmers of the study areas is seed having the priority index value of 1.17. The quality of fruits depends upon the quality of seeds. The seeds used by the farmers are often inferior in quality. Due to poverty the use of improved high yielding seeds are not widely practicsed except few households in the study area. Hence they are forced to use local varieties of seeds which yield average quantity of fruits in comparision to other seeds.

Besides these, there are other problems faced by the orange grown in the study area are discussed below.

7. 1.5 Natural Calamities

The natural calamities that destroy the orange orchard are hailstone, strong wind, heavy rainfall, etc. Its impact is very dreadful. The farmers are suffering from the impact of hailstone because the large size hailstone destroys the plant which in turn affect production. Likewise, heavy rainfall and strong wind destroy the seed at the time of sowing and also destroy the orange orchard at the time of flowering. To prevent these calamities the farmers should adopt one method which is to cover the tree with net. But this method is very costly. Only few farmers use this method and can prevent the destruction but the poor farmers cannot use it. So, they suffer loss from these calamities. However, this results in fluctuation of productively in the study area.

7. 1.6 Common Fungal Diseases and Pests

A. Diseases

Majority of the farmers in the study area compelled the problem of fungal disease and pests. Such diseases and pests are Gummosis, scab, powdery mildew, leaf minor, borer with their symptoms has been explained below separately.

a. Gummosis

Gummosis is the diseases which is very dangerous to orange plants. It may spread over whole garden which directly hamper the quality and production of crops.

Symtoms

Symtoms of this diseases are the excretion of gum from the bark of the trunk. The bark crocko open and in the later stages dries up and falls off. Cow urine is found useful in controlling this disease. Water stagnation should be avoid during rainy season. Bordeax mixture should be applied on the tree trunk upto 60 cm height from the ground level "According to the farm holder these disease can be controlled, by inserting cotton soaked in petrol or kerosene in the tunnel and plug it with mud.

b. Powdery Mildew

This is one of the major diseases which gradually damage the leaves and twings of a tree. About 40 percent of the sampled household are facing such problem in the study area.

Symtoms

Initial symptoms of these diseases are gradually growing whitish powdery on young leaves and twings. The affected leaves and twings get distorted and in severe condition it will drop down. The disease can easily be controlled by dusting with sulphus or folian spray of 0.1 percent per 1 litter of water.

c. Scab

Scab is another fungal disease which causes due to the temperature. The disease occur in low temperature and high humidity. It decrease the quality of mandarin orange.

Symtoms

The symptom of scab and powdery mildew are similar. Scab infection also occurs on the leaves, twings and fruits. The leaves become mis-shaped and wrinkled. Such cases are seen in some household in the study area. Such disease are controled by spraying boardex mixture. Farmer usually spray cow urine to control almost all types of diseases in the study area.

B. Common Pests

a. Orange Leaf Minor

It is a serious pest in the nurseries as well as in young and old orchards. The larvae usually underside leaves make serpentine mines, which are silver coloured because of entrapped air. The mining effects badly distort the leaves resulting in their curling and defoliation during severe attack.

This problem is faced by almost the farmers of the sampled household of the study area. To control this disease various measures are

adopted like spay of phosphomiden, cow urine, rogor, etc. The photo ( ) below indicates the disease.

Photo 5: Showing problem of orange leaf minor

b. Orange bark borer

The bark and shoot bores are serious pests in orange, especially neglected and old orchards. The cater pillars feed on bark and thus destroy the translocation tissues of the bark. Since they feed at night, they generally escape unnoticed but their presence on an infested tree in indicated by the presence of hanging loose mass of fine pieces of woods and of excreta, mixed with silky adhesive material on the branches and stem of the tree. This diseases are control by inserting petrol into the holes and plugging the holes with the mud.

c. Trunk borer

The farmers of the study area noticed about this diseases. According to them, the tree dies eventually due to infectation. This is serious problem faced by the producer.

d. Fruit sucking moth

This is most common in the study area which directly damaged the fruits. The moth suck the juice of ripe fruits. The fruit usually drops

within a few days. In such cases, the fruits has low market value. The pre-harvest contractor deals by examining the quality of fruits. So producer have to sell their product at low price.

Producers adopted various methods for controlling it. Infested fruits are be destroyed by the farmers for reduting the insect population. Basically they use poison baits in the orchards about two months before harvesting.

C. Bacterial Disease

a. Orange cancer

The part of the tree damaged by injury or bacterial diseases enlarge slightly and turn into brownish and corky. The yellow brown hole surrounds the part, particularly in the leaves. Actually this disease is known as "cancer of orange tree". Before the infection seen in the tree, farmers started to prunnings and burning of diseased twigs especially before monsoon and spray cow urine and rogor.

7. 1.7 Problems of new Tools and Technique

The orange farmers are not so much familiars with high quality of new tools and technique about the orange cultivation. According to the farmers of the study area, still today, they are using traditional methods of cultivation. Due to illiteracy, the farmers are technically very poor about the modern management system of orchards farm. Even some farmers didn't know "Good outputs in the result of good inputs" in the study area. In almost all parts of Sikkim, technically less priority has been given to agricultural inputs. Thus, Lack of new tools and technique creates problems in orange cultivation.

7.2 Prospects

Though there are several problems faced by the farmers in the study area during the field survey, it has been found that maximum number of respondents believe that there is more possibility or orange cultivation in Khamdong Gram Panchayat Unit of East District. The local orange growers are very much interested due to the increasing demand of orange and its commercial value. Orange cultivation plays a vital role in the balance of declining environment conditions. Contineous cultivation of cereal crops decrease the fertility of soil. Increasing population pressure creates various natural disasters like, soil erosion, landslide etc due to uneven balances of environment.

Studies have revealed that orange farming is much more profitable than other cereal crops. In comparison to other crops orange is found to be good source of income in the study area. However, orange cultivation may generate employment by establishing subsidiary industries. Thus it will solve the problem of unemployment. There are sufficient possibilities of orange cultivation in the study area, so it is necessary for both government and private sector to take keen initiative in helping farmers for quality production.

Orange has better prospect not only in the Khamdong Gram Panchayat Unit but also in whole parts of the Sikkim, due to the continuously increasing population. Now days, there is a great demand of orange fruits in Sikkim.

Due to its great demand and commercial value, the non-orange growers are also interested to cultivate orange. Almost all orange grower are satisfied with its cultivation and agreed with its good future prospect.

And the number of households engaged in this farming are steadily increasing.

No doubt, due to favourable climatic conditions, high demand in market there is great possibilities. As well as good future prospect of orange cultivation in Khamdong Gram Panchayate Unit.

CHAPTER VIII
CONCLUSION AND RECOMMENDATION

8.1 Conclusion

Being an agricultural state, about 72 percent of the total populations are engaged on agriculture for their fulfilling basic needs. In Sikkim, Orange ranked first in terms of producing other fruits. Sikkim is suitable for orange as an important citrus fruits, which is successfully grown here.

Khamdong is a notable orange growing area in the East District. Orange has been cultivated from time immorial in the study area. Initially orange was cultivated only for self-consumption but later on, it receives more popularity due to high demand in national and international market.

Khamdong is located at altitude between 700-1500m above msl and it is drained by four streams, they are school Khola, Bhotange Khola, Beng Khola and DungDung Khola. All these streams flow into the major river Tista. Temperature of this area ranges from 10^0 C to 32^0 C. The soil of this area is brown loamy and gravelly. All these factors played a vital role in the cultivation of orange.

The area is diverse in ethnicity. Majority of the household are engaged in orange farming with the passage of time, this trend will continue to rise. Moreover orange cultivation is a fruitful occupation. There is high demand for oranges from neighboring market centers i.e., Gangtok, Siliguri and Kolkota.

Sometimes the farmers do not receive good returns. It is always the presence of middlemen who absorbs majority of the profit. However due to the lack of co-operations, facilities, transportation, the farmers prefer

garden selling. It is the small farmers who sell their products in the local market.

The trend of orange, in term of area and production is increasing in the study area. According to the field survey report, in 2000 the area under the orange cultivation was 42 Acre and the production was 1286000 (in 100 piece) and in 2005 the area under the orange cultivation was 71 Acre with 2343000 of total production. Even though the production is fluctuating due to various factors, the least square method of trend analysis shows that 2066 piece in hundred has been found as annual increase in the study area.

In term of cost and benefit of orange cultivation orange is mostly beneficial. The cost of orange production per acre is Rs 8200 and the benefit per acre is Rs. 18200. In short, cost over showed by benefit.

Majority of households in the study area getting the road facility (82.1%) and remaining (17.9%) are the not getting road facility.

In term of uses of pesticides and insecticides it has been found that 64.2 percent of the total households uses both insecticides and pesticides and 35.8 percent of total households are deprived of such facilities.

Orange farming provides more income to most of the households. Most of the farmer's are serious and they try to employ technological know-how in orders to increase production. Moreover the government also seems drawing out policies for the betterment of farmers.

Problem analysis associated to orange farming has been done by using the tools of priority order and its index has been concluded. Storehouse for keeping orange for the beneficial marketing time has been

found to be the 1st rank in terms of priority order and its priority index value has bee found maximum (2.44).

Analyzing the overall scenario catering to orange cultivation. The prospect for orange cultivation in Sikkim as well as in the study area is bright. Sikkim produces good quality orange, which finds ready market in the national and international level.

8.2 Recommendation

While doing research, it has been found that the orange growers of the study area experienced certain problems. So the following recommendations are appropriate to overcome, problems.

- The Department of Horticulture, government of Sikkim and research agencies should arrange a regular training for the field functionaries.
- Fencing should be done to protect the seedlings from animals.
- Emphasis must be given for the development of organized marketing system and scientific storage facilities.
- Suitable intercrop with maize, soybean may be taken, because the feather root of soybeans is good manure for orange production.
- Healthy mother trees should be selected as the sources for collection of seeds.
- Modern tools and technology should be provided to the farmers for better production.
- Rejuvenation should be done in order to restore its vigor in terms of production and health of the trees.
- Pruning and burning of diseased twigs should be done especially before monsoon.

- Farmer's co-operatives should be established, so maximum profit can be earned.
- Loans should be made available so that technology is afforded to increase production as well as the mountain the farms.
- Professional guidance and support should always be made available to the farmers.
- Farmers should be encouraged to adopte orange cultivation because of rich economic benefit.

REFERENCES

Adhikari, P.K. 1995/96, *Rapid Market Appraisal (RMA); A Project Report on Horticulture Product*, Government of Sikkim and Switzerland, India.

Banerjee, M. (1995), *Essence of Marketing, Marketing in India*, 3rd Edition, S. Chand and Company Ltd., New Delhi.

Bose, T.K. 1990, *Fruits Tropical and Sub-tropical*, Naya Prakashan, Calcutta, India.

Dale, R. 2004, *Development Planning,* Published by Zed Books Ltd. 7 Cynthia Street, New York.

Danthy, M.E. 1995, *Fruits and Vegetable Processing* International Book Distributing Co, Charbagh, Lucknow, India.

Department of Horticulture, Government of Sikkim, *Monthly Progress Report, Crop calendar Scientific Management of Orange Orchard in Sikkim*, 2001.

DOH, 2005, *Package and Practices of Fruits*, Krishin Bhawan, Gangtok, India.

DOH, Government of Nagaland 2006, *Package and Practice for Orange*, Nagaland, Kohima, India.

Feliciano, victor C. 1974, *The Impact of Marketing Law and Regulation, Legal Framework of Fruits and Vegetables Marketing*, Department of Agriculture Economic, University of Philippines, Mc Graw Hill for Eastern Publisher(s) Ltd Singapore.

Ghosh, S.P. 1987, *Horticulture in North Eastern India*, Associated Publishing Co. Shidipura Karolbagi, New Delhi.

Government of Sikkim, 2005, *Sikkim: A Statistical Profile 2005-2006*, Directorate of Economics, Statistics, Maintaining and Evaluation, government of Sikkim, Gangtok, Sikkim, India.

Horticulture News letter, 2006, *The Horticulture Society of North-East India*, Department of Horticulture, SASRP, Medciphema Campus, Nagaland University, India.

Hussain, Majid 1999, *Systematic Agricultural Geography*, Rawat Publications, Jaipur and New Delhi,

Lama, M.P. (2003), *The Glory of New Sikkim*, Information and Public Relations Department, Government of Sikkim, Gangtok.

Rai, S.K. 1998, *A Study of Orange Cultivation in The Eastern Hill Range; A Case Study from Chhintang VDC*, Unpublished Dissertation, CDG, T.U., Kirtipur.

Rai, T.B. 2003, *Orange Production and Marketing in Sikkim; A Case Study of Melli-Constituency in South Sikkim*, Unpublished Dissertation, EDE, T.U, Kirtipur, Kathmandu, Nepal.

Rajbanshi, A. 1997, *A Study of Mandarin Orange Farming in Manakamana VDC*, Gorkha District, Mini Research Project, T.U. Kirtipur, Kathmadhu.

Sema, A. 2006, *Nursery Management of Mandarin*, Department of Horticulture, Government of Sikkim, Gangtok, India.

Sharma, S. 2004, *Mandarin Orange*, Special Reference to Mandarin Orange in Sikkim, Department of Horticulture, Government of Sikkim, Gongtok, India.

Shrestha, G.K. (1998). *Fruits Development of Nepal*, Prof. of Horticulture, Institute and Agriculture and Animal Science, Rampur, Chitwan: Nepal.

Shrestha, P. k. 1996, *Markets and Sales Study of Orange at Bhojpur District*, Unpublished dissertation, Central Department of Management, T.U., Kirtipur Kathmandu, Nepal.

Subba J.R. 2005, *Horticulture in an Economically Variable and Environmentally sustainable Driver of Socio-Economic Development in Mountain Sikkim*, Government of Sikkim, Krishi Bhawan, Tadong, Sikkim India.

Subba, J.R. 1984, *Agriculture in the Hill of Sikkim Sikkim Science Society*, Gangtok, Sikkim, India.

Thapa, B.B (2005), *Orange Cultivation in the Western Hill Region, A Case Study of Shanker Pokhar VDC of Parbat District*, An Unpublished Dissertation, CDG, T.U, Kirtipur, Kathmandu.

Upadhaya, 1979, *Fruit Marketing in Nepal with Special Reference to Orange Marketing in Eastern Hill*, Unpublished dissertation, T.U, Kirtipur.

Verma, Rajesh 1997, *A Guide and Hand Book*, Gangtok, East Sikkim.

ANNEX

Questionnaire

Date:

District:

Name of the Village:

Total No. of Family Member:

Respondent Name: Age: Sex:

Religion: Caste:

1. Family Composition on the basis age, sex, education and occupation

S.N.	Relation with HH	Marital Status	Sex	Age	Education	Occupation	
						Primary	Secondary
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

2. Information of Animal Husbandary

Types of Animal	Pig	Cattle	Goat & sheep	Poultry	Others
Total No. of Animal					

3. Agricultural Information

Crops types	Food Crops				Cash Crops		Total
	Rice	Maize	Wheat	Millet	Orange	Ginger	
Area (In Acre)							
Production (in 100 piece)							
Income (in Rs.)							

4. How much land do you have ?

_____

5. Landholding and ownership

Land Type	Total	Own				Rented			
		Khet	Bari	Pakho	Others	Khet	Bari	Pakho	Others
Area (in Acre)									

6. When did you started orange cultivation ? Year ……..

7. What are the causes of practicing orange cultivation.?

a._____ b. _____

c._____ d._____

8. How much land do you use for orange Cultivation ?

No. of Orange Tree	Cost (input)	Ravenue earn	Farm size (in Area)	Annual Production (in Saikan)	Benefit

9 Do you cultivated other crops inside the orange field ?

a. Yes b. No

If yes, name of the crops …….…….

and why ? ……

10. Do you use manure to cultivate orange ?

a. Yes b. No

If yes, types of manure

i. Composed …….. ii. Chemical ……..

iii. Others ……

11. For orange cultivation how much money do you spend ?

Rs. ……

12. What type of orange do you produce in your field ?

Varieties		
Local	Hybrid	Emphasis by Govt.

13. For what e\extend of rainfall is best for orange cultivation ?

_____

Methods for Orange Cultivation

14. a. Land preparation ……

b. Seed ……

c. Site ……..

d. Manuring …….

e. Spacing ……..

15. Fertilizer use for orange per acre.

Quantity	Fertilizers	
	Dung (Domestic animal)	Chemical fertilizer
Doko		
k.g		

16. Cost for Orange Production (per acre in Rs)

Seed Preparation	Land	Seed	Showing	Manuring	Harvesting	Storage

17. Is there any harmful insects which injure the orange trees ?

a…….

b. …….

c. ……

18. Do you use any medicine to control this insects ?

If Yes, name of the medicine.

Name of medicine	Amount of insecticides
a.	
b.	
c.	

19. In comparison to other crops, orange in mostly beneficial or not ?

a. Yes b. No

If, Yes, how ……...……

……

20. By orange cultivation, what sort of changes are brought in your family ?

1. ……

2. ……

3. ……

21. Do you get any help from Govt. and any other organization for orange cultivation?

If yes, what are they ……..

……..

22. Where do you sell your orange ?

a. Garden Selling ……..

b. Market selling ……

c. Selling in 100 piece (saikara) …….

23. What types of orange do you sell more ?

a. Ripe (Yellow) b. Unripe (Green)

Why ? give reasons

a. …….

b. …….

c. ……..

24. When did you sell ?

a. When the price is high …….

b. When you need money ……

c. At the time of harvesting ……

d. Others ……..

25. Which is your nearest market ?

……

26. What is the distance between your home and market center ?

……

27. How much money is needed for transportation ?

……

28. How do you transport your orange to reach the market center ?

a. By Vehicle	Transportation Cost
i. Jeep	
ii. Truck	
b. Self	
c. Others	

29. Price distribution of orange per k.g and 100 piece.

Varieties	Market	Village	Winter	Summer
Green				
Yellow				

30. Have you got satisfactory price while selling your products ?

a. Yes b. No

If No, give reasons ……

31. What sort of difficulties do you face in marketing ?

a. Transportation ……. b. Unsatisfactory price ……..

c. Lack of storage ……..d. Others……

32. What is your yearly income from orange production ?

……

33. Have you taken any type of loan from government for orange cultivation?

a. Yes b. No

If yes, amount

Purpose of Taking Loan	Amount

34. Beside loan, have your taken any other assistance from Agricultural Department ?

a. Seed …….. b. Chemical …….

c. Fertilizers …….. d. Others ……

35. What is the trend of orange production ?

a. Increasing ……

b. Constant ……

c. Decreasing ……

36. If the trend is decreasing, what are the main causes for ?

a. …… b. ……..

c…… d. ……

37. What is the production within six years ?

Year	Area (in Arce)	Production	Price (in 100 piece)
2000			
2001			
2002			
2003			
2004			
2005			

38. What are the main problems that you are facing in cultivation of orange ? (in priority order)

If yes, what are the problems ……

a. transportation …… b. capital ……..

c. marketing …….. d. Chemicals …….

e. Lack of storage …….. f. Others …….

39. What are the prospects and possibilities in orange cultivation ? and why ?

a. …… b. ……

c. …… d. ……

The End